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Cyclic spell-out and the interaction of Seenku tonal processes

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Abstract

This paper demonstrates how tone can provide clues about large-scale grammatical architecture, by focusing on the interaction between three tonal processes in Seenku, a Mande language of Burkina Faso with a four-height tone system (tones: eL, L, H, eH). First, a phonotactic restriction against H in word-final position in open class vocabulary triggers epenthesis of eL, creating a H-eL contour. Second, plurals are formed in part by a raising tonal chain shift, argued to be due to the suffixation of a [+raised] feature. Third, the tone of inalienably possessed nouns changes according to the possessor (spreading from non-pronominal possessors, a series of tonal alternations triggered by pronominal possessors). The interaction of these three processes points to systemic cyclicity, rather than word-level cyclicity in the phonology: the possessor must undergo all tonal processes first, as the raised plural tone or epenthesized eL can spread to the possessed noun. Within the possessed noun's cycle, it must undergo possessive interactions before plural formation. The facts can be accounted for in a framework of cyclic spell-out, where more deeply embedded phases (here, the possessor's DP) are sent to spell-out and receive morphophonological form before less deeply embedded phases (the overarching DP containing the possessed noun). Further, the order of processes within a cycle points to Morphology before Phonology in the computation of surface form. This approach fares better than alternatives, including cophonologies and Stratal OT.

Index Terms: tone, Mande, phases, cyclicity

1. Introduction

Seenku (Northwestern Mande, Burkina Faso) has four level tones (extraL, L, H, extraH) in addition to numerous contour tones (some lexical, some grammatical, some created by the phonology). While the peripheral tones, eL and eH, have a fairly free distribution, the middle tones L and H are subject to phonological and grammatical restrictions: H is never found in word-final position in open class vocabulary; instead, we find a proliferation of HeL contour tones, suggesting a phonotactic restriction (*H#) and a subsequent repair (epenthesis of eL, §2.1). L tone is never underlying in open class vocabulary (nouns, verbs) but can be derived by morphophonological processes, most commonly plural formation (§2.2).

Seenku vocabulary is largely monosyllabic with almost exclusively open syllables, resulting in a high functional load for tone. Nevertheless, lexical tone can be altered (and indeed at times neutralized) in certain phonological and grammatical contexts. This paper addresses three interacting cases, two grammatical and one phonological. Their interactions provide evidence for two main theoretical points: First, the order of application of the three processes is consistent with a theory of cyclic spell-out [1][2], with syntactic structure sent to Morphology, and then PF and LF in chunks known as **phases**, which are claimed to then be impervious to syntactic operations at later cycles. However, the tonal form of spelled out phases is susceptible to change in a few isolated cases, supporting the argument that the phonological form of spelled out material must remain visible and derivationally active. On a more local scale, Morphology must precede Phonology within a single cycle to account for the surface patterns. As we will see, the cyclicity argued for in this paper is not phonological cyclicity but rather **systemic** cyclicity, with the whole grammar progressing in cycles from Syntax, to Morphology, then to Phonology and Semantics before beginning again with the next phase of syntactic structure.

In §2, I illustrate the three tonal processes: eL epenthesis (§2.1), plural formation (§2.2), and genitive tonal alternations (§2.3). In §3, I describe the interactions of these three processes, showing that on a large scale, the formulation of the possessor's tone must precede its inclusion in the genitive construction, and that on the smaller scale, genitive tonal alternations precede plural formation. I turn to grammatical architecture in §4, showing that a framework with cyclic spell-out and Morphology before Phonology properly accounts for the data. In §5, I address alternative approaches, while §6 concludes.

2. Three tonal processes

2.1. eL epenthesis

When we look at Seenku open class vocabulary (nouns, verbs), we find eL and eH vocabulary is well attested, but not H. Instead, a very common tone pattern is the contour HeL, represented in this transcription system with circumflex. For example: *bî* 'goat', *gɔ̂ɔ* 'tree', *tágɛ̂* 'chicken'. I argue that these roots are underlyingly H but undergo eL epenthesis in order to satisfy a phonotactic constraint *H# that applies to open class vocabulary (e.g. /bí/ → [bî]). Further evidence for underlying /H/ can be found in plural formation (§2.2), and evidence for epenthesis of an eL tone instead of the contour being the phonetic realization of H can be found in genitive tonal alternations (§2.3).

2.2. Plural formation

Plural formation in Seenku involves one or both of the following changes: vowel fronting and tone raising [3]. I will focus only on the latter in this paper. Tone raising is a chain shift with one step missing, shown in (1):

(1) eL → L, H → eH (→ eH)

For example, an eL singular noun like *bɛ̀ɛ* 'pig' raises to L in the plural: *bɛ̀ɛ* 'pigs'. As noted in the introduction, L is not attested as a singular tone pattern, so there is no L to H raising, and there are no level H singular nouns, given the eL epenthesis process discussed in §2.1. However, all HeL singular nouns raise to eH in the plural, corroborating the analysis that the root is underlyingly H, with the eL epenthesized only in those cases where H would end up in word-final position. Examples include *bî* → *bǐ* 'goat(s)' and *tágɛ̂* 'chicken' → *tágɛ̌* 'chicken(s)'. Singular eH nouns remain

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eH in the plural, leaving vocalic changes as the overt morphological marking: *sŭ́* → *suĭ́*'antelope(s)'.

I analyze this chain shift as being the result of featural affixation [4][5] using the tonal feature system proposed in [6] shown in Table 1.

Table 1. *Tone features in Seenku.*

	eL	L	H	eH
[upper]	-	-	+	+
[raised]	-	+	-	+

The plural is marked with a featural suffix [+raised], a reflex of a historical H-toned suffix (cf. [7]), that docks to the final tone of the noun; this raises eL to L and H to eH, while leaving L and eH unaffected (visibly true for eH nouns, untestable for L nouns, given the lack of singular L tones). Evidence that [+raised] is a suffix can be found in multitonal words, where only the final tone is affected:

(3) a. kó-kô → kó-koɛ̆́
'rooster' 'roosters'

b. dɛ̀â → dɛ̆ɛ̌
'basket hanger' 'basket hangers'

c. jɔ̀ŋwǎ → jɔ̀ŋwɛ̌
'cat' 'cats'

In (3a), only the second reduplicant H is raised to eH. In the (3b), the H portion of the underlying /eLH/ tone sequence is raised to eH. In (3c), [+raised] docks to eH, resulting in no audible tone change, while the initial eL is not affected.

This pattern supports the analysis that eL is epenthetic on HeL singular nouns and that it is epenthesized after plural formation. If not, HeL nouns like *gɔ̀ɔ* 'tree' would have unattested plural forms like **gɔ́è* 'trees' (eL raising to L) rather than attested *gɔɛ̌́* (H raising to eH).

2.3. Genitive tonal alternations

In inalienable genitive constructions, the possessed noun follows the possessor and undergoes tonal changes whose nature depends on whether the possessor is pronominal or non-pronominal. If non-pronominal, its final tone spreads onto the possessed noun, neutralizing lexical tone contrasts.

(4) a. bɛ̆ɛ + ɲâ→ bɛ̆ɛ ɲa̰
pig mother 'pig's mother'

b. sŭ + ɲâ→ sŭ ɲǎ
antelope mother 'antelope's mother'

c. bɛ̆ɛ + nɨ̀ → bɛ̆ɛ nɨ̀
pig father 'pig's father'

d. sŭ + nɨ̀ → sŭ nɨ́
antelope father 'antelope's father'

Evidence that the contour tone on underlyingly H singular nouns consists of two tonal elements, H and eL, comes from genitive constructions where it is the eL tone that spreads onto the possessed noun: *bî ɲa̰* 'goat's mother', *bî nɨ̀* 'goat's father'.

More complicated is the tonal behavior with pronominal possessors. Rather than spreading their final tone, they trigger a series of tonal alternations on the possessed noun depending both on the tone of the pronoun and the tone of the noun. Table 2 summarizes the possessed noun's tonal alternations.

After eH pronouns (1pl *mĭ́*, 3pl emphatic *kŭ́ɛ*), possessed nouns all become eH (*mĭ́ ɲǎ* 'our mother', *mĭ́ nĭ́* 'our father'); a pattern indistinguishable from the spreading seen in (3). This is similar to the behavior of possessed nouns after eL pronouns (3sg *a̰*, 3pl *ɨ̀*), except that eH nouns lower to H rather than all the way to eL (*a̰ ɲa̰* 'his mother', *a̰ ní* 'his father'); note that this derived H does not require eL epenthesis, a topic I leave for future research. The behavior of the possessed noun after H pronouns (1sg *ń*, 1sg emphatic *mó*, 2sg *á*, 2pl *î*) is the most erratic: eL switches to eH, while both H and eH become eL (*mó ɲa̰* 'my mother', *mó nĭ́* 'my father').

Table 2. *Tonal alternations with pronominal possessors.*

		Possessed noun		
Pronoun		**eL**	**H**	**eH**
	eL	eL	eL	H
	H	eH	eL	eL
	eH	eH	eH	eH

There is no apparent unifying mechanism behind these tonal changes: no pressures like antihomophony between underlying and possessed tone (eL remains eL after eL) or avoidance of neutralization of lexical tone (everything neutralizes after eH, two tones neutralize after both eL and H), no simple spreading, assimilation, or dissimilation. In this paper, I treat the changes as paradigmatic morphology or constructional changes similar to the notion of the "construct state" [8], though future work could reveal phonological principles underlying the system.

3. Ordering of tonal processes

The three tonal processes show two crucial orderings and interactions: 1. The possessor must have its surface tonal form (including plurality and eL epenthesis) before it assigns tone to the possessed noun (§3.1), and 2. Plural formation on possessed nouns must follow genitive tonal alternations (§3.2).

3.1. Possessor before possessed

As shown in §2.3, non-pronominal possessors spread their final tone onto the possessed noun. This tone can be the underived lexical tone, seen in the singular, or the raised tone of the plural:

(5) a. bî + ɲâ→ bî ɲa̰
goat mother 'goat's mother'

b. bĭ́ + ɲâ→ bĭ́ ɲǎ
goat.PL mother 'goats' mother'

In (5b), [+raised] must have already docked to the singular H tone, deriving eH, before spreading onto the possessed noun. Similarly, (5a) shows that eL epenthesis takes place before genitive tone spreading, since it is eL rather than H that spreads. Otherwise, we predict the unattested form **bí ɲâ* (with eL epenthesis at the end of the H stretch).

3.2. Genitive alternations before plural formation

Focusing on the tonal form of a single word, we find that genitive tonal alternations, either spreading or pronominally-triggered tone changes, must occur before plural formation, since the [+raised] feature affects the result of genitive alternations. This is illustrated in (6a) with the H noun /kyɛ́n/ 'breast' (the incorrect ordering is given for contrast in 6b):

(6) a. mó ky**ɛ́n** → mó ky**ɛ̀n** → mó ky**ɛ̀n** 'my breasts'
Gen. Alt. Plural

b. *mó kyɛ́n → mó kyɛ́̋n → mó kyɛ̋n
Plural Gen. Alt.

The same can be seen in cases of spreading. The examples in (7) illustrate the correct (7a) and incorrect (7b) ordering of tonal processes for the eL noun /tsɛ̋̀/ 'foot':

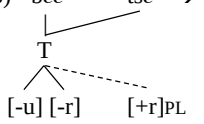
(7) a. bî ts**ɛ̋̀** → bî ts**ɛ̋̀** → bî ts**iɛ̋̀** 'goat's feet'
Gen. Alt. Plural

b. *bî tsɛ̋̀ → bî tsiɛ̋̀ → bî tsɛ̋̀
Plural Gen. Alt.

If plural formation preceded genitive tonal alternations, then the resulting raised tone would be reverted to eL by spreading from the possessor.

If genitive alternations with non-pronominal possessors are the result of spreading, then we would expect that docking [+raised] to the possessed noun would also affect the possessor since the two are linked by a single tonal autosegment. This prediction is borne out:

(8) bɛ̋̀ɛ tsɛ̋̀ → bɛ̀ɛ tsiɛ̋̀ 'pig's feet'



This form is ambiguous with 'pigs' feet', where the plural possessor was already marked as [+raised].

4. Architecture of the grammar

In this section, I argue that the data patterns described above provide evidence for a grammatical architecture with two key features: cyclic spell-out [1][2] and Morphology before Phonology. This architecture is schematized in Figure 1 [9]:

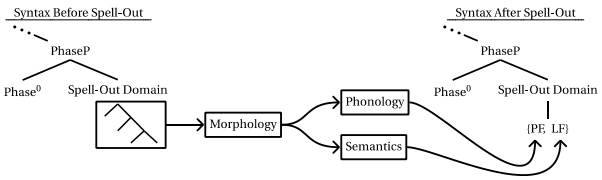


Figure 1. *Grammatical architecture.*

Particular syntactic heads, known as phase heads, trigger a cycle of spell-out, in which the complement to the phase head is sent first to Morphology then to PF and LF. The resulting form lacks internal syntactic structure but has phonological form and semantic interpretation; it is essentially, as [1] puts it, grammatically treated as "a giant lexical compound". For the Seenku data, I follow standard assumptions in which DPs are phases. This means that possessors (their own DPs) will be sent to spell-out and receive their morphophonological form before they are added to a separate nominal phrase headed by the possessed noun. This larger DP (containing both the possessor DP and the possessed noun) is then sent to spell-out and computing its tonal form.[1] Once syntactic structure is spelled out, it is first passed through Morphology and only then passed on to Phonology, accounting for the ordering relations described in §2.2 (pluralization before eL epenthesis) and §3.2 (genitive alternations before pluralization).

To understand the architecture, I walk through derivations for examples (6) and (7).

4.1. *mó kyɛ̀n* 'my breasts' (6)

4.1.1. First cycle: Possessor

Computing the tonal form of the possessor is simple when it is pronominal: nominal pluralization patterns do not apply, nor does eL epenthesis, since pronouns are not open class vocabulary. Thus, for 1SG, /mó/ is inserted in the Morphology to match the morphosyntactic features, and its phonological form emerges unaltered from the Phonology: [mó] is reinserted into the structure as the form of the possessor.

4.1.2. Second cycle: Possessor + Possessed noun

The phonological form of the possessor, *mó*, has been established on an earlier cycle of spell-out, and now the spell-out domain of possessed noun's DP, containing the already spelled-out possessor, is sent to spell-out to receive morphological and phonological form.

In §3.2, I showed that the genitive alternations must apply first. As suggested above, I argue that pronominal genitive alternations are assigned morphologically, tied together in the lexicon into constructional paradigms (as in Construction Morphology [10]). When the spell-out domain is sent to Morphology, the lexical items inserted into the structure carry the appropriate tonal form matching the cell in the paradigm (as in Table 2). In the case of 'breast', this is eL *kyɛ̋̀n*, the tonal form associated with a H-toned pronominal possessor and a H-toned noun. The morphosyntactic features of the spelled-out structure also specify [+pl], so the featural suffix [+raised] is pulled from the lexicon. Thus, the morphological forms /mó kyɛ̀n + [+raised]/ are passed on to Phonology, where [+raised] docks onto eL, raising it to the L tone seen on the surface ([mó kyɛ̀n]). Though the combination of cyclic spell-out with a constructional morphology may seem out of place, there is no *a priori* reason why Morphology of the lexicon must adhere to syntactic principles, as in Distributed Morphology [11]. However, nothing in this paper hinges on the choice of morphological framework, and the data may be equally well accounted for using a mechanism like context-sensitive rewrite rules [12].

4.2. *bî tsiɛ̋̀* 'goat's feet' (7)

4.2.1. First cycle: Possessor

When the syntactic structure of the possessor, 'goat', is sent to spell-out, the noun /bí/ is selected in the Morphology. It is singular, so the plural morpheme [+raised] is not selected along with it. The form /bí/ then gets passed on to the Phonology, where the constraint *H# motivates epenthesis of eL. The form of the possessor reinserted into the syntax is [bî].

4.2.2. Second cycle: Possessor + Possessed noun

Just as pronominal genitive alternations are morphologically assigned, so too are spreading alternations with non-pronominal possessors; in this case, Morphology inserts a

[1] It has also been argued [1] that material in specifiers is sent to spell-out before merging as specifiers, so if the possessor is in the specifier of the possessed noun's NP, it will be spelled out first regardless of whether DPs are phasal or not.

toneless allomorph of the noun, which will be filled in in Phonology via a spreading operation. As before, the morphosyntactic feature [+pl] pulls out the suffix [+raised] in Morphology, and so the forms /bî tsɛ̃ + [+raised]/ are sent to Phonology, where the possessed noun receives tone by spreading eL from the possessed noun, to which the floating feature docks, raising it to L ([bî tsiɛ̃̀]).

Note that if we had instead an all eL possessor like *bɛ̏ɛ* 'pig', docking of [+raised] would cause raising not only of the possessed noun but of the possessor as well. This was seen in (8) above for the resulting surface form [bɛ̀ɛ tsiɛ̃̀] 'pig's feet'. Cases like this one raise an important point about cyclic spell-out: the morphophonological form of spelled out material must not only be visible at later cycles (in order to determine the tonal form of the possessed noun) but is able to be altered by material added later, contra recent proposals in the literature [13][14].

5. Alternative approaches

As I have argued, cyclicity is a property of the system, with cycles of syntactic spell-out, Morphology, then PF and LF, rather than any particular component. There are at least two logical alternatives, both of which I show provide a less elegant explanation for the data.

5.1. Stratal phonology

Rather than the systemic cyclicity proposed in §4, one could instead claim that cyclicity is a property of phonology, with cyclic and non-cyclic rules, as proposed in Lexical Phonology (e.g. [15]) and later in Stratal OT (e.g. [16]). Under this framework, cyclic (word-formation or lexical) processes apply first, followed by non-cyclic (post-lexical) processes.

Unless we introduce the sort of systemic cyclicity proposed in Figure 1, we could expect all words in the phrase to go through the strata in tandem, producing the wrong result. For instance, if we took the form *bî tsiɛ̃̀* 'goat's feet' from (7) and (9), we begin with the sequence of roots /bí$_{SG}$ tsɛ̃̏$_{PL}$/, tagged for number. The order of operations here becomes difficult. On the one hand, we might expect the operations applying within the stem or word itself will apply before operations between words; this would put eL epenthesis and plural formation before genitive formation, which, as shown in §3.2, predicts the wrong results. If we assume that the morphological (cyclic) rules apply and include genitive alternations and plural formation, in that order, then we end up spreading the H of the possessed noun before the phonological (postlexical) rule of eL epenthesis applies. We could claim eL epenthesis is also cyclic and applies before plural formation, but then this predicts the wrong result for a simple H plural noun, where eL would become the final tone to which the plural [+raised] is added, as discussed in §2.2.

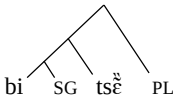
This is not to say that there is no place for cyclicity in the phonology, but simply that without syntactic or systemic cyclicity as argued for in this paper, we cannot account for the Seenku data patterns.

5.2. Cophonologies

In cophonology theory (e.g. [17][18]), itself a member of the constructional approaches to morphophonology, different morphemes can have specific sets of rules or rankings associated with them. When structure is added, its associated cophonology computes the phonological form of the resulting constituent. Seenku would require cophonologies for plural formation, non-pronominal possessors, and possibly each pronominal possessor to account for the idiosyncratic genitive alternations it triggers. Additionally, a general or singular (co)phonology would have to epenthesize eL on H-final nouns.

This approach would work, provided that the form of the possessor is computed first, with plural formation and its associated cophonology or singular formation and its associated cophonology, before constructing the phrase containing the possessed noun. This is illustrated below for the form in (7) (discussed in §4.2.2).

(9) Cophonologies approach to Seenku



bi + SG — SG cophonology: eL epenthesis → bî
bî + tsɛ̃̏ — Genitive cophonology: spreading → bî tsɛ̃̏
bî tsɛ̃̏ + PL — PL cophonology: [+raised] docking → bî tsiɛ̃̀

In principle, this is how the theory would deal with phrasal data (i.e. the order of operations would be determined by syntactic structure), but the majority of the literature on cophonologies addresses word-internal morphological structure, leaving the phrasal level somewhat open to interpretation. If we assume the same order of operations as the phasal spell-out proposed in this paper, then the framework is essentially a notational variant. If, on the other hand, the structure was instead built from the bottom up, we might expect the possessed noun to be built first before progressing up the tree to where the possessor is attached. In the cyclic spell-out framework of §4, this order of operations falls out naturally from the architecture.

6. Conclusions

In summary, the interaction between morphological and phonological tone processes in Seenku provide evidence for a grammatical architecture with cyclic spell-out and Morphology before Phonology. Future work should seek independent syntactic evidence for spell-out domains and explore blocking of eL epenthesis in derived environments.

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