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Phrasal grammatical tone in the Dogon languages: The role of constraint interaction[1]

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Abstract

Tonosyntax in the Dogon languages of Mali is characterized by word-level tone overlays that apply in specific morphosyntactic contexts. This paper focuses on the resolution of competitions that arise when a word is targeted by more than one tone overlay. For example, in Poss N Adj the possessor and the adjective compete to impose their respective tone overlays on (at least) the noun, and Dogon languages show different outcomes. We argue that overlays are tonal morphemes associated with particular syntactic positions and propose a series of phrasal Optimality Theoretic constraints, grounded in syntactic structure, that control the association of these morphemes. The relative ranking of constraints determines the outcome of tonosyntactic competitions in a given language.

1 Introduction

1.1 The problem

This paper focuses on Tommo So and related Dogon languages, which share a unique system of phrasal grammatical tone in which words take **tonal**

[1]We would like to thank Bruce Hayes, Russell Schuh, Kie Zuraw, Larry Hyman, Anoop Mahajan, Laura Kalin, Byron Ahn, Hilda Koopman, and audiences at UCLA, UC Berkeley, ACAL 44, OCP 10, and AIMM 2 for helpful comments and feedback in the development of this topic. This paper has also benefitted immensely from the thoughtful comments of the editor and three anonymous reviewers; any errors that remain are strictly our own. We gratefully acknowledge the funding of NSF grants BCS-0537435 (2006-09), BCS-0853364 (2009-13), and BCS-1263150 (2013-16) that made this research possible, as well as the Fulbright Foundation and the NSF Graduate Research Fellowship Program (first author). Finally, we would like to thank our many Dogon consultants for sharing their languages with us.

overlays in particular syntactic configurations. Though phrasal, this system has little in common with traditional phrasal tone phenomena, such as Bantu spreading (e.g. Cassimjee and Kisseberth 1998) or Chinese sandhi (e.g. Chen 2000), and we will show in §7.1 that the data patterns are fundamentally incompatible with mainstream theories of phrasal phonology. Rather, the system resembles the more common phenomenon of replacive grammatical tone at the word level, with overlays triggered by an affix or a morphosyntactic feature (e.g. Hausa, Inkelas 1998; Newman 1986, 2000). In the Dogon languages, the triggers of tonal overlays are words of certain syntactic categories, which target words that they c-command. Due to the heavy involvement of syntax, following Cole-Beuchat (1961), Hetzron (1980), and Heath and McPherson (2013), we refer to the system as **tonosyntax**.

To illustrate, consider the following examples from Tommo So, using the lexically LH-toned noun *bàbé* 'uncle':[2]

(1) a. bàbé tààndú 'three uncles'

b. bàbè^{L} kómmó 'skinny uncle'

c. Sáná ^{L}bàbè 'Sana's uncle'

d. mí ^{H}bábé 'my uncle'

In (1a), the addition of the numeral *tààndú* 'three' triggers no tonal changes. When this numeral is replaced by an adjective, as in (1b), the noun surfaces with a {L} overlay; a {L} overlay is likewise triggered by a nonpronominal possessor as in (1c), which in this case precedes the noun. Finally, (1d) illustrates that not all overlays are {L}: a pronominal possessor imposes an all {H} overlay on the noun. It is crucial to note that all members of a syntactic category (i.e. all numerals, all adjectives) behave in the same

[2] Here and elsewhere, tonal overlays are indicated both by tone marking on the word (using acute accent for H and grave accent for L) and by a superscript of the melody, located on the right side of the target if it is controlled from the right and on the left side of the target if it is controlled from the left. For example, the superscript L in (b) indicates a {L} tone overlay from the adjective on the right. The segmental transcription system is roughly IPA, with the following differences: <j> stands for IPA [ʥ], <y> stands for IPA [j], <r> stands for IPA [ɾ]; nasalization is marked with a superscript *n* (v^{n}); vowel and consonant length is marked by doubling the letter.

way; tonal overlays are not lexically specific.

Further, tonosyntactic overlays neutralize lexical tone. Tommo So has three lexical tone patterns for non-verbal stems,[3] /H/, /LH/, and /HL/, all of which are replaced by {L} when preceding an adjective, as shown in (2a) with a {L} overlay and in (2b) with a {H} overlay:

(2)

a.	/H/	gámmá	'cat'	gàmmà^{L} gɛ́m	'black cat'
	/LH/	ɛ̀nɛ́	'goat'	ɛ̀nɛ̀^{L} gɛ́m	'black goat'
	/HL/	pállà	'cloth strip'	pàllà^{L} gɛ́m	'black cloth strip'
b.	/H/	náá	'mother'	mí ^{H}náá	'my mother'
	/LH/	bàbé	'uncle'	mí ^{H}bábé	'my uncle'
	/HL/	(unattested)			

The {H} overlay applies only to inalienable nouns (kinship terms in Tommo So); since /HL/ is a very uncommon tonal melody, largely confined to loanwords, it is unsurprising that we do not find an example amongst closed-class (typically) native vocabulary. Notice that overlay application can be vacuous, as in the {H} overlay on lexically /H/ *náá* 'mother'.

Of particular interest are cases where two or more triggers target the same word(s). For example, if we combine the triggers of (1b) and (1d) in a phrase like 'my skinny uncle', we find that the adjective's {L} overlay takes precedence:

(3) mí bàbè^{L} kómmó
1SG.PRO uncle skinny
'my skinny uncle' (cf. *bàbé*)

Here and subsequently, citation tones are given in parentheses after the gloss. Different Dogon languages resolve this conflict differently, which, as we will show, can be captured by constraint interaction.

[3]Verbal tone patterns in Tommo So, as in most Dogon languages, display only a {H} vs. {LH} contrast, which is largely predictable based on the initial segment.

1.2 The proposal

Heath and McPherson (2013) described the principles unifying the classes of words that trigger tonal overlays ("controllers") and those that do not ("non-controllers"); for a brief summary, see §3. In this paper, we offer a formal analysis of Dogon replacive tone, seeking to account not only for cases with a single controller but also cases like (3) of tonosyntactic conflicts.

Our main claims can be summarized as follows: Dogon grammatical tone consists of replacive overlays, imposed by particular syntactic categories on words that they c-command. Due to the involvement of specific syntactic information, we suggest that these effects belong in the morphology rather than the phonology proper and propose a series of morphological constraints on tonal realization. The evaluation of overlays must be global, i.e. all overlays must be present and evaluated in one step; word-by-word cyclic build-up of the phrase (Chomsky, Halle, and Lukoff 1956, McHugh 1990), akin to cyclic build-up of the word in cophonology theory (Anttila 2002, Orgun and Inkelas 2002, Inkelas and Zoll 2005, etc.), predicts the wrong results (see §7.2). We show that the Dogon system upholds the basic premise of Optimality Theory (Prince and Smolensky 1993), i.e. that complexity arises naturally from **constraint interaction**. The data further support the tenet of constraint-based frameworks that crosslinguistic variation arises from re-ranking the same set of constraints; we show that nearly identical constraint sets, suitably ranked, capture the tonosyntactic grammars of (at least) five Dogon languages.

1.3 Outline of the paper

In §2, we provide background information on the Dogon language family and our data. §3 introduces the main tonosyntactic data patterns in Tommo So, the Dogon language which will serve as our illustrative case for the bulk of the paper. In §4, we highlight the essential generalizations about the data: 1. That tonosyntax is category-sensitive; 2. That the domain of tonal overlays is determined by c-command; and 3. That competitions between controllers are resolved by constraint ranking. The formal analysis of Tommo So is given in §5. There we introduce the morphological constraints, which compete with each other as well as with faithfulness constraints. An innovation is that the cyclic spellout of syntactic material in phases may give rise to transcyclic phase-phase faithfulness, captured in the constraint IDENT-PHASE(T). We show how the combination of these ingredients can account for the full range of Tommo So tonosyntax. In §6, we provide further evidence for the constraint set, bringing in data from other Dogon languages to illustrate cases of re-ranking. §7 discusses alternative analyses while §8 concludes.

2 Dogon languages

Dogon is a family of around twenty languages spoken in east central Mali in West Africa. The exact genetic affiliation is unclear, but one hypothesis is that it forms its own branch of Niger-Congo (Blench 2005). This paper focuses on Tommo So, using data from McPherson (2013a) and the first author's field notes (gathered in Mali from 2008-2012); generalizations are based on both elicited and textual data. Tommo So is spoken by about 60,000 people along the northern plateau of the Bandiagara Escarpment. Like all Dogon languages, it has a phonemic distinction between L and H tone, though it additionally shows surface underspecified syllables (Ø), which receive F0 through interpolation (McPherson 2011). Importantly, almost all Dogon languages have a ban on lexically /L/ words; this means that the most common overlay, {L}, is always audibly distinct from lexical tone.

Additional data are drawn from Ben Tey (Heath 2013a), Jamsay (Heath 2008), Najamba (Heath 2011a), and Yorno So (Heath 2011b). Tommo So, Ben Tey, Jamsay, and Yorno So are all tentatively grouped in "eastern Dogon", while Najamba belongs to "western Dogon". For more information on the Dogon languages and their sub-groupings, see http://www.dogonlanguages.org.

3 A brief sketch of the data patterns

In this section, we briefly lay out the basic data patterns for Tommo So tonosyntax involving a noun with one other DP element. More complex data patterns involving three or more words will be addressed in §4.2 and beyond.

As indicated in (1), not all syntactic categories in Tommo So trigger tonal overlays. Heath and McPherson (2013) show that the distinction between tonosyntactic controllers and non-controllers across the Dogon languages is based on **reference restriction**. In particular, controllers (adjectives, demonstratives, possessors, relative clauses) restrict the reference of the words they modify, while non-controllers (numerals 2+, plural, universal quantifier) do not. Categories with borderline semantics (the numeral 'one', the definite determiner) behave differently in different Dogon languages, sometimes patterning with controllers and sometimes with non-controllers. In Tommo So, the numeral 'one' is a controller while the definite is not.

The distinction between controllers and non-controllers at the phrase level is similar to the distinction between dominant and recessive suffixes for word-level tone and accent (Kiparsky 1984, Steriade 1988, Golston 1990, Inkelas 1998, Alderete 2001, etc.). For example, in Hausa, dominant suffixes cause tonal overwriting on the stem, while recessive ones do not. Thus, we can think of controllers as being "dominant modifiers" and non-controllers as "recessive modifiers" with regards to phrasal tonology.

Controllers are given in (4). Relative clauses, though controllers, are not discussed here due to their complicated nature. For a description of Tommo So relative clauses, see McPherson (2013a); for syntactic analyses of relative clauses in other Dogon languages, see Culy (1990) and Cinque (2011):[4]

(4) a. N^{L} Adj
gàmmà^{L} gɛ́m
'black cat' (cf. *gámmá*)

b. N^{L} 'one'
gàmmà^{L} túmɔ́
'one cat'

c. N^{L} Dem
gàmmà^{L} nɔ́
'this cat'

d. PossNonP ^{L}N
Sáná ^{L}gàmmà
'Sana's cat'

e. PossIP $^{H(L)}$N
mí ^{H}bábé

[4]The following abbreviations pertain to possessors: Poss = possessor, P = pronominal, I = inalienable, A = alienable. Thus, PossIP is an inalienable pronominal possessor, while PossNonP is a nonpronominal possessor (with undetermined alienability).

‘my uncle’ (cf. *bàbé*)

The data in (4) contrast with those in (5), which illustrate the non-controller status of a numeral (2+), definite determiner, plural, and universal quantifier, respectively:

(5) a. N Num
gámmá tàànd́ú
‘three cats’

b. N=Def
gámmá=gɛ
‘the cat’

c. N=PL
gámmá=mbe
‘cats’

d. N ‘all’
gámmá kɛ́m
‘all/any cat(s)’

The plural and the definite are toneless enclitics in Tommo So, receiving surface pitch via interpolation.[5]

All postnominal controllers (adjectives, the numeral ‘one’, demonstratives, and relative clauses) impose {L}. Nonpronominal possessors (both alienable and inalienable) impose {L} as well, while pronominal inalienable possessors impose {H} or {HL}. The choice between the two overlays is determined by the mora count of the possessed noun; nouns with 1-2 moras

[5]In phrase-final position, toneless elements interpolate between the preceding specified tone and a phrase-final L boundary tone, producing a linearly falling F0. While this phonetic realization on a single syllable resembles a specified L tone (which is subject to some carryover from a preceding H), the difference emerges with two or more syllables: underspecified syllables show linear interpolation across the whole sequence, while L-toned syllables reach the L target (typically) by the end of the first syllable. See McPherson (2011) for further discussion. We know that {L} overlays are specified for L tone since the word carrying the overlay is realized as a stretch of level L rather than displaying the interpolation characteristic of underspecification.

take {H} while nouns with three or more moras take {HL}:

(6)

a.	wó ^{H}náá	'his mother'	/náá/
	mí ^{H}bábé	'my uncle'	/bàbé/
	bé ^{H}nínɛ́	'their (paternal) aunt'	/nìnɛ́/
b.	wó ^{HL}ánìgè	'his friend'	/ánígé/
	mí ^{HL}tírɛ̀-àn-nà	'my grandfather'	/tìrɛ̀-àn-ná/
	bé ^{HL}náà-dìyɛ̀	'their (maternal) aunt'	/nàà-díyɛ̀/

Thus, we see that while reference restriction characterizes the binary distinction [+/- Controller], semantics, lexical status (pronominal vs. nonpronominal), and even phonological information about the target can affect the tonal content of the overlay.

Alienable pronominal possessors in most Dogon languages do not behave like the other possessors (nonpronominal or inalienable): they appear after the possessed noun, they are morphologically complex (consisting of an amalgamation of the pronoun and a possessive clitic or classifier), and they trigger no tonal overlays:

(7) a. gámmá ḿmɔ 'my cat' (< mí=mɔ)

b. jàndúlu wómɔ 'his donkey' (< wó=mɔ)

We remain agnostic as to the best syntactic analysis of these post-nominal possessors. In the following analysis, we will set aside data from alienable pronominal possessors unless required to illustrate the behavior of another element in the DP.

Note that possessive constructions (Poss N) are formally distinct from nominal compounds (N N). In the latter, all non-final words are replaced with L tone (e.g. *gàmmà*^{L} *íí* 'kitten', lit. cat child). McPherson (2013b) argues for a phonological rather than tonosyntactic origin of compound noun tonology, motivated by lexical tonotactics for noun stems; we will not discuss compound nouns any further in this paper.

4 Essential generalizations about the data

Now that we have illustrated the basic system of tonosyntax, we can turn to three essential generalizations about the data that motivate the analysis given in this paper. First, in §4.1, we motivate the claim that the status of a word as a controller depends on its syntactic category. In §4.2, we show that the domain of a controller's overlay is determined by syntactic structure. Finally, in §4.3, we argue that competitions between controllers are resolved by constraint interaction.

4.1 Tonosyntax is category-sensitive

Our first point is summarized in (8):

(8) The status of a word as a tonosyntactic controller is entirely determined by its syntactic category.

What this means is that there are no effects of lexical item or phonological shape in determining the controller status of a word; only syntactic category matters. This point emerges from the discussion in the preceding section and can be observed to be adhered to in all of the data in the paper.

One puzzle is the numeral 'one', which is a controller while other numerals are not. This might seem to indicate that something more than syntactic category is required. However, at least in Tommo So, 'one' is unusual not just in its tonosyntactic behavior but also its morphology. While other numerals often (though not obligatorily) take the suffix *-go*, described below in fn.7, *túmɔ́* 'one' does not; if it is added, the meaning changes to the adverb 'together' (*túmɔ́-go*). The numeral 'one' also can take an intensifier, *rék*, lending the meaning 'one and only one'. Such intensifiers are common with adjectives but otherwise unattested on numerals. Both of these facts suggest that the numeral 'one' is syntactically an adjective rather than a numeral, thus showing that syntactic category alone is sufficient to determine controller status. Alternatively, following Heath and McPherson (2013), we could say that its controller status follows directly from the semantics of the modifier, but since the semantics correlate with syntactic category, these explanations are largely equivalent.

4.2 Controllers, targets, and c-command

We assert the following generalization:

(9) The domain of a controller's overlay is determined by syntactic structure: a controller can only target words that it **c-commands**, or itself.

Most commonly, controllers target c-commanded words; we will leave a discussion of "self-control" to §6.2.[6]

The clearest argument for the role of c-command in tonosyntax comes from possession. If we compare alienable and inalienable possessors on nouns with a numeral modifier (which is not itself a controller), we find differences in the domains of overlays:[7]

(10) a.

PossANonP	^{L}{N	Num}
Sáná	^{L}{gàmmà	nèè-gò}
Sana	cat	two-ADV

'Sana's two cats' (cf. *gámmá*, *néé-go*)

b.

PossINonP	^{L}N	Num
Sáná	^{L}bàbè	néé-go
Sana	uncle	two-ADV

'Sana's two uncles' (cf. *bàbé*)

The alienable possessor in (10a) has a large tonal domain, encompassing both the noun and the numeral; here and elsewhere, multi-word tonal domains are enclosed in curly brackets. The inalienable possessor in (10b), in contrast, controls only the noun; the numeral retains its lexical tone.

The same difference in domains arises with an adjective modifying the possessed noun. The alienable possessor's {L} overlay encompasses both the noun and the adjective, while the adjective retains lexical tone with the

[6] Again, domains could be defined in terms of the semantic scope of reference restricters rather than syntactic structure. Assuming that semantics is compositional, these arguments are equivalent. We present a syntactic analysis in this paper for the sake of concreteness.

[7] Tommo So has an optional suffix *-go* on numerals that we gloss here as an adverbial suffix, since it is found in pairs like *díyɛ̀* 'big' vs. *díyɛ̀-go* 'a lot'. Consultants report no difference when it is added to a numeral.

inalienable possessor:

(11) a. PossANonP ^{L}{N Adj}
Sáná ^{L}{gàmmà kòmmò}
Sana cat skinny
'Sana's skinny cat' (cf. *gámmá*, *kómmó*)

b. PossINonP N^{L} Adj
Sáná $bàbè^{L}$ kómmó
Sana uncle skinny
'Sana's skinny uncle' (cf. *bàbé*)

In (11b), the {L} overlay on the possessor could be attributed to either the adjective or the possessor (or both). The analysis presented in this paper gives control to the adjective in this case; see §5.2.2 below for more details.

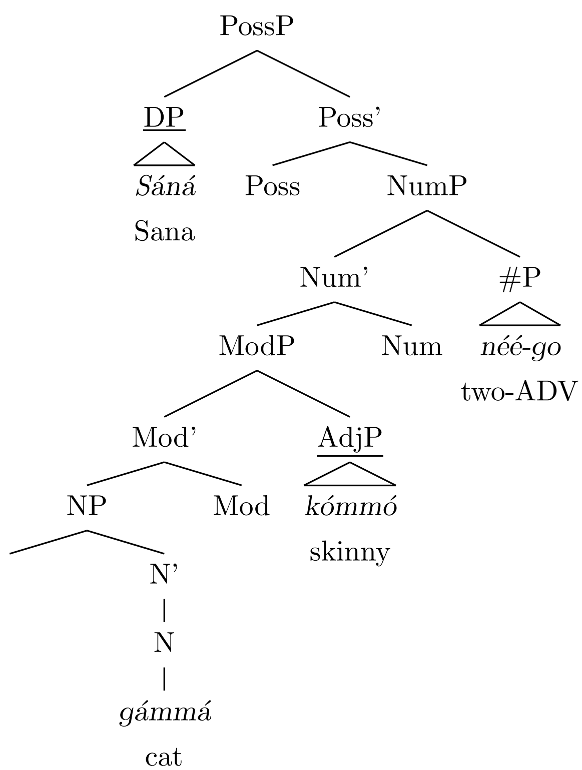
We argue that these differences arise from differences in syntactic structure and hence c-command relations for alienable and inalienable possessors. The trees in (12) illustrate the syntactic structures assumed for alienable possessors and inalienable possessors, respectively (empty projections left in place for the sake of illustration); glossed examples are given above each for easy comparison. Concerning the structure of trees, we assume current views in the Chomskian research tradition (e.g. Chomsky 1981, Kayne 1994, Chomsky 1995, Cinque 2005), in particular that trees are binary-branching and that DP modifiers are contained in their own projections (rather than being adjuncts to the noun); this is essential in defining the c-command relations on which the analysis depends.[8]

[8] The placement of adjectives and numerals in functional projections (ModP and #P, respectively), rather than adjoining them to the NP or placing them on the spine is meant to capture their potentially phrasal nature ("very skinny", "only three", etc.). This move is not crucial, and the same results would hold in a model with spinal AdjP and NumP.

(12) a.

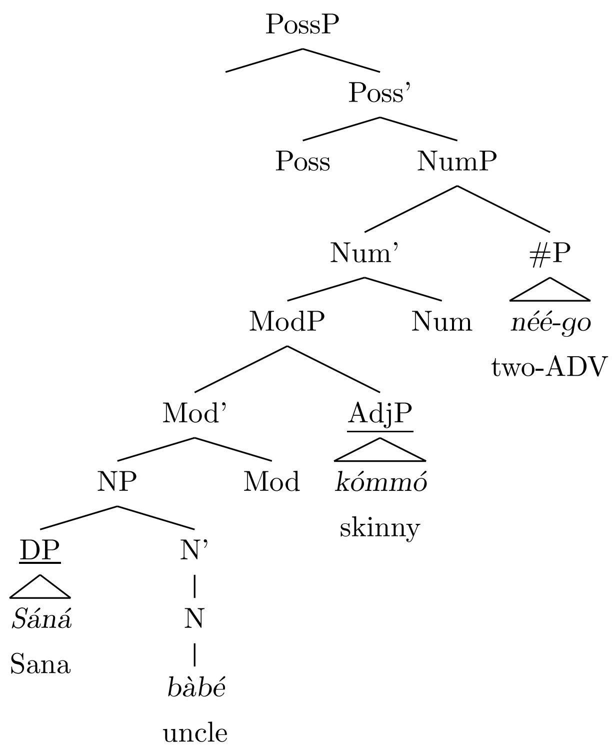
PossANonP	^{L}{N	Adj	Num}
Sáná	^{L}{gàmmà	kòmmò	nèè-gò}
Sana	cat	skinny	two

‘Sana’s two skinny cats’ (cf. *gámmá*, *kómmó*, *néé-go*)



b. | PossINonP | N^L | Adj | Num
| --- | --- | --- | --- |
| Sáná | bàbè^L | kómmó | néé-go |
| Sana | uncle | skinny | two-ADV |

‘Sana’s two skinny uncles’ (cf. *bàbé*)



Following proposals by Español-Echevarría (1997), Suzuki (1997), Alexiadou (2003), Dobler (2008) and others, we place the inalienable possessor in the specifier of NP, which gives it a close syntactic relationship with its possessed noun, while the specifier of a PossP projection hosts the alienable possessor. This syntactic distinction between alienable and inalienable possessors is further supported by the fact that in a number of Dogon languages, including Jamsay (Heath 2008) and variably Yorno So (Heath 2011b) and Tommo So (McPherson 2013), a possessive particle is possible with the alienable possessor (perhaps the realization of the Poss head) but not with an inalienable possessor. Compare the following examples from Jamsay:

(13) a. Sáydù mà úró (Jamsay, alienable)
Seydou POSS house
'Seydou's house'

b. Sáydù ^{HL}déè (Jamsay, inalienable)
Seydou father
'Seydou's father' (cf. *dèé*)

c. *Sáydù mà dèé

The possessive particle *mà* appears after an alienable possessor (13a) but is ungrammatical with an inalienable possessor (13c). There are likewise two different series of pronouns used, with the alienable series more morphologically complex than the inalienable one (see (7)).[9]

The alienable possessor (PossANonP), in the specifier of PossP, c-commands the adjective and numeral as well as the possessed noun. Hence, all three words are included in the target domain. The inalienable possessor (PossI-NonP), from its position in the specifier of NP, c-commands only the possessed noun, making this the only target for the possessor's {L} overlay. The two examples have the same linear order and yet the tonosyntactic patterns differ. We take this as clear evidence that tonal domains are determined by c-command and not simply word order.[10]

[9] A reviewer asks whether any purely syntactic arguments support the proposed structural positions. The most common syntactic argument stems from word order; unfortunately, the DP structure of Dogon languages is such that no differences can be found: possessors are the only modifiers to precede the noun, so both are noun-adjacent. Given the consistent parallel between syntactic structure and domains of tonal overlays across the languages, we take the domains of tone control in the case of possessors to be strong evidence for the positions proposed.

[10] For further evidence of this structural account, we might look to cases of coordination, for example [[N and N] Adj] or [[[N] Adj and Adj] Dem], to see if a controller is capable of imposing its overlay on all words in a c-commanded constituent. Unfortunately, Dogon languages avoid these structures, coordinating DPs rather than NPs (e.g. '[N Adj] and [N Adj]') and stacking rather than coordinating adjectives. To pursue this issue, it will be necessary to consider relative clauses with conjoined subject NPs that cannot be separated, as in 'the men and women who quarreled', but this would take us too far afield to consider here.

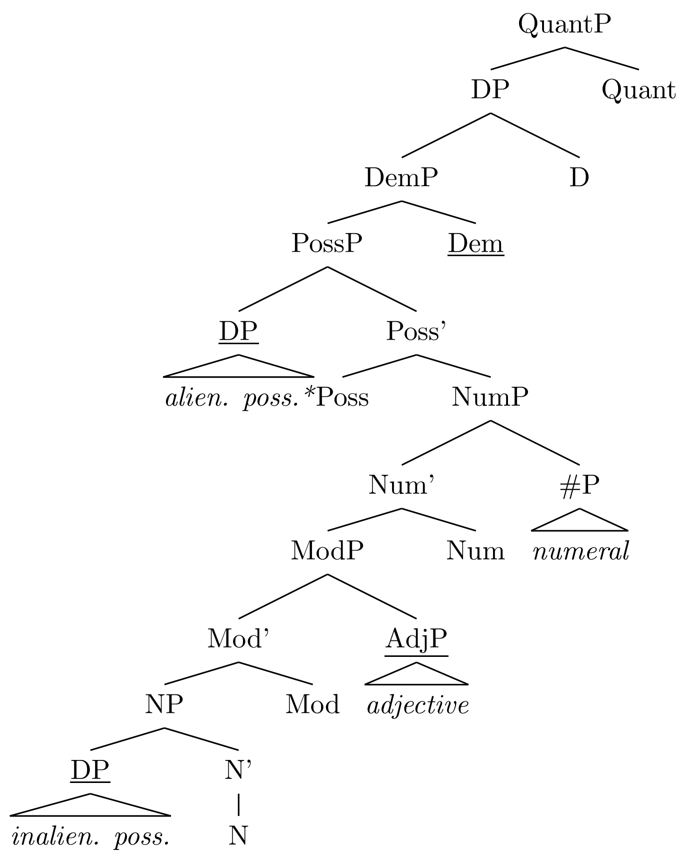
In (12), we see that an adjective has both the noun and the inalienable possessor in its c-command domain.[11] Example (11b) shows that the {L} overlay on the noun could be the result of either the possessor or the adjective. In §5.3, we will propose faithfulness constraints tied to the notion of phases (Uriagereka 1999, Chomsky 2000, etc.) to explain why the possessor does not succumb to the adjective's {L} overlay, despite being in its c-command domain. We will also show that this is a language-specific parameter; in a language like Jamsay, the possessor too would be overwritten with {L}.

The full tree structure assumed for the Dogon DP is given in (14b), where controllers are underlined, as they will be throughout the rest of the paper; the resulting linear order of this tree is given first in (14a):

[11] Here, it is clear why binary branching is crucial: if modifiers like adjectives and numerals were sisters to the noun and ternary branching were allowed, then the adjective would symmetrically c-command the noun, but also symmetrically c-command the numeral, yet a following numeral is never subject to adjectival tone overlays in any Dogon language.

(14) a. Poss N Adj Num Dem Def Quant

b.



The alienable possessor carries an asterisk, since it is a controller when non-pronominal but not when pronominal.[12] This tree structure also shows that controllers and non-controllers are interleaved; it is not the case that elements closer to the head noun control overlays while outer ones do not. Without reference to syntactic category, it would be impossible to predict the tonosyntactic behavior of a word. This fact in and of itself makes Dogon tonosyntax difficult to analyze in standard models of phonology-syntax interface, such as Prosodic Phonology (Nespor and Vogel 1986, Selkirk 1978,

[12] In all likelihood, this syntactic position (DP in the specifier of PossP) is always associated with tone control and the alienable pronominal possessor falls in a different projection like an appositive phrase (AppP). We do not explore the syntax of alienable pronominal possessors further here.

Selkirk 2011), where phrasing is purported to be category-insensitive; if such theories were augmented to allow reference to syntactic category, they would be highly applicable to the Dogon data, where overlays do apply to phrasal domains.

4.3 Tonosyntactic conflicts are resolved by constraint interaction

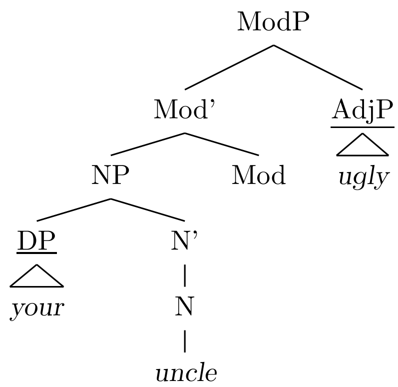
Here, we give the final essential generalization about tonosyntactic grammars: The presence of multiple controllers leads to conflicts, which can be suitably resolved in a constraint-based theory. We will propose an analysis in which the tonal effects of each controller are encapsulated in a morphological constraint (i.e. a constraint demanding the realization of a tonal morpheme across syntactic phrases). The main analytical claim following from this generalization is given in (15):

(15) When more than one controller targets the same word(s), it is the relative strength of the constraints involved that determines the surface form.

In this formulation, we use the general term "strength" to encompass either constraint ranking (as in Optimality Theory, Prince and Smolensky 1993) or constraint weighting (as in Harmonic Grammar, Legendre et al. 1990). In this paper, we will give all analyses with constraint ranking, but see McPherson (2014) for data supporting a weighted constraint analysis for Tommo So and other Dogon languages.

The need for constraint interaction is evident in that fact that a) it is not always the highest c-commanding controller that wins a competition (unlike in Lai, Kathol 2003, or Hawrami, Holmberg and Odden 2008, where the highest element controls morphophonological form) and, relatedly, b) different Dogon languages resolve tonosyntactic conflicts differently. Consider the following syntactic configuration with an inalienable pronominal possessor and an adjective:

(16)



Both the possessor and the adjective c-command the noun. The adjective also c-commands the possessor. Hence, the possessor has a potential one-word target domain and the adjective has a potential two-word target domain. The outcomes of this competition for Tommo So, Jamsay, and Nanga, respectively, are given in (17):[13]

(17) a. <u>PossIP</u> N^{L} <u>Adj</u> (Tommo So)
<u>ú</u> bàbè^{L} mɔ̀ɲjú
2SG.PRO uncle ugly
'your ugly uncle' (cf. *bàbé*)

b. {<u>PossIP</u> $\text{N}\}^{\text{L}}$ <u>Adj</u> (Jamsay)
{<u>ù</u> $\text{lèjù}\}^{\text{L}}$ <u>mɔ̀ɲú</u>
2SG.PRO uncle ugly
'your ugly uncle' (cf. *ú, lèjé*)

c. <u>PossIP</u> $^{\text{HL}}\text{N}$ <u>Adj</u> (Nanga)
<u>ú</u> $^{\text{HL}}\text{lésî}$ <u>mɔ̀sí</u>
2SG.PRO uncle ugly
'your ugly uncle' (cf. *lèsí̂*)

[13] The Jamsay example in (17b) contains an idiosyncratic segmental change on the possessed noun, with final /e/ changing to /u/ when possessed. A construction-based account, along the lines of that proposed in McPherson (2014), is able to handle cases of lexical idiosyncrasies by using sub-schemas that specify a particular lexical item instead of a syntactic category like N. Note that *bàbé* in Tommo So refers to a paternal uncle (younger than the father), while *lèsî* and *lèjé* refer to a maternal uncle (cf. Tommo So cognate *níɲju*).

In Tommo So, the adjective's {L} overlay takes precedence, but does not control the tone of the possessor (i.e. it does not control its entire c-command domain). In Jamsay, the adjective imposes {L} on the entire c-command domain. In Nanga, the lower controller, i.e. the possessor, takes precedence and imposes {HL} on the possessed noun; the adjective's {L} overlay goes unrealized. As a first approximation, we can say that in Tommo So and Jamsay, a constraint motivating the adjective's tonal overlay outranks the possessor's (Adjective $\gg$ Possessor), while in Nanga, the reverse is true (Possessor $\gg$ Adjective); additional constraints (given in §5.3) account for the difference between Tommo So and Jamsay. For evidence in favor of the specificity of the constraint set (i.e. "adjective" rather than "non-possessive modifier"), see §6.2.

The next section fleshes out this constraint-based theory and gives a full analysis of Tommo So tonosyntax.

5 Analysis

With these basic generalizations in place, we can now turn to the necessary ingredients for a constraint-based analysis. The analysis could be adapted for a variety of morphophonological frameworks, such as Construction Morphology (Riehemann 2001, Booij 2010, among others) or Realization Optimality Theory (Aronoff and Xu 2010, Xu 2011), provided they allow global constraint-based evaluation of the DP. We will remain largely neutral on the topic here, but for an implementation using elements of Construction Morphology, see McPherson (2014). In §7.2, we consider how other models might account for Dogon tonosyntax, with varying degrees of success.

5.1 The status of the overlay

Given the heavy involvement of syntactic category and structure, we assume tonal overlays arise as the result of the morphology rather than as purely phonological effects. In this paper, we put forth the view that surface overlays are the phonological instantiation of two tonal morphemes.[14] Possessive DPs

[14]While we analyze the overlays as tonal morphemes, with the phenomenon under the heading of morphology, the analysis does not hinge crucially on these definitions. An alternative approach would be to treat the overlays as only tones whose distribution is

introduce a tonal morpheme, {T}, with the morphological feature [+Poss]. This feature can be seen as akin to the Finnish "possessed case" (Pierrehumbert 1980), realized on the possessed NP, rather than as genitive case, realized on the possessor. The tonal morpheme {T} has different allomorphs, triggered by aspects of the possessor, the possessed noun, or both. For example, in Tommo So, the [+Poss] allomorph with nonpronominal possessors is {L}, while with inalienable pronominal possessors, it is {H} or {HL}; words with 1-2 moras subcategorize for the {H} allomorph, while words with 3 or more moras subcategorize for {HL}. In §6, we will see different allomorphic patterns in other Dogon languages.

The other controllers introduce a tonal morpheme {L}, with something like the morphological feature [+Mod] for "modified". Crucially, non-controllers like numerals do not trigger this feature. Though tonal allomorphy is possible in principle for this morpheme as well, all of the Dogon languages considered in this paper display just a single realization, {L}.[15]

Though we describe [+Poss] and [+Mod] as essentially tonal morphemes, they differ in their phonological behavior from traditional floating tones described in the literature. Most importantly, they completely replace the tone of their target rather than concatenating with it, as we have seen in the data thus far. In this way, Dogon tonal overlays could be viewed as akin to Semitic templatic morphology under the overwriting analysis of Trommer and Zimmerman (2011), rather than concatenating prefixes or suffixes. The interesting aspect of the system is that these tonal morphemes can potentially overwrite the tone of multiple words; they are phrasal rather than word-level in their scope.

The second difference from traditional floating tones is that Dogon tonal morphemes can sometimes dock on non-adjacent words, with an intervening H-toned pronominal:

determined by syntactic information, i.e. tonosyntax proper. This is a larger debate about how to characterize phrasal phonological alternations with little perceived meaning that goes beyond the scope of this paper.

[15] An alternative analysis, following Heath and McPherson (2013), would be to propose a unifying feature [RR] for "reference restriction". Different syntactic categories would trigger different allomorphs of this feature ({L} from an adjective, {H} from a pronominal possessor, etc.). Such a morphosemantic feature has not, to our knowledge, been proposed in the literature, but Dogon could give evidence for it. The problem with using a single feature like [RR] is that there would be no competitions; while different controllers may impose different allomorphs of the [RR] morpheme, any allomorph would satisfy the need to realize the morpheme. This is not what we find.

(18) gàmmà^{L} ḿmɔ n̲ɔ̲́
cat 1SG.POSS this
'this cat of mine' (cf. *gámmá*)

The demonstrative's {L} overlay skips over the possessor and applies to the noun; for discussion and analysis, see §5.3 and example (32).

The behavior of the proposed tonal morphemes is similar to that described for Kalabari Ijo (Harry and Hyman 2014), where certain syntactic categories trigger tone reduction followed by the reassociation of their floating tones on other words in the DP. As we will show in the next section, we formulate our morphological constraints to apply the replacive overlay in a single step (i.e. without a separate step for reduction).

Another curious aspect of Dogon tonal overlays is that they appear to overwrite not just the lexical tone of a target but also any tonal morphemes associated with controllers in the target domain. This assertion arises from following surface-true generalization about Dogon tonosyntax: Controllers that have taken an overlay themselves never impose their own tonal overlay on other words. This generalization means that configurations like the following are never attested:

(19) a. [[Poss^{L}] ^{HL}N Adj]

b. [Poss [N^{L} ^{HL}Adj]]

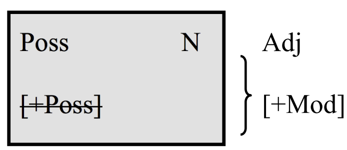
In (19a), a possessor that has taken {L} from a c-commanding adjective still applies its {HL} tonal morpheme on the noun. In (19b), the possessor c-commands the adjective and imposes {HL} on it, but the adjective also imposes {L} on the noun. Never do we find these outcomes in the Dogon languages.[16]

This systematic absence leads us to a model where candidates like those in (19) are not just penalized by a violable constraint (e.g. FREECONTROLLER, a controller must be free of overlays itself) but are simply not generated. From the standpoint of constraints on overlay application, if a controller no longer has an overlay to apply, it cannot incur any violations; see §5.2-5.4.

[16] Importantly, the same is true even if a controller has taken its own overlay in a process we call "self-control"; see §6.2 for discussion.

Consider a case like (19a), where an adjective c-commands both the noun and the possessor. In Jamsay, the output for this configuration is $\{\text{Poss N}\}^{\text{L}}$ Adj, with the {L} applied to all c-commanded words. By virtue of taking the {L} overlay, the possessor loses both its lexical tone and its {HL} overlay, rendering its c-command constraint Poss $^{\text{HL}}$X moot (since there is no longer a {HL} to dock to c-commanded words). From a morphological perspective, if a syntactic category has an associated floating morphological feature (here [+Poss] from the possessor), that feature is lost if the word has a feature dock to it (here [+Mod] from the adjective). This overlay application for Jamsay can be schematized with the following diagram:

(20) Schematic of overlay application



The top tier indicates words in their linear order. If a word has a tonal morpheme (represented here as its morphological feature) feature, it is listed underneath. In the application of overlays, the adjective's [+Mod] encompasses both the possessor and the noun, wiping out any associated tonal morphemes. For a tableau illustrating the Tommo So outcome of this competition (Poss N^{L} Adj), see (30); for a tableau illustrating the Jamsay outcome ($\{\text{Poss N}\}^{\text{L}}$ Adj), see (53).

Though we have stipulated the behavior of overlays based on the empirical data, it is possible that further study could derive this behavior from the architecture of the grammar. One suggestion from a reviewer for *NLLT* is that this situation arises as the result of cyclicity: on the first cycle, the possessor imposes {HL} on the noun, then on the next cycle the adjective overwrites the results with {L}. While we are sympathetic to the idea, we believe that a cyclic approach to the data is ultimately untenable; see §7.2. Our best guess is that these data patterns are a historical residue from a time when tonal changes were the result of something akin to phrasal stress: a word could not be simultaneously prominent (deemphasizing others in the phrase) and deemphasized itself. For further discussion of the relation between Dogon tonosyntax and a phrasal reduction system, see §7.1.

5.2 Constraint formulation

Our constraint formulation has three components: the controller (Poss, Adj, Dem, etc.), the tonal overlay ({L} for [+Mod], variable {T} for [+Poss]), and the target of the tonal morpheme (overlaid on c-commanded words). Following McCarthy and Prince (1993), Pater (2007), and others, we propose a universal constraint template that can take language-specific syntactic categories as its argument. The constraint format used here is given in (21):

(21) X^T CAT: Words (X) c-commanded by a particular syntactic category (CAT) take a tonal overlay {T}.

For example, the constraint for adjectives in Tommo So would be X^L ADJ, which favors outputs in which words c-commanded by an adjective (=X) take a {L} overlay, representing [+Mod]. In our implementation, a violation is assessed for every **word** in such a configuration that does not take the {L} overlay, since we never find cases of overlays applying to only one or two syllables, which would suggest that evaluation should be carried out at a syllabic or moraic level; there is simply no strong faithfulness to lexical tone at all.

In all likelihood, the Universal Grammar template for this constraint is even more general, with a tonal overlay {T} replaced by a placeholder representing any morphophonological change. The effects of c-command have been reported many times in the literature on phrasal phonology and morphology (Selkirk 1986, Odden 1990, Borsley and Tallerman 1996 et seq., Green 2006, Holmberg and Odden 2008, among many others), so with such a general constraint template, these phenomena could be accounted for using the same toolset. For example, in Hawrami (Holmberg and Odden 2008), we could propose constraints like X-i ADJ or X-æ DEF to represent that all words c-commanded by an adjective take an *izafe* suffix *-i*, and all words c-commanded by the definite take the *izafe* suffix *-æ*.

We assume that the specifics of the c-command constraint are acquired during the learning process and are language-specific. In other words, we do not expect a language like Tommo So to have a constraint for a numeral, since nowhere in the learning data did speakers experience tonal overlays associated with a numeral. For Tommo So, we adopt the following set of c-command constraints, corresponding to the examples in (4):[17]

(22) Tommo So c-command constraints

a. X^L ADJ:
Assess a violation for every word c-commanded by the adjective that is not included in its {L} domain.

b. X^L DEM:
Assess a violation for every word c-commanded by the demonstrative that is not included in its {L} domain.

c. POSS ^TX:
Assess a violation for every word c-command by the possessor that is not included in its {T} domain.

The phonological realization of {T} is filled in by principles of allomorph selection. The wording of the constraints is such that a) if a controller has lost its tonal morpheme by overlay application from another controller, it no longer has an overlay domain and no violations can be assessed, and b) the overlay is one single domain, not a repetition of the feature on each c-commanded word. This will be clear in languages like Ben Tey, discussed in §6, where a possessive {HL} overlay is realized on the whole c-commanded word string as {HL....L} and not as {HL}...{HL}.[18]

As can be seen in (22), constraints exist for each controller, not for each tonal morpheme. The reason for this is that in some cases, controllers pattern differently with respect to one another and to other constraints. An analysis with only two constraints (e.g. REALIZE[+Poss], REALIZE[+Mod]) would not be able to account for these differences. For one such case in Ben Tey, see §6.2. Given this category specificity, the c-command constraints can be viewed as akin to morpheme-indexed constraints (Pater 2000, 2010, Gouskova

[17]Additionally, the grammar would contain a c-command constraint for a relative clause, X^L REL, but in the interest of space, we do not consider such forms in this paper.

[18]It may be that these constraints can be decomposed into a constraint defining the domain of application and another phonological constraint like ALIGN determining how the tonal morpheme is mapped to TBUs. As the issue of mapping is somewhat orthogonal to our main point (application of and competition between overlays), we do not address it further here.

2007, Jurgec 2010, among others); while indexed constraints tie phonological requirements (either markedness or faithfulness) to particular morphemes, the c-command constraints tie tonal morphemes and their target domains (the c-command domain) to particular syntactic categories.

5.2.1 Competition between a c-command constraint and faithfulness

A simple tableau is given below showing the interaction between X^L ADJ and the faithfulness constraint IDENT(T) for *gàmmà^L gém* 'black cat' in Tommo So.

(23)

Input: /gámmá <u>gɛ́m</u>/	X^L ADJ	IDENT(T)
a. gámmá <u>gɛ́m</u>	∗!	
b. ☞ gàmmà^L <u>gɛ́m</u>		∗

Fully faithful candidate (a) incurs one violation of X^L ADJ, since the noun *gámmá* 'cat', c-commanded by the adjective, does not take a {L} overlay. Candidate (b) wins, where the adjective's constraint is satisfied at the cost of one faithfulness violation.

5.2.2 Competition between two c-command constraints

Competition between different controllers' constraints is crucial for our analysis of Dogon tonosyntax. In the last mini tableau, we saw an adjective impose {L} on a noun, violating FAITH. In the following mini tableau, we see that when an adjective and a pronominal possessor come into conflict, the adjective's {L} [+Mod] overlay trumps the possessor's {H} [+Poss] overlay because X^L ADJ outranks POSS ^TX. The example in (24a) is provided to show the behavior of the possessor in the absence of an adjective:

(24) a. PossIP ^{H(L)}N
<u>mí</u> ^Hbábé
1SG.PRO uncle
'my uncle' (cf. *bàbé*)

b. PossIP N^{L} Adj
mí bàbè^{L} kómmó
1SG.PRO uncle skinny
'my skinny uncle'

c.

Input: /mí bàbé kómmó/		X^{L} ADJ	POSS ^{T}X	ID(T)
a. ☞	mí bàbè^{L} kómmó	*	*	*
b.	mí ^{H}bábé kómmó	**!		*
c.	mí bàbé kómmó	**!	*	

The adjective c-commands both the noun and the possessor. For now, we leave out candidates in which the possessor also takes a {L} overlay; for a discussion of these conflicts, see §5.3. Candidates (b) and (c) both incur two violations of X^{L} ADJ, as opposed to the single violation in candidate (a). If the ranking of the two c-command constraints were reversed, candidate (b) would be chosen as winner.

Even though X^{L} ADJ outranks POSS ^{T}X, the possessor's overlay will be applied if it is the highest c-commanding controller, given the fact that controllers that have taken an overlay lose their ability to control. This outcome is illustrated in the following tableau for Poss ^{L}{N Adj}, with an alienable possessor:

(25) a. PossANonP ^{L}{N Adj}
Sáná ^{L}{gàmmà kòmmò}
Sana cat skinny
'Sana's skinny cat' (cf. *gámmá, kómmó*)

b.

Input: /Sáná gámmá kómmó/		X^{L} Adj	Poss $^{\text{T}}$X	Id(T)
a.	☞ Sáná $^{\text{L}}${gàmmà kòmmò}			∗∗
b.	Sáná gámmá $^{\text{L}}$kòmmò		∗!	∗
c.	Sáná gàmmà$^{\text{L}}$ kómmó		∗!∗	∗
d.	Sáná $^{\text{L}}$gàmmà kómmó	∗!	∗	∗
e.	Sáná gámmá kómmó	∗!	∗∗	

The winning candidate imposes the possessor's overlay on both the c-commanded noun and adjective. By virtue of taking an overlay, the adjective loses its own and hence X^{L} Adj is rendered moot. The situation is similar in candidate (b), but Poss $^{\text{T}}$X incurs one violation, since the noun does not take the possessive overlay. Candidate (d) likewise incurs one violation of Poss $^{\text{T}}$X for the adjective, but since it retains lexical tone in this case, it retains its ability to impose an overlay; because this overlay goes unrealized, X^{L} Adj incurs a violation for the c-commanded noun. In candidate (c), X^{L} Adj is non-vacuously satisfied, since the noun takes the [+Mod] {L} overlay; however, this results in two violations of Poss $^{\text{T}}$X, one for each c-commanded word. Fully faithful candidate (e) maximally violates both c-command constraints.

If both controllers impose the same tonal morpheme ({L} [+Mod]), there is no overt competition. The {L} overlay, though introduced by both controllers, will in principle satisfy either, as shown in the following tableau for {N Adj}$^{\text{L}}$ Dem in Tommo So:

(26) a.

{N	Adj}$^{\text{L}}$	Dem
{gàmmà	gɛ̀m}$^{\text{L}}$	nɔ́
cat	black	this

'this black cat' (cf. *gámmá, gɛ́m*)

b.

Input: /gámmá gɛ́m nɔ́/		X^{L} Adj	X^{L} Dem	Id(T)
a.	☞ {gàmmà gɛ̀m}$^{\text{L}}$ nɔ́			∗∗
b.	gàmmà$^{\text{L}}$ gɛ́m nɔ́		∗!	∗
c.	gámmá gɛ̀m$^{\text{L}}$ nɔ́		∗!	∗
d.	gámmá gɛ́m nɔ́	∗!	∗!∗	

Both the adjective and the demonstrative introduce [+Mod], with the tonal allomorph {L}. In candidate (a), both the noun and the adjective take the overlay, which can only be seen as demonstrative-controlled since the adjective is itself controlled (hence losing its own [+Mod]). In candidate (b), only the noun takes an overlay. Because this overlay is [+Mod], it satisfies X^L ADJ and half-satisfies X^L DEM; this single morphological feature satisfies the requirements of two controllers. In candidate (c), only the adjective takes {L}, which half-satisfies X^L DEM. By virtue of taking the {L} overlay, X^L ADJ is rendered moot. Candidate (d) is fully faithful, incurring one violation of X^L ADJ (for the c-commanded noun) and two violations of X^L DEM (for the noun and adjective).

5.3 Faithfulness to words and phases

As the preceding tableaux have shown, general IDENT(T) is low ranked; if it were not, overlays would not apply at all. However, consider the following with *bàbé* 'uncle':

(27) a.

PossIP	^{H}N
mí	^{H}bábé
1SG.PRO	uncle

'my uncle' (cf. *bàbé*)

b.

N^L	Adj
bàbè^L	kómmó
uncle	skinny

'skinny uncle'

c.

PossIP	N^L	Adj
mí	bàbè^L	kómmó
1SG.PRO	uncle	skinny

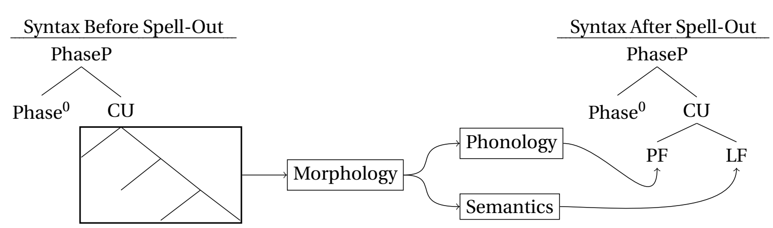
'my skinny uncle'

The tree in (12b) showed that an adjective c-commands both the noun and its inalienable possessor, but it only applies its overlay to the noun.

In the set of DP data considered here, possessors are the only elements subject to special faithfulness. An adjective, for example, will never specially resist the overlay of a c-commanding demonstrative, nor will a numeral resist an overlay applied by a c-commanding possessor. Thus, while we could stipulate a specific faithfulness constraint for possessors, nothing in that system would bar the existence of such a constraint for other DP elements.

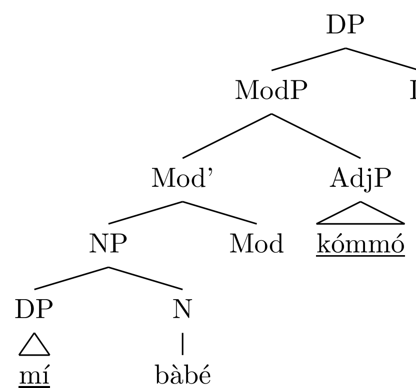
Instead, we argue that the greater faithfulness to possessors is straightforwardly accounted for in a phase-based or cyclic spell out model of syntax (Chomsky 1999, Uriagereka 1999, Pak 2008, etc.). In this model, syntactic structure is built from the bottom up and is sent to spell out (both PF and LF) in chunks, sometimes referred to as "computational units" (CUs). In the sense that syntax is built from the bottom of the tree up, it is similar to the notion of cyclicity in phonology (Chomsky and Halle 1968, Kiparsky 1985, Halle and Kenstowicz 1991, Odden 1993). However, not every new addition triggers a phase and a subsequent cycle of spell out. The basic idea behind the theory is that certain high-level functional projections, often vP, DP, and CP (and crucially not PossP, ModP, NumP), are phases. When these phase boundaries are reached, the material below them (the complement to the phase head) is sent to spell-out (both the morphological and phonological components as well as LF); under certain views of spell out (the "conservative proposal", Uriagereka 1999), this spelled out material is then reinserted into the syntactic derivation, but consisting only of PF and LF (i.e. lacking internal syntactic structure), as shown in (28):

(28) Schematic overview of cyclic spell-out (Ahn and McPherson, in prep)



The motivation behind cyclic spell-out of phases is that the **syntactic material** of the phase becomes inalterable after spell-out. As Uriagereka (1999:256-257) puts it, "...[a] collapsed merge structure is no longer phrasal, after Spell-out; in essence, the [syntactic unit] that has undergone Spell-out is like a giant lexical compound, whose syntactic terms are obviously interpretable but are not accessible to movement, ellipsis, and so forth". However, there is no reason why the **morphophonological material** of this "lexical compound" should be inalterable by higher morphophonological demands (contra many proposals in the literature, such as Newell and Piggott (2006), Lowenstamm (2010), Dobler et al. (to appear), etc.).[19] We assume that once a computational unit has been spelled out, the phonological output is reinserted into the syntax, where it concatenates with higher spell-out domains and may be targeted by morphological or phonological processes therein. For example, consider the following tree structure for *mí bàbè*^{L} *kómmó* 'my skinny uncle':

(29)



More deeply embedded structure is sent to spell-out first. Here, this is the possessor DP. At spell-out, the possessive pronoun takes its phonological form [mí]. The syntactic structure of this DP is then frozen, but the phonological material is reinserted. When ModP (the complement here to the phase head D) is sent to spell-out, the morphological constraint X^{L} ADJ seeks to impose {L} on all c-commanded words: the head noun *bàbé* 'uncle' and the possessor DP *mí*.

We suggest that because the possessive DP has been spelled out already and has received a phonological form at PF, it is subject to extra faithfulness, in particular faithfulness to the output of a previous phase: IDENT-PHASE (cf. Michaels' 2013 PIC constraints or Šurkalović's 2013 phase-phase faithfulness constraints). This constraint captures the idea that phases should ideally preserve the phonological form assigned to them in the previous cycle of spell-out. This immutability was previously argued to be the result of stipulated principles of grammar (such as "Phase Integrity" or "Phase Im-

[19]Thank you to Byron Ahn for bringing this syntactic vs. phonological distinction to our attention.

penetrability for Phonology" put forth by authors such as Newell and Piggott 2006 or Lowenstamm 2010 and argued against by Embick 2013). However, since constraints are inherently violable, the approach taken in this paper accounts for the fact that in some Dogon languages it is possible to undo what has been spelled out in an earlier phase at some cost.

The following tableau is an expanded version of (24c) above, where IDENT-PHASE(T) is shown to protect the possessor from the adjective's overlay:

(30) a. PossIP N^L Adj
mí bàbè^L kómmó
1SG.PRO uncle skinny
'my skinny uncle' (cf. *bàbé*)

b.

Input: /mí bàbé kómmó/	IDENT-PHASE(T)	X^L ADJ	POSS TX	IDENT(T)
a. ☞ mí bàbè^L kómmó		*	*	*
b. mí ^{H}bábé kómmó		**!		*
c. mí bàbé kómmó		**!	*	
d. {mì bàbè}^{L} kómmó	*!		*	**

In a competition between the adjective's {L} overlay and the possessor's {H} overlay, the {L} overlay wins. However, as candidate (d) shows, it is not allowed to take its full effect, since doing so would alter the tone of the possessor, which is protected by phase-based faithfulness. Instead, candidate (a) wins, since it incurs only one violation of X^L ADJ. Candidate (b), in which the possessor's {H} overlay applies, and fully faithful candidate (c) both violate X^L ADJ twice.

A reviewer suggests that the imperviousness of possessors to overlays could derive from position (faithfulness to the noun's left sister) rather than to syntactic structure and the architecture of the grammar. Three pieces of evidence argue against such an analysis. First, while the possessor is most often to the left of the noun, it is not always its sister. Alienable possessors are argued to be in PossP, considerably higher in the syntactic structure than the noun, and yet they are still impervious to higher overlays, as shown in the following PossANonP N^L Dem configuration:

(31)

PossANonP	N^L	Dem
Sáná	gàmmà^L	nɔ́
Sana	cat	this

‘this cat of Sana’s (cf. *gámmá*)

Faithfulness would have to be dependent simply on linear order rather than on the sister relationship holding between the possessor and the noun. Second, alienable pronominal possessors occur to the right of the noun but are equally protected from overlays, arguably due to the fact that they are DP phases. This can be seen in a form like the following:

(32)

N^L	PossAP	Dem
gàmmà^L	ḿmɔ	nɔ́
cat	1SG.POSS	this

‘this cat of mine’ (cf. *gámmá*)

The demonstrative c-commands both the noun and the possessor, but the latter resists tonal overlays, despite being to the right of the noun. Both of these examples show that **all** possessive DPs are protected by phase-based faithfulness, regardless of structural position. Finally, if we look beyond the data considered in this paper, we find cases of special faithfulness in relative clauses that are consistent with phase-based faithfulness. We do not have space to address these forms here, but see McPherson (2014) for data and discussion.

Excursus: syntactic movement — Our analysis appeals to syntactic category, syntactic structure, and the Minimalist notion of phases. A natural question is whether syntactic movement interacts at all with tonosyntax.

To the best of our knowledge, DP-internal movement would not affect overlay application. First, unless we assume an antisymmetric view of syntax (Kayne 1994), in which all postnominal modifiers are the result of DP roll-up (NP moves into the specifier of ModP, which moves into the specifier of #P, etc.), then no movement is necessary to account for Dogon DPs at all. The only potential case of movement we see in the data considered here is the postnominal alienable possessor, which surfaces not in the usual prenominal position but rather after the head noun. Our best guess is that this possessor is not generated in PossP (like the nonpronominal alienable possessor) but rather exists as a kind of appositive phrase that may be generated in the position we see on the surface.

Second, even if there were syntactic movement in the DP, tonosyntax would not be calculated until after the movement, when the D phase head is reached and the computational unit sent to spell-out; sub-DP projections, such as ModP or PossP, do not trigger spell-out themselves. Therefore, we do not expect to find a differentiation between overlays applied before movement vs. after movement. Overlays are assigned based on whatever syntactic structure is spelled out. This is not problematic at all for the cases of cyclicity considered here, namely possessor DPs being spelled out then imposing overlays in the next cycle. The first cycle assigns phonological form to the possessor itself, blind to its position in the larger DP (i.e. blind to the fact that it is a possessor at all). In the next cycle, that possessive DP imposes its tonal morpheme on c-commanded words, with c-command defined by the syntactic structure sent to spell-out. There is likewise no interaction between tonosyntax and focus or other possible movements targeting the whole DP; overlays are assigned to the DP as a whole, regardless of where in the larger sentence structure it occurs.

5.4 The full analysis of Tommo So tonosyntax

By this point we have established all of the elements needed for a full analysis of Tommo So tonosyntax. In §4, we presented evidence for the three main requirements of our analysis: the need for syntactic category, syntactic structure, and constraint interaction. The preceding subsections of §5 fleshed out a constraint-based theory and discussed necessary assumptions about how overlays are applied for the purposes of evaluation.

To implement the analysis, we constructed tableaux for twenty-five canonical syntactic constructions, consisting of two (e.g. N Adj), three (e.g. PossIP N Adj), and four (e.g. PossIP N Adj Dem) words. These tableaux were fed into the Constraint Demotion algorithm (Tesar and Smolensky 1993) to derive the appropriate ranking, given in (33):

(33)

Stratum #1:	IDENT-PHASE(T)
Stratum #2:	X^L ADJ
	X^L DEM
Stratum #3:	POSS ^TX
Straum #4:	IDENT(T)

We can make a few observations about Tommo So tonosyntax based on this ranking. First, the undominated nature of IDENT-PHASE(T) means that possessors are always protected from overlays, regardless of their source. Second, when both the possessor and a non-possessive controller retain their tone (i.e. when the non-possessive modifier c-commands the possessor but is unable to control it due to phase-based faithfulness), [+Mod] is uniformly stronger than [+Poss]. In §6, we will see how re-ranking this constraint set gives rise to tonosyntactic grammars found in other Dogon languages.

Earlier in this section, we saw tableaux illustrating cases of one controller (23) and two controllers ((24), (25), (26)). The same set of constraints equipped to handle conflicts between two controllers can account for cases of three controllers with no additional stipulations. In the data set considered here (not including relative clauses), the only cases we find involve the combination of a possessor, adjective, and demonstrative, illustrated in (34):[20]

(34) a.

PossANonP	{N	Adj}^{L}	Dem
Sáná	{gàmmà	gɛ̀m}^{L}	nɔ́
Sana	cat	black	this

‘this black cat of Sana’s’ (cf. *gámmá, gɛ́m*)

b.

PossINonP	{N	Adj}^{L}	Dem
Sáná	{bàbè	kɔ̀mmɔ̀}^{L}	nɔ́
Sana	uncle	skinny	this

‘this skinny uncle of Sana’s’ (cf. *bàbé, kɔ́mmɔ́*)

[20]Following the usual conventions, {L} superscripted on the left is the instantiation of [+Poss], while {L} superscripted on the right is the instantiation of [+Mod].

c. PossIP {N Adj}^{L} Dem
mí {bàbè kòmmò}^{L} nɔ́
1SG.PRO uncle skinny this
'this skinny uncle of mine'

The example in (34a) involves an alienable nonpronominal possessor, which c-commands both the noun and adjective. The demonstrative c-commands the noun, adjective, and possessor, but the latter is protected by phase-based faithfulness. Because X^{L} DEM outranks POSS ^{T}X, the demonstrative's {L} overlay is imposed on the noun and the adjective rather than the possessor's {L} overlay, while the adjective's own overlay is suppressed.

In (34b), the possessor is inalienable, and hence only c-commands the noun. The demonstrative's c-command domain remains the same, encompassing all three other words in the phrase. The surface form is the same as that of (34a). The adjective's c-command constraint continues to be rendered moot by the application of the higher {L} overlay from the demonstrative.

Finally, in (34c), the inalienable pronominal possessor seeks to impose {H} on the possessed noun, but once again it is trumped by the demonstrative.

Tableaux for these and all other examples are available in the online supplemental materials.

6 Evidence of re-ranking in the other Dogon languages

Further evidence for our analysis comes when we look beyond Tommo So to other Dogon languages, all of which share the same basic system of tonal overlays. Despite the gross similarities, no two languages are identical in the details of tonosyntactic implementation. We show that re-ranking the same basic set of constraints can account for all of these grammars (see also Anttila 1997 and Anttila and Cho 1998 for constraint-based analyses of variation within a language group). Space does not permit full explorations of other Dogon grammars, but in this section, we will highlight some predictions made by our constraint inventory and show how these predictions are in fact supported by Dogon data.

We will draw on data from four other Dogon languages: Ben Tey, Najamba, Jamsay, and Yorno So. To verify the model on these languages, we followed the same procedure as for Tommo So, composing tableaux for a total of between 21 and 25 canonical syntactic constructions, depending upon the availability of data for each language. In every case, an OT grammar could be found that produces the attested data patterns. The full tableaux for each language can be found in the online supplemental materials.

The following subsections cover cases of hierarchical reversals in tone control, controllers reabsorbing their own overlays in a process of "self-control", and low-ranked phase faithfulness, including differentiation between lexical and non-lexical phases. In explaining these phenomena, a few other constraints will be introduced, many of which play a role in the grammar of Tommo So as well when all data patterns are considered; we will highlight these cases as they arise.

6.1 Hierarchical reversals

In Tommo So, it was always the case that the highest c-commanding controller imposed its overlay, but in the Dogon languages, this is not always the case. For example, in Ben Tey, we find cases where a syntactically lower controller imposes its overlay, leaving a higher controller unsatisfied.

Under the implementation of overlays put forth in this paper, ranking reversals are only possible in one configuration: a syntactically lower possessor competing with a higher non-possessive controller. The other potentially relevant configurations, e.g. alienable [Poss [N Adj]], exclude the possibility of ranking reversal, since the overlay imposed by one controller (here the possessor) replaces not only the lexical tone of the unsuccessful controller but also the latter's associated tonal overlay, rendering its c-command constraint moot; see the tableau in (25). Specifically, in this configuration where the possessor is alienable and c-commands the adjective, full application of a [+Poss] overlay satisfies POSS ^{T}X and renders moot X^{L} ADJ. If the adjective's overlay were applied to the noun instead (the other way of satisfying X^{L} ADJ), this would result in two violations of the possessor's constraint, making this a suboptimal output, regardless of the ranking of POSS ^{T}X and X^{L} ADJ.

The difference in configurations where the possessor is the lower controller is phase-based faithfulness. Despite being c-commanded by an adjective or a demonstrative, possessors are able to resist overlays by virtue of the fact that DPs are phases; no such faithfulness protects non-possessive modifiers, since they are not sent to spell-out until the whole DP has been built, as per the tree structure in (12). By retaining their tone, possessors retain the ability to impose their tonal morphemes. Consider the case of a possessor with a demonstrative, with the bracketing [[Poss N] Dem], such as Tommo So *mí bàbè^{L} nɔ́* 'this uncle of mine'.[21] If phase-based faithfulness is highly ranked, Poss will resist the overlay from Dem, meaning that the demonstrative has only one viable target (N). The possessor shares this same target, since it does not c-command the demonstrative. In such a case, the relative ranking of Poss ^{T}X and X^{L} Dem determines the outcome, and in Tommo So, X^{L} Dem outranks Poss ^{T}X. The tableau in (30) illustrates the parallel case of [[Poss N] Adj] (inalienable possessor), with the ranking X^{L} Adj $\gg$ Poss ^{T}X.

Because of these rankings, the possessor's overlay is always trumped by a higher non-possessive overlay in Tommo So, but the opposite occurs in other languages. Ben Tey, for example, displays the outcome Poss ^{HL}N Dem for both alienable and inalienable possessors,[22] illustrated in (35a) with an alienable possessor, rather than the Tommo So outcome Poss N^{L} Dem. For comparison, an example of N^{L} Dem, showing the demonstrative's usual {L} overlay, is given in (35b):

(35) a. | PossANonP | ^{HL}N | Dem | (Ben Tey)
|---|---|---|---|
| yǎ-m | ^{HL}íɲjὲ | mùú | |
| woman-AN.SG | dog | this.AN.SG | |

'this dog of a woman' (cf. *ìɲjɛ̌-m*[23])

b. | N^{L} | Dem | (Ben Tey) |
|---|---|---|
| ìɲjὲ^{L} | mùú | |
| dog | this.AN.SG | |

'this dog'

[21] Possession here is inalienable, but the same bracketing holds of alienable possessors, which are also c-commanded by the demonstrative. If the competing controller is an adjective, however, then this configuration only applies to an inalienable possessor, i.e. [[PossI N] Adj] but [PossA [N Adj]].

[22] Ben Tey has very complicated rules of tonal allomorphy for the possessive overlay, relying on details of both syntactic structure of the possessor and on its final tone. For the sake of simplicity, we demonstrate just one case, where the overlay is {HL}. For description of the other allomorphs, see Heath and McPherson (2013: exs. 13-16).

[23] The animate singular suffix on the noun is lost in modified contexts.

This result is obtained when the ranking of Poss ^{T}X and X^{L} Dem is reversed, as shown in the following tableau:[24]

(36)

Input: /yǎ-m ìɲjɛ̌ mùú/	Id-Phase(T)	Poss ^{T}X	X^{L} Dem	Id(T)
a. ☞ yǎ-m ^{HL}íɲjɛ̀ mùú			**	*
b. yǎ-m ìɲjɛ̀^{L} mùú		*!	*	*
c. {yà-m ìɲjɛ̀}^{L} mùú	*!			**
d. yǎ-m ìɲjɛ̌ mùú		*!	**	

In summary, this section has shown that when a possessor is protected from a higher overlay by Ident-Phase(T), the possessive overlay comes into direct competition with the c-commanding modifier (adjective or demonstrative) for control of the noun. The outcome of this competition depends on the relative ranking of Poss ^{T}X and X^{L} Dem/Adj. In Tommo So, the non-possessive constraints outrank Poss ^{T}X, meaning that the possessor's overlay goes unrealized. In Ben Tey, Poss ^{T}X outranks X^{L}Dem, meaning that the noun takes possessive {HL} and the demonstrative's tone goes unrealized (as in (36)); the possessor does not control the tone of the demonstrative, since it does not c-command it. We will see in the next subsection that unlike in Tommo So, demonstratives and adjectives pattern differently in Ben Tey, supporting the category-specific nature of non-possessive constraints.

6.2 Self-control

A similar situation holds for competitions between possessors and adjectives in Ben Tey, but with a twist. Relevant Ben Tey data are given in (37a) (alienable) and (37b) (inalienable). Comparable data with numerals (non-controllers) are given in (37c) and (37d).[25]

[24]The possibility for the animate singular suffix on the noun is left out for the sake of illustration.

[25]In these examples, it is clear that a {HL} overlay is realized across a stretch of words rather than iteratively on each word.

(37) a. PossAP ^{HL}{N Adj} (Ben Tey)
ú ^{HL}{úrò dìy^{n}à-w^{n}}
2SG house big-INAN
'your big house' (cf. *úrò, díy^{n}à-w^{n}*)

b. PossIP ^{HL}N Adj^{L} (Ben Tey) (Inalienable)
ú ^{HL}lésù mòsù-m^{L}
2SG uncle bad-AN
'your bad uncle' (cf. *lèsú, mòsû-m*)

c. PossAP ^{HL}{N Num} (Ben Tey)
ú ^{HL}{úrò pèrù}
2SG house ten
'your ten houses' (cf. *pérú*)

d. PossIP ^{HL}N Num (Ben Tey)
ú ^{HL}lésù pérú
2SG uncle ten
'your ten uncles'

Cases (37a), (37c), and (37d) are schematically the same as we saw in Tommo So (though with nonpronominal rather than pronominal possessors, cf. (10) and (11)). In (37a), the possessor c-commands the noun and adjective and imposes its overlay on both; the same is true in (37c), though the numeral is not a controller in the first place. This can be seen in (37d), where the c-commanding numeral simply retains lexical tone while the inalienable possessor imposes {HL} on the c-commanded noun. The outcome in (37b) is more unusual. The adjective surfaces with a {L} overlay, even though the syntactic structure posited in (12) places the inalienable possessor below the adjective.

There are a number of possible analyses for this data pattern. The first, and in many ways simplest, possibility is that the syntactic structure of Ben Tey differs from that of Tommo So in that the inalienable possessor c-commands the adjective, rendering the syntactic structures of alienable and inalienable possession indistinguishable (as they arguably are in some Dogon languages, such as Toro Tegu, Heath 2012d). There are two arguments against such an analysis. First, the numeral is included in the overlay domain of an alienable possessor (37c) but not of an inalienable possessor (37d), so they must be distinguished syntactically. Second, Ben Tey also has a variant of (37c) in which the possessor is included in the overlay domain of the adjective ({PossIP N}^{L} Adj, Heath 2012:111), but no such variant exists for the alienable possessor. These two pieces of evidence strongly suggest that the syntactic structure differs for alienable and inalienable possessors in a manner consistent with the syntactic structures proposed for Tommo So.

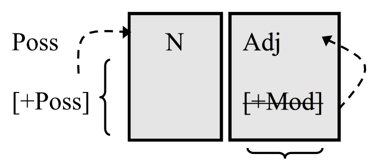
A second possibility is that Ben Tey differs from Tommo So in its tonosyntactic grammar, such that overlays sometimes extend beyond their c-command domains. For example, we could say that the possessor's overlay simply extends beyond its c-command domain to wipe out the adjective's unrealized overlay as a sort of "clean up" rule. Again, two arguments dissuade us from such an analysis. First, this would be the only case of a controller affecting something syntactically higher than itself, and we find such a move undesirable. Second, in other Dogon languages we find cases where a controller surfaces with an unexpected {L} overlay even when it is in the only controller in the phrase, ruling out the possibility that this overlay is the result of such an extended domain; see the discussion of Tommo So beginning at (41) below.

A third possibility is that the Ben Tey constraint set includes specific output-oriented constraints demanding the realization of elements in a particular local context. This case would call for a constraint ADJ^{L}/POSS, penalizing any adjective that surfaces without {L} in the presence of a possessor. Constraints of this sort may turn out to be necessary for some of the more tonosyntactically divergent Dogon languages, such as Tiranige (Heath 2012b) or Togo Kan (Heath 2012c). The need for such constraints would lend support to a more constructional rather than concatenative approach to tonosyntax, along the lines envisioned in McPherson (2014).

The final possibility we wish to explore here is that the unexpected {L} overlay on the adjective in (37d) is actually the adjective's own [+Mod], which has docked tautomorphemically in a process we call **self-control**. We find similar data patterns in a number of Dogon languages when a controller's overlay is otherwise blocked from applying to c-commanded words (in this paper, see (41) for Tommo So and (54a) for Yorno So). Rather than go unrealized, leaving the controller with lexical tone and an active violable c-command constraint, the overlay docks to its own controller. The result is that the c-command constraint is rendered moot, since a form that has been subjected to an overlay never controls other words, **even if the overlay is**

its own. We can visualize this process as follows:

(38) Schematic representation of adjectival self-control



Possessive control here is regular: the [+Poss] feature projects an overlay on the noun, replacing its tone. The adjective's [+Mod] feature, however, projects onto itself. Because the controller has taken an overlay, its tonal morpheme is rendered inactive and cannot be applied to other words. Self-control is then, in a sense, self-destruction of the controller just in case its overlay would otherwise go unrealized.

If this output were not penalized by the grammar, then whenever the controller has multiple targets (e.g. N Num Dem), the candidate N Num Dem^{L} would win, since it renders X^{L} Dem moot while violating Ident(T) only once. This kind of self-control is never seen in the Dogon languages. It is always a last resort option, turned to only when something blocks the overlay from applying to c-commanded words. The constraint *SelfControl penalizes this option, requiring violations of other constraints to motivate its application:

(39) *SelfControl: Assign a violation to any controller that takes its own overlay.

This constraint can be thought of like Wolf's (2007) constraint against tautomorphemic docking of floating features NoTauMorDoc or Myers and Carleton's (1996) constraint *Domain, barring the realization of floating tones in the domain in which they are introduced. Cases of tautomorphemic docking, violating these constraints, are attested: Wolf offers a couple of examples, including a tonal case from San Agustín Mixtepec Zapotec (Beam de Azcona 2004) and a moraic example from Tiberian Hebrew (Prince 1975). Thus, there is crosslinguistic precedent for the sort of tautomorphemic docking or self-control proposed here.

In the case of Ben Tey [[Poss N] Adj], two factors combine to trigger the violation of *SelfControl: phase-based faithfulness, ensuring that the possessor will retain its tone and remain an active controller despite being c-commanded by the adjective, and the ranking X^{L} Adj ≫ *SelfControl, making self-control a viable way to satisfy X^{L} Adj. With this combination, the ranking of Poss ^{T}X with respect to X^{L}Adj is actually immaterial, since both c-command constraints are fully satisfied by the self-control candidate, as illustrated by the following tableau for (37b):

(40)

Input: /ú lèsú mòsû-m/	Id-Phase(T)	Poss ^{T}X	X^{L} Adj	*SelfCont	Id(T)
a. ☞ ú ^{HL}lésù mòsù-m^{L}				*	**
b. ú ^{HL}lésù mòsû-m			*!*		*
c. ú lèsù^{L} mòsû-m		*!	*		*
d. ú lèsú mòsû-m		*!	**		
e. {ù lèsù}^{L} mòsû-m	*!				**

The winning candidate (a) satisfies Poss ^{T}X by applying the possessive overlay to the noun and renders X^{L} Adj moot by self-control. Crucially, this requires *SelfControl to be ranked below X^{L} Adj. If the ranking were reversed, candidate (b) would win. The Tommo So-like output (illustrated in (30)) is in candidate (c), but this output is suboptimal since it violates both Poss ^{T}X and X^{L} Adj, as does faithful candidate (d). Candidate (e) is ruled out by phase-based faithfulness; however, due to variable ranking of Ident-Phase(T) with respect to X^{L} Adj, this candidate does sometimes win (providing evidence that the adjective does in fact c-command the possessor). See §6.4 for parallels in Jamsay and Yorno So.

Here, it becomes clear why non-possessive controllers, though all carrying [+Mod] {L}, must have separate constraints. In Ben Tey, adjectives undergo self-control when c-commanding a Poss N constituent while demonstratives do not, as we saw in (35). This result is obtained through the ranking X^{L} Adj ≫ *SelfControl ≫ X^{L} Dem.

At the beginning of this subsection, we asserted that there are cases of self-control with only a single controller, which could not be analyzed as overextending its overlay to take down a competitor. One such case is found in the Tommo So N PossAP Dem configuration. In (32), we saw the output N^L PossAP Dem, where the demonstrative's overlay is imposed on the noun but the possessor is protected by IDENT-PHASE(T). The constraint-based grammar in the last section accounts for this output. However, we find free variation for this configuration, with another output, N PossAP Dem^L, which we argue to be a case of self-control. Illustrative examples are given in (41):

(41) a. N^L PossAP <u>Dem</u> (Tommo So)
gàmmà^L ḿmɔ <u>nɔ́</u>
cat 1SG.POSS this
'this cat of mine' (cf. *gámmá*)

b. N PossAP <u>Dem</u>^{L} (Tommo So)
gámmá ḿmɔ <u>nɔ̀</u>^{L}
cat 1SG.POSS this
'this cat of mine' (cf. *nɔ́*)

Descriptively, either the noun (41a) or the demonstrative (41b) surfaces as {L}, but never both; the possessive pronoun likewise never surfaces as {L}, since it is a possessive DP and is protected by phase-based faithfulness. In this configuration, the demonstrative is the only controller (since postnominal possessive pronouns never impose overlays). Thus, we analyze form (41b) as a case of self-control. By virtue of taking an overlay, it is no longer able to impose an overlay on other words, and the c-command constraint is rendered moot.

Since self-control is a last resort option, something must trigger its application. In the configuration N PossAP Dem, where the possessor is protected from the demonstrative's {L} overlay by phase-based faithfulness, there are two possible output forms: either the demonstrative can apply the overlay to one of its two c-commanded words (the noun), incurring a violation of X^L DEM, or it can absorb the overlay itself, incurring a violation of *SELFCONTROL. In the context of the rest of the grammar, though, a single violation of X^L DEM would not overpower *SELFCONTROL; another trigger is needed.

When we look across the Dogon language family, we find that overlays are almost always blocked when the targeted domain is non-adjacent to the controller.[26] We use LINEARITY (McCarthy and Prince 1994), which penalizes forms like N^L PossAP Dem:[27]

(42) LINEARITY: Assess a violation whenever the surface domain of a tonal overlay is non-adjacent to its controller.

The form in (41a) can be easily captured with the ranking in (43a) (the basic ranking from (33), but now including *SELFCONTROL and LINEARITY), illustrated with a tableau in (43b):

(43) a. *SELFCONTROL, IDENT-PHASE(T) >> X^L DEM >> LINEARITY, IDENT(T)

b.

gámmá ḿmɔ nɔ́	*SELFCONT	ID-PHASE(T)	X^L DEM	LINEARITY	ID(T)
a. ☞ gàmmà^L ḿmɔ nɔ́			*	*	*
b. gámmá ḿmɔ nɔ́			**!		
c. {gàmmà m̀mɔ̀}^{L} nɔ́		*!			**
d. gámmá ḿmɔ nɔ̀^{L}	*!				*

Informally, it is better to have non-local control (across an intervening possessor) than to have self-control.

To account for the self-control form in (41b), *SELFCONTROL must be demoted such that it is dominated by X^L DEM as illustrated in (44):

[26]The adjacency requirement must be applied to domains and not individual words, since in a multi-word domain such as Poss ^{T}{N Adj}, the adjective is non-adjacent but the form is not penalized, because the overlay domain is adjacent to the possessor.

[27]Surface linearity is sufficient for the data set explored here. Relative clauses may necessitate **structural locality** or a movement analysis rather than strict linear order.

(44) a. IDENT-PHASE(T) >> X^L DEM >> *SELFCONTROL, LINEARITY, IDENT(T)

b.

gámmá ḿmɔ nɔ́		ID-PHASE(T)	X^L DEM	*SELFCONT	LINEARITY	ID(T)
a.	☞ gámmá ḿmɔ nɔ̀^{L}			*		*
b.	gàmmà^L ḿmɔ nɔ́		*!		*	*
c.	gámmá ḿmɔ nɔ́		*!*			
d.	{gàmmà m̀mɔ̀}^{L} nɔ́	*!				**

LINEARITY does not need to be promoted, since the candidate violating *SELFCONTROL, candidate (a), fully satisfies X^L DEM while the candidate violating LINEARITY does not.

However, the ranking in (44) is incompatible with the output forms of other configurations. These problems arise due to the ranking of X^L DEM above *SELFCONTROL, which predicts the output form *mí ^{H}bábé nɔ̀^{L}* 'this uncle of mine' for the configuration PossIP N Dem:

(45) a. PossIP N^L Dem (Attested output)
mí bàbè^L nɔ́
1SG.PRO uncle this
'this uncle of mine' (cf. *bàbé*)

b.

Input: /mí bàbé nɔ́/		ID-PHASE(T)	X^L DEM	*SELFCONT	POSS ^{T}X
a.	☹ mí bàbè^L nɔ́		*!		*
b.	mí bàbé nɔ́		**!		*
c.	mí ^{H}bábé nɔ́		**!		
d.	☞ mí ^{H}bábé nɔ̀^{L}			*	
e.	{mì bàbè}^{L} nɔ́	*!			

The attested surface form, candidate (a), is incorrectly ruled out due to a violation of X^L DEM. PossIP N Dem and other configurations require the ranking *SELFCONTROL ≫ X^L DEM, but this ranking predicts the wrong winner for N PossAP Dem, assuming high-ranked LINEARITY that would rule out the form N^L PossAP Dem:

(46) a. N PossAP <u>Dem</u>^{L} (Attested output)
gámmá ḿmɔ <u>nɔ̀</u>^{L}
cat 1SG.POSS this
'this cat of mine' (cf. *nɔ́*)

b.

Input: /gámmá ḿmɔ <u>nɔ́</u>/			LINEARITY	ID-PHASE(T)	*SELFCONT	X^L DEM
a.	☹	gámmá ḿmɔ <u>nɔ̀</u>^{L}			*!	
b.	☞	gámmá ḿmɔ <u>nɔ́</u>				**
c.		{gàmmà m̀mɔ̀}^{L} <u>nɔ́</u>		*!		
d.		gàmmà^L ḿmɔ <u>nɔ́</u>	*!			*

Candidate (a), the actual attested form, is incorrectly ruled out by *SELF-CONTROL.

Using the Recursive Constraint Demotion algorithm (Tesar and Smolensky 1993) in the OTSoft software package (Hayes, Tesar, and Zuraw 2013), we have confirmed algorithmically that there is no possible constraint ranking that produces self-control in N PossAP Dem but no self-control in PossIP N Dem. The only way to account for the outcome in (46a) using the current constraint set is to appeal to constraint **cumulativity**, where the combined penalty of more than one violation of weaker constraints can outweigh a single violation of a stronger constraint.

For the sake of presentational simplicity, we will account for cumulativity using constraint conjunction (Smolensky 1995, 2006); for an analysis in Harmonic Grammar (Legendre et al. 1990, Smolensky and Legendre 2006), see McPherson (2014). The Tommo So case requires self-conjunction of the constraint X^L DEM:

(47) X^L^ DEM&X^L^ DEM: Assign a violation if X^L^ DEM is violated more than once.

We could make more fine-grained distinctions (for example, by assessing two violations of the self-conjoined constraint if there are three violations of X^L DEM), but for the purposes of the Tommo So data pattern, this constraint formulation will suffice. When this constraint is added at the top of the ranking to the tableau in (46), the correct result is obtained:

(48)

Input: /gámmá ḿmɔ nɔ́/		X^L DEM&X^L DEM	LINEARITY	ID-PHASE(T)	*SELFCONT	X^L DEM	ID(T)
a.	☞ gámmá ḿmɔ nɔ̀^{L}				*!		*
b.	gámmá ḿmɔ nɔ́	*!				**	
c.	{gàmmà m̀mɔ̀}^{L} nɔ́			*!			**
d.	gàmmà^L ḿmɔ nɔ́		*!			*	*

The variation between N^L PossAP Dem and N PossAP Dem^L can now be modeled with variable ranking of LINEARITY with respect to *SELFCONTROL. If it dominates *SELFCONTROL, as in (48), then candidate (a) wins. If it is ranked at the bottom of the grammar, then candidate (d) wins. This ranking produces the correct results across the grammar, including configurations like PossIP N Dem, where LINEARITY is not at play (since both controllers are adjacent to a susceptible target N).

6.3 Undominated LINEARITY and *SELFCONTROL

The two constraints introduced in the last subsection were both dominated by other constraints in the language, allowing output forms to surface that violated one or the other. In Najamba (Heath 2011a), however, both constraints are undominated. This can be demonstrated with the following examples:

(49) a. N PossAP (Najamba)
pɛ̀gɛ́ ɔ́-yɛ̀
sheep 2SG.PRO-POSS.AN.SG

‘your sheep’

b. N[L] Dem (Najamba)
pɛ̀gɛ̀[L] ǒm
sheep PROX.AN.SG
‘this sheep’

c. N PossAP Dem (Najamba)
pɛ̀gɛ́ ɔ́-yɛ̀ ǒm
sheep 2SG.PRO-POSS.AN.SG PROX.AN.SG
‘this sheep of yours’

Example (49a) shows a N PossAP configuration; as in Tommo So, postnominal possessors impose no tonal overlays, so all words surface with regular tones. Example (49b) shows that demonstratives impose {L} on c-commanded words. However, when the demonstrative is added after a postnominal possessor, as in (49c), overlays are blocked.[28] This result is obtained from the ranking *SELFCONTROL, LINEARITY, IDENT-PHASE(T) ≫ X[L] DEM ≫ IDENT(T):

(50)

Input: /pɛ̀gɛ́ ɔ́-yɛ̀ ǒm/		*SELFCONT	LINEARITY	ID-PHASE(T)	X[L] DEM	ID(T)
a. ☞	pɛ̀gɛ́ ɔ́-yɛ̀ ǒm				**	
b.	pɛ̀gɛ̀[L] ɔ́-yɛ̀ ǒm		*!		*	*
c.	pɛ̀gɛ́ ɔ́-yɛ̀ òm[L]	*!				*
d.	{pɛ̀gɛ̀ ɔ̀-yɛ̀}[L] ǒm			*!		**

The tableau in (50) contains all of the same output candidates and constraints as the tableau for Tommo So (minus the conjoined constraint, unnecessary for the analysis of Najamba). It is the relative ranking of these constraints

[28]Alternatively, we could posit a {L} overlay from the demonstrative on the already L-toned classifier *-yɛ̀*, but this would mean that the demonstrative has controlled only **part** of the possessive DP, violating not only phase-based faithfulness but also the Phase Impenetrability Condition (Chomsky 2000), by which the spelled out material loses internal syntactic structure.

that determines which tonosyntactic pattern is allowed to surface.

6.4 Unfaithful phases

Up to now, we have seen no examples in which a possessor takes an overlay. However, §5.3 asserted that the resistance of DP phases to overlays is due to a violable constraint, IDENT-PHASE(T), not from a rigid principle of grammar (e.g. spelled out material is invisible in later cycles, as in Piggott and Newell 2006, Lowenstamm 2010). Evidence for this position can be found in other Dogon languages, where c-commanded possessors do in fact succumb to tonal overlays.

Compare, for example, the following examples from Tommo So and Jamsay (Heath 2008):

(51) a. PossIP N^{L} Adj (Tommo So)
ú bàbè^{L} mɔ̀ɲjú
2SG.PRO uncle ugly
'your ugly uncle' (cf. *bàbé*)

b. {PossIP N}^{L} Adj (Jamsay)
{ù lèjù}^{L} mɔ̀ɲú
2SG.PRO uncle ugly
'your ugly uncle' (cf. *ú, lèjú*)

The adjective's {L} overlay is dominant in both languages (X^{L} ADJ ≫ POSS ^{T}X), but in Jamsay, it is also applies to the possessor. This is indicative of lower-ranked phase-based faithfulness in Jamsay than in Tommo So. Non-pronominal possessors are also subject to overlays, as shown in (52a); a possessor's usual effect, a {HL} overlay, is illustrated in (52b):[29]

[29] Only inalienable possessors can receive overlays. This is arguably due to LINEARITY, since nonpronominal alienable possessors are all followed by a possessive particle *mà*, making them non-adjacent. A counterexample to this is that Jamsay alienable pronominal possessors are not followed by *mà*, yet they too cannot receive overlays from other controllers, nor do they impose overlays themselves. 1sg alienable possessor *má* could possibly have resulted from fusion of an original H-toned pronominal morpheme with possessive **mà*, in which case this combination would have been consistent with a LINEARITY-based explanation. However, the broader history of Dogon possessive pronominals is not yet clear, and we leave the behavior of Jamsay alienable possessors as an outstanding prob-

(52) a. {<u>PossINonP</u> N}^{L} <u>Adj</u>
{<u>Sàydù</u> lèjù}^{L} <u>mɔ̀ɲú</u> (Jamsay)
Seydou uncle ugly
'Seydou's ugly uncle' (cf. *Sáydù, lèjú*)

b. <u>PossINonP</u> ^{HL}N (Jamsay)
<u>Sáydù</u> ^{HL}léjù
Seydou uncle
'Seydou's uncle'

The tableau for (52a) is given in (53):

(53)

Input: /<u>Sáydù</u> lèjú <u>mɔ̀ɲú</u>/	X^L Adj	*SelfControl	Poss ^{T}X	Id-Phase(T)	Id(T)
a. ☞ {<u>Sàydù</u> lèjù}^{L} <u>mɔ̀ɲú</u>				*	**
b. <u>Sáydù</u> ^{HL}léjù <u>mɔ̀ɲù</u>^{L}		*!			**
c. <u>Sáydù</u> lèjù^{L} <u>mɔ̀ɲú</u>	*!		*		*
d. <u>Sáydù</u> ^{HL}léjù <u>mɔ̀ɲú</u>	*!*				*
e. <u>Sáydù</u> lèjú <u>mɔ̀ɲú</u>	*!*		*		

Candidate (a), with the adjective's overlay on both the noun and the possessor, is allowed to surface due to the low ranking of phase-based faithfulness. Candidate (b), the Ben Tey-like output, similarly leaves both c-command constraints unviolated, but it incurs a violation of *SelfControl, which is undominated in Jamsay. The Tommo So-like output is in candidate (c), but it is ruled out since it incurs one violation each of X^L Adj and Poss ^{T}X. Candidates (d-e) are ruled out since X^L Adj is maximally violated.

Thus far, pronominal and non-pronominal possessors have patterned the same way with regards to phase-based faithfulness. In Yorno So (Heath 2011), however, the two diverge. Consider the following data:

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lem.

(54) a. PossINonP ^{L}N Adj^{L} (Yorno So)
Sáydù ^{L}nàà sàlà^{L}
Seydou mother bad
'Seydou's bad mother' (cf. *náá*, *sálá*)

b. {PossIP N}^{L} Adj (Yorno So)
{mù nàà}^{L} sálá
1SG.PRO mother bad
'my bad mother' (cf. *mú*)

A nonpronominal possessor retains its tone in the face of a c-commanding adjective, as in (54a). Yorno So displays a Ben Tey-like output in this case, with the adjective undergoing self-control (see (40) above). If the possessor is pronominal, as in (54b), the adjective is able to fully realize its overlay on all c-commanded words. To account for these differences, we propose splitting phase-based faithfulness into two constraints, general IDENT-PHASE(T) (employed in all examples up to this point) and lexically-specific IDENT-PHASE(T)/LEX, which only penalizes phases containing lexical (i.e. nonpronominal) material.

The different Yorno So outcomes in (54) arise from the ranking IDENT-PHASE(T)/LEX, X^{L} ADJ ≫ *SELFCONTROL ≫ POSS ^{T}X ≫ IDENT-PHASE(T), IDENT(T). In other words, faithfulness to phases containing lexical material (nonpronominal) is undominated, while faithfulness to phases with only functional material (pronominal) is very low-ranked. In the interest of space, we will not provide tableaux here, as the nonpronominal tableau for Yorno So can be viewed as tableau (40) for Ben Tey (with IDENT-PHASE(T)/LEX alone at the top) and the pronominal tableau can be viewed as (53) above for Jamsay (with IDENT-PHASE(T) alone at the bottom).

6.5 Local summary

In this section, we have shown that the same system of constraints, suitably ranked, can capture a wide range of tonosyntactic effects represented across the Dogon languages. We briefly summarize here the differences in tonosyntactic patterns and the constraints responsible for them.

First, we saw that in a competition between a possessor and a higher c-commanding modifier (where the possessor is protected by phase-based faithfulness), the relative ranking of the tonosyntactic constraints determines the outcome:

(55) *Tonosyntactic constraint reversal*

Language	Schematic output	Constraint ranking
Tommo So	Poss N^L Dem	X^L DEM ≫ POSS ^{T}X
Ben Tey	Poss ^{T}N Dem	POSS ^{T}X ≫ X^L DEM

Second, languages differ in whether they allow a controller to take its own overlay ("self-control"). If *SELFCONTROL is undominated, then self-control is blocked, as in Najamba, but if it is dominated by a tonosyntactic constraint (Ben Tey) or a configurational constraint like LINEARITY (Tommo So), it is allowed:

(56) *Variable ranking of *SELFCONTROL*

Language	Schematic output	Constraint ranking
Najamba	N PossAP Dem	*SELFCONTROL, LINEARITY ≫ X^L DEM
Tommo So	N PossAP Dem^L	X^L DEM ≫ *SELFCONTROL, LINEARITY
	N^L PossAP Dem	*SELFCONTROL ≫ X^L DEM, LINEARITY
Ben Tey	Poss ^{T}N Adj^L	POSS ^{T}X, X^L ADJ ≫ *SELFCONTROL

Finally, we saw that phase-based faithfulness varies across languages depending on the ranking of IDENT-PHASE(T). In Yorno So, we found evidence for two versions of the constraint, IDENT-PHASE(T) and IDENT-PHASE(T)/LEX, of which the former is lowly ranked and the latter undominated:

(57) *Variable phase-based faithfulness*

Language	Schematic output	Constraint ranking
Tommo So	PossI N^L Adj	ID-PHASE(T) ≫ X^L ADJ
Jamsay	$\{$PossI N$\}^L$ Adj	X^L ADJ ≫ ID-PHASE(T)
Yorno So	PossINonP N^L Adj	ID-PHASE(T)/LEX ≫ X^L ADJ
	$\{$PossIP N$\}^L$ Adj	X^L ADJ ≫ ID-PHASE(T)

For full constraint rankings and tableaux for each language, see the online supplemental materials.[30]

7 Further issues

This section addresses two further issues: The first, in §7.1, is the relation of tonosyntax to phrasal phonology. We argue here that a phrasal phonological model of Dogon tonosyntax, akin to phrasal stress, is unable to account for the data. The second issue is how other morphological frameworks could account for the data presented in this paper; this topic is addressed in §7.2.

7.1 Phrasal phonology vs. tonosyntax

Every Dogon language studied to date has a tonosyntactic system. None are identical in the details, as indicated by the sample of languages considered here, but all share the same characteristic overlays in similar contexts. In the languages in this paper, we observed that all nonpossessive overlays (those controlled from the right) are {L}, while overlays controlled by possessors on the left are {H}, {HL}, or {L} depending on various language-specific factors. A reviewer suggests that these patterns could be accounted for in a system of phrasal reduction to {L} such that each controller-controlee domain contains a single H peak (culminativity). Under this view, any {H} or {HL} cases would be attributed to subsequent local spreading of an external H tone onto this {L}. This reduction would be roughly the tonal equivalent of English phrasal stress rules, such as those proposed by Chomsky and Halle (1968), Liberman (1975), Liberman and Prince (1977), and subsequent work.

While tonosyntax may have originated as a phrasal phonological system, giving rise to phrasal patterns resembling a system of reduction, we argue that such an analysis is ultimately untenable from a synchronic standpoint.

The first issue we see is a conceptual one. Reduction systems like culminativity ought to be driven by phonological constraints, and as such, we would

[30]The tableaux for Yorno So contain one extra constraint, X^L NUM/POSS, which accounts for a data pattern in which a numeral gains the ability to impose {L} on c-commanded words when a possessor is present. This pattern is unique to Yorno So in the set of languages considered here, but the data pattern is mirrored in other Dogon languages. For maximum comparability, we use the entire proposed constraint set for each language even if one or more the constraints may be unnecessary for that particular language. Section 3 of the OTSoft output lists whether constraints are necessary or unnecessary in the grammar.

expect to see the effects in phonologically-determined domains. As we have emphasized, Dogon tonosyntax is sensitive not to any sort of phonological phrase but to specifics of syntactic category and structure. For instance, even though numerals occur between adjectives and demonstratives in DPs (N Adj Num Dem), numerals fail to control tone overlays while both adjectives and demonstratives do. This is in sharp contrast to English-like prosody where numerals behave like adjectives (my six/seven dogs, my sick/clever dogs), and it is not clear to us why an adjectival domain would trigger reduction while a numeral domain would not. On a larger scale, all phrasal overlays are found in the DP and never in the VP, so H tone culminativity would have to be very narrowly defined in order to capture the Dogon patterns.

Even assuming that culminativity domains could be determined by syntactic structure with reference to syntactic category, analogously to the domains proposed in this paper, the tonal effects in many Dogon languages do not actually display surface patterns describable in terms of reduction and subsequent spreading. One example is Jamsay. In Jamsay, inalienable pronominal possessors are L-toned while alienable pronominal possessors are H-toned. It is precisely the L-toned inalienable pronominal possessors like 1Pl *ɛ̀mɛ̀*, along with nonpronominal inalienable possessors (which can end in either H or L tone), that require {HL} overlays on following nouns: *ɛ̀mɛ̀ ^{HL}déè* 'our father' (from *dèé* 'father'). By contrast, H-toned alienable pronominal possessors (the only alienable possessors that are directly adjacent to nouns, with no intervening genitive morpheme), such as 1Pl *ɛ́mɛ́*, fail to spread their H tone onto the onset of the noun, which preserves its lexical tones: *ɛ́mɛ́ ɲàmàkúù* 'our ginger'. Not only can the H of the {HL} overlay not be attributed to spreading from the possessor, it also does nothing to reduce the overall number of H tones in the domain, the core notion behind the culminativity analysis. Though we could propose different analyses for a language like Tommo So, where {H(L)} always follows a H-final possessor, and Jamsay, where it does not, we prefer a unified analysis of overlays, consistent with both types of languages.[31]

However, even in Tommo So, where the H of the inalienable possessive overlay could hypothetically be linked to the possessor, nowhere else in the language do we find such spreading. For example, the same set of pronouns is used to mark subjects in relative clauses, and no spreading is found:

[31] For a possible diachronic explanation for such "spreading" and "non-spreading" languages, see McPherson (2014).

(58) gàmmà^L mí bɛ̀ndɛ́-dɛ=gɛ
cat 1SG.PRO hit-IMPF=DEF
'the cat that I will hit' (cf. *gámmá*)

The head noun *gámmá* 'cat' takes a {L} overlay, but the pronoun *mí* has no effect on the verb. Thus, it is unlikely that there is any kind of phonological motivation for the tonal effects found with possessors.

It was suggested that culminativity could account for cases of supposed self-control: If the c-commanded words are unable to reduce to {L}, then the controller will. The problem with such an analysis is that it is not fine-grained enough to capture the data patterns. Presumably, a single constraint on the number of H tones in a particular domain would drive the reduction, but in Ben Tey, adjectives undergo self-control while demonstratives and numerals do not. Unless faithfulness constraints were indexed to each syntactic category, these patterns would remain unaccounted for, while the ranking of *SelfControl with respect to each controller's c-command constraint straightforwardly predicts the attested forms.

Thus far we have seen only {L} and {H(L)} overlays, with the latter confined to constructions in which the controller is on the left (possessors). If we bring western Dogon languages such as Bunoge (Heath 2012a) and Tiranige (Heath 2012b) into the picture, we can also cite {LH} overlays on nouns. {LH} can be required by controllers either to the right (adjectives) as in Bunoge *sùgùlè* 'ear' but modified *sùgùlé*^{LH} *bìgì* 'big ear', or to the left (possessors) as in Tiranige *gàànà* 'cat' but possessed X ^{LH}*gààná* 'X's cat'. A {LH} melody is incompatible with a reduction/culminativity model since the overlay can actually introduce H tones, and in most cases there is no reasonable way to account for the final H-tone as a phonologically motivated add-on.

Further points suggesting that tonosyntax differs from a system of phrasal stress include insensitivity to focus and speech rate and discontinuous domains of application (once again violating H tone culminativity). An example of the former is given in (59a) from Najamba[32] and and of the latter in (59b) from Tommo So:

[32] Thank you to Abbie Hantgan for collecting this example, from the Kindige dialect of Najamba-Kindige.

(59) a. mí gàŋ-à^{L} jɛ́m-ɛ̀ mó gì yà
1SG.PRO cat-NCL1 black-NCL1 DEF.AN.SG ACC FOC
dɛ̀ɲj-ɛ́-m, ŋ̀gw-ɛ̀^{L} jɛ́m-ɛ̀ mó gì là.
hit-PFV-1SG dog-NCL1 black-NCL1 DEF.AN.SG ACC NEG
(Najamba)

'It was the black cat that I hit, not the black dog.'

b. jàndùlù^{L} wómɔ pìlù^{L} nɔ́ (cf. /jàndúl/, /píl/, Tommo
donkey 3SG.POSS white this
So)

'this white donkey of his' (cf. *jàndúlu wómɔ* 'his donkey')

Phrasal stress patterns are affected by focus. While the regular pronunciation of *black dog* in English would more heavily stress the noun *dog*, putting focus on the color draws stress to this adjective (*BLACK dog*). The same is not true for tonal overlays. The example from Najamba in (59a) shows that even if the noun in a N Adj construction is focused, it still takes a {L} overlay. Example (59b) from Tommo So shows an example of a discontinuous domain of overlay application. The demonstrative imposes {L} on the adjective and the noun but fails to control the tone of the possessor due to phase-based faithfulness. Thus, the intervening possessive pronoun *wómɔ* 'his' retains its tone, in violation of H tone culminativity.

In conclusion, DP tonosyntax in all Dogon languages is more straightforwardly accounted for in a morphological system of overlays with sensitivity to syntactic category and structure. This is a more unified and learnable system for speakers than one based on ad hoc, exception-ridden phrasal rhythms and tone-spreading processes. We do not exclude the possibility that one or more Dogon languages not yet fully studied, in particular Tomo Kan, may be amenable to a prosodic analysis. We also do not deny that phrasal rhythms and tone reduction may have played key roles in the origins of Dogon tonosyntax. They almost certainly did, but distant origins are not the basis for learnable synchronic systems.

7.2 Other approaches

Before concluding, we briefly consider other possible approaches to the data. While details of implementation are subject to interpretation (e.g. whether or not overlays instantiate morphemes vs. are simply idiosyncratic phonological effects), we argue straight away that a theory without constraint interaction will be unable to adequately model Dogon tonosyntactic grammar in its varied forms across the language family. This rules out a model like standard Distributed Morphology (Halle and Marantz 1993, Harley and Noyer 1999, Embick and Noyer 2007). However, hybrid models combining aspects of Distributed Morphology with morphophonological constraints have been proposed, the most pertinent of which to tonosyntax is Trommer's (2011) Extended Stratal Containment. Trommer discusses cases of tonal overwriting in languages like Jumjum, Dinka, Anywa, and Hausa, showing that lexical tone succumbs to grammatical tone overlays because the latter are circumfixal and part of the same morpheme. If CONTIGUITY is sufficiently high ranked, the optimal outcome is to delete association lines with lexical tones intervening between the two halves of the circumfix.

The main difficulty we see with this analysis lies in the fact that tonal overwriting in Dogon is a phrase-level phenomenon. If the overlay morpheme were to be copied to every word dominated by its trigger, then we would find unattested cases where a possessive {HL} overlay is realized as [H...L] on every word. To match the data patterns, the circumfix would have to surround multiple words. This seems to be an undesirable innovation, since we see no cases of clear segmental phrase-level circumfixes cross-linguistically.

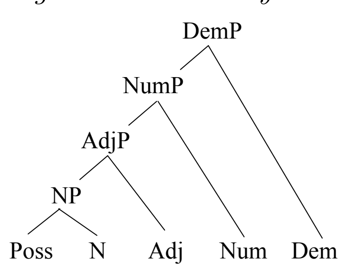
Realization Optimality Theory (Aronoff and Xu 2010, Xu 2011) is conceptually more similar to the theory proposed in this paper in that the phonological realization of a morphosyntactic feature is implemented using violable constraints, whose basic format is given in (60):

(60) {Morphosyntactic feature}: {Morphophonological form}

For example, in English, a constraint {pl}: *-s* is violated if an input form marked as plural does not take a suffix *-s* in the output. Our constraints go a step further in motivating how the morphological change is phonologically realized in context. For example, X^{L} ADJ could be envisioned as [+Mod]: {L}, with the understanding that {L} is realized in a replacive fashion across a multi-word domain. However, it differs as well in that the trigger of the morphological feature is appealed to in the constraint. Once again, this is due to the fact that different controllers pattern differently with respect to both other controllers and other constraints in the grammar; see §6.2. If Realization Optimality Theory were modified to make these same assumptions, the frameworks would be notational variants.

If the Dogon overlays applied at the word or stem level rather than the phrase level, a natural contender for analysis might be Cophonology Theory (Anttila 2002, Orgun and Inkelas 2002, Inkelas and Zoll 2005, Caballero and Inkelas 2013, etc.), where morpheme-specific phonologies enforce their effects on the structure with each new morphological addition. At the phrasal level, however, such a word-by-word cyclic model is rarely defended, though it has in the past been proposed (e.g. Chomsky, Halle, and Lukoff 1956, McHugh 1990). We argue that a word-by-word cyclic model, with the application of overlays progressing up the tree as each new modifier is added, would be unable to account for the data given standard assumptions of bracket erasure. The syntactic structure proposed for Dogon was given in (12), but for now, the following hierarchy will suffice for the discussion of cyclicity (maintaining a fixed phonology across the levels rather than a cophonology for each modifier):

(61) *Dogon DP hierarchy with an inalienable possessor*



The problem in cyclic build-up is bracket erasure, the idea that higher elements do not see the internal structure of outputs from lower levels. This problem is evident if we consider Poss N Adj in Tommo So. Poss N would first be calculated, yielding Poss ^{H}N. This NP would then combine with Adj, where only Adj would be active as a controller (the internal syntactic information of NP having been lost). This means that X^{L} ADJ would demand the output $\{$Poss N$\}^{L}$ Adj. However, this is not the output we find. Instead, we find Poss N^{L} Adj, where the adjective's {L} overlay does not extend past the noun. In the framework proposed in this study, the faithfulness of the possessor is due to special faithfulness associated with phases (§5.3); the status of the possessor as a DP phase is visible to the constraint set because the larger DP is being evaluated globally, with all syntactic information available, but under a cyclic theory with bracket erasure, the fact that NP consists of two words at all should no longer be visible to Adj. Thus, we support an analysis in which cyclicity is on a larger phasal scale, with global constraint evaluation on all words in the spellout domain. We suspect any framework likewise employing global constraint evaluation of this sort should achieve a similar degree of success.

8 Conclusion

In this paper, we have shown that Dogon replacive overlays are appropriately analyzed in a constraint-based model. These constraints are morphological in nature, encoding the phonological form of a morphological feature ([+Mod] or [+Poss]), its trigger, and its target words; constraint formulation makes crucial reference to syntactic category for the trigger and to syntactic structure (c-command) in defining a target domain. We find that a relatively simple set of constraints, suitably ranked, is able to account for the whole range of interactions found in a sample of five Dogon languages.

Future work should seek to fold Dogon relative clauses into the analysis and extend this model to other cases of phrasal alternations, such as tonal overlays in Kalabari Ijo (Harry and Hyman 2014), Awa (Loving 1973), and Usarufa (Bee and Glasgow 1973), as well as to segmental alternations such as Celtic consonant mutations (Ní Chiosaín 1991, Borsley and Tallerman 1996 *et seq.*, Green 2006, Wolf 2007, etc.) or French liaison (Agren 1973, Morin and Kaye 1982, Selkirk 1986, Booij and de Jong 1987, Green and Hintze 1988, Bybee 1995 etc.). We believe that a better typology of phrasal morphological alternations, such as Dogon tonosyntax, can greatly inform our understanding of the interplay between the components of grammar.

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