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Replacive grammatical tone in the Dogon languages

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by

Laura Elizabeth McPherson

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Abstract of the Dissertation

Replacive grammatical tone in the Dogon languages

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This dissertation focuses on replacive grammatical tone in the Dogon languages of Mali, where a word's lexical tone is replaced with a tonal overlay in specific morphosyntactic contexts. Unlike more typologically common systems of replacive tone, where overlays are triggered by morphemes or morphological features and are confined to a single word, Dogon overlays in the DP may span multiple words and are triggered by other words in the phrase. DP elements are divided into two categories: controllers (those elements that trigger tonal overlays) and non-controllers (those elements that impose no tonal demands on surrounding words). I show that controller status and the phonological content of the associated tonal overlay is dependent on syntactic category. Further, I show that a controller can only impose its overlay on words that it c-commands, or itself.

I argue that the sensitivity to specific details of syntactic category and structure indicate that Dogon replacive tone is not synchronically a phonological system, though its origins almost certainly lie in regular phrasal phonology. Drawing on inspiration from Construction Morphology, I develop a morphological framework in which morphology is defined as the idiosyncratic mapping of phonological, syntactic, and semantic information, explicitly learned by speakers in the form of a construction. The same constructional format can be used for both word-level and phrase-level phenomena. Under this view, Dogon replacive tone is

idiosyncratic phonology (tonal overlays) associated with syntactic structure (category and c-command).

A key feature of the Dogon system of grammatical tone is that when two or more controllers target the same word(s), conflicts can arise, with each constructional schema demanding different output forms. I argue that morphological constructions act as constraints on output form, and cases of competition are resolved through constraint interaction. I further show that the cyclic spell-out of syntactic structure can block the application of overlays, but that this blocking is a language-specific parameter, suggesting violable constraints protecting the morphophonological form of phases. In most cases, strict ranking (as in Optimality Theory) is sufficient to account for the data, but in two languages, Tommo So and Nanga, even nonstochastic patterns require constraint ganging, indicating the need for weighted constraints. I couch the analyses of Tommo So and nine other Dogon languages in Maximum Entropy Grammar, a stochastic version of Harmonic Grammar that can account for both constraint ganging and for surface variation. I show that the same constraint set, suitably weighted, is able to capture eight of the ten languages. The other two languages, Tiranige and Togo Kan, have followed different diachronic paths and require different constraints but still fit into the constructional framework.

The framework developed in this dissertation seeks to explain how restructured phrasal phonological systems are learned and implemented. I show how predictions of the model regarding the nature of the trigger, target domain, and resolution of conflicts are upheld by other phenomena outside of the Dogon language family.

The dissertation of Laura Elizabeth McPherson is approved.

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For Jeffrey Heath

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CHAPTER 1

Introduction

1.1 The problem

1.1.1 Morphophonological alternations specific to syntactic context

This study focuses on non-concatenative morphology triggered not by typical morphosyntactic features, like inflection or derivation, but rather by morphosyntactic context in a phrase. Due to the absence of obvious triggering features and to their non-concatenative nature, these changes look like phonological alternations, but ones lacking an obvious phonological environment for application.

A classic case of this phenomenon can be found in Celtic consonant mutations. To illustrate, in Irish, certain possessive pronouns trigger consonant mutations while others do not (Green 2006:1949). For example, the 1sg *mə* and the 3sg masculine ə trigger lenition of the initial consonant of *kat* 'cat' to [x]:

(1) a. mə xat (Irish)
1SG cat
'my cat'

b. ə xat (Irish)
3SG.M cat
'his cat'

The phonetically identical 3sg feminine possessive pronoun triggers no lenition:

(2) ə kat (Irish)
3SG.F cat
'her cat'

Barring the existence of floating elements (see §1.3.1.1), the phonological environment cannot be the trigger of lenition, since both the masculine and feminine are ə, nor can phrasing or syntactic bracketing be responsible, since possessive pronouns are presumably parsed into phrases in the same way regardless of person/number specifications.

In this study, I focus on the test case of replacive tonal overlays found in the Dogon languages of Mali. Like consonant mutation, tonal overlays cannot be characterized by phonological environment. To take a simple example, in Tommo So (McPherson 2013), a noun modified by an adjective sees its lexical tones replaced with a {L} overlay, but in a nearly identical phonological context with a numeral, no overlay is applied. This is illustrated in (3) for the /LH/ noun *gìnɛ́* 'house':[1]

(3) a. gìnɛ̀^{L} pílu (Tommo So)
house white
'white house'

b. gìnɛ́ pɛ́lu (Tommo So)
house ten
'ten houses'

The {L} overlay is indicated in the transcription both with a superscript L and by marking the tones on the noun using grave accents. In both (3a) and (3b), the noun *gìnɛ́* 'house' is followed by a modifier with a /H/ tone pattern with the shape /pVl/ plus an epenthetic

[1]The transcription system used for the Dogon languages is basically IPA, with a few substitutions: long vowels are written with two vowels (e.g. aa), the voiced palato-alveolar affricate is written 'j', the alveolar tap is written 'r', and nasalization is indicated with a superscript 'n' (e.g. r^{n}). There are two phonemic tones, H and L, marked with acute (v́) and grave (v̀) accents, respectively; unmarked syllables are toneless.

[u].[2] Both the segmental environment and the presumed phonological phrasing are the same between the two examples, yet the adjective triggers a tonal change while the numeral does not. As we will see below, this pattern is consistent across all adjectives and all numerals, suggesting that (3) should not be analyzed using something like lexically-specified floating tones; to characterize **all** adjectives and no numerals as carrying a floating L would introduce a great deal of redundancy into the lexicon.

It is not always the case that the overlay is {L}. Consider the noun *bàbé* 'uncle', which surfaces with {L} before an adjective but with {H} after a possessor:[3]

(4) a. bàbè^{L} kómmó (Tommo So)
uncle skinny
'skinny uncle'

b. mí ^{H}bábé (Tommo So)
1SG.PRO uncle
'my uncle'

Like the {L} overlay, {H} is context specific and regular, occurring after every pronominal possessor.

Phenomena like mutations and replacive overlays involve changes in phonological form, but without a discernible phonological environment or trigger. They all arguably have diachronic origins in regular, automatic phonology (reduction, intervocalic lenition, etc.), but through language change and restructuring, the changes end up fragmented and idiosyncratic, tied to morphosyntactic or lexical contexts rather than phonological ones. Nevertheless, in their environments for application, these morphophonological changes are robust and productive, and hence are undoubtedly part of the speaker's grammar.

[2]For a discussion of epenthesis, see McPherson (2013:§3.4.6).

[3]The H superscript in this case appears at the left edge of the noun, since its triggering element, the possessor, is to its left.

In this study, I will argue that these restructured phrasal phonological changes belong in the morphology, rather than the phonology proper. This echoes the sentiment of Green (2006) for Celtic consonant mutations, another case of restructured phrasal phonology. Green states: "I will argue that since the morphosyntactically conditioned consonant mutations of Celtic are not motivated by well-formedness conditions, they cannot be phonological. Instead, the mutations are best regarded as being exclusively in the domain of the morphology, not the phonology at all" (pg. 1947). However, this relies on a definition of morphology that extends beyond word formation. I take a lexicalist view of morphology, inspired by Booij's (2010) Construction Morphology framework, defining it as follows:

(5) Morphology: Idiosyncratic mappings of phonological, syntactic, and semantic information that must be explicitly learned and lexicalized.

These idiosyncratic mappings may be morphologically simple (roots, monomorphemic words) or complex; see the discussion in §1.2.1. Under this view, morphology is not so much a component of grammar unto itself as it is an interface. For Dogon replacive tone and other similar phenomena, I propose that these changes do not necessarily instantiate any morphosyntactic features (such as case, number, or derivational features), as they do not contribute meaning.[4] Rather, they are idiosyncratic phonology tied to syntactic structure. In §1.2, I will flesh out this view of morphology and develop a framework capable of accounting for the data patterns.

1.1.2 Dogon replacive tone

The phenomenon motivating the view of morphology put forth in this work is the rich system of grammatical tone found in the Dogon languages of Mali. Unlike many African tone systems, which tend to involve processes like assimilation, dissimilation, contour tone

[4]Though they almost certainly help in parsing.

simplification, etc., Dogon grammatical tone is a replacive (Welmers 1973: 132-3) system built off of the **tonal overlay**. I define replacive tone for the Dogon languages as follows:

(6) Replacive tone: In certain morphosyntactic contexts, a word's lexical tone is completely overwritten by a grammatically-conditioned tonal overlay.

I use the designation "morphosyntactic" to reflect that fact that overlays may be conditioned either at the word level, by morphosyntactic features, or at the phrase level, by syntactic category and structure. In the Dogon languages, DP[5] replacive tone relies on relations between words in the phrase, while VP replacive tone relies on morphological conditions like inflectional category and operating at the word level. Given the heavy involvement of syntactic information, I will often refer to Dogon replacive tone, particularly at the DP level, as "tonosyntax" (Heath and McPherson 2013).

Let us consider first the more usual case of word-level replacive tone in Dogon VPs. The tone of the verb stem can be targeted by replacive overlays triggered by inflectional categories. For example, in Tommo So, the verb stem takes a {HL} overlay in the affirmative imperfective in main clauses, but not in relative clauses, where it retains lexical tone. This {HL} overlay neutralizes lexical tone contrasts in verbs, as demonstrated by the /LH/ verb on the left and the /H/ verb on the right.

[5]I use DP rather than NP to reflect the fact that the larger projection is headed by D (Abney 1987).

(7) *Tommo So verbal overlays*

a.	jɔ́bɔ̀^{HL}-dɛ	kánà^{HL}-dɛ
	run-IMPF	do-IMPF
	'(s)he runs' or '(s)he will run'	'(s)he does' or '(s)he will do'
b.	jɔ̀bɔ́-dɛ	káná-dɛ
	run-IMPF.REL	do-IMPF.REL
	'that runs' or 'that will run'	'that does' or 'that will do'

In (7a), both /LH/ and /H/ verb stems surface with the {HL} overlay associated with the affirmative imperfective; they are also suffixed with *-dɛ*. However, this overlay is only characteristic of main clauses. In subordinated clauses like the relative clause, no overlay is applied, shown in (7b). I use .REL in the gloss following the verb form to single this out as a relativized verb.

In examples (3) and (4) above, we saw canonical examples of DP tonal overlays. As in the case of verbs, replacive tone on words in the DP is neutralizing. The following examples show that the lexical distinction between /HL/, /LH/, and /H/ neutralizes to {L} before an adjective in Tommo So:

(8)

	(Tommo So)					
a.	/HL/	pállà	'cloth strip'	→	pàllà^{L} gɛ́m	'black cloth strip'
b.	/LH/	gìnɛ́	'house'	→	gìnɛ̀^{L} gɛ́m	'black house'
c.	/H/	gámmá	'cat'	→	gàmmà^{L} gɛ́m	'black cat'

In these examples, there is no trace left of the original lexical specifications of tone when an adjective is added.

Most theories of the phonology-syntax interface have as a central tenet that phonological processes are blind to syntactic category (Inkelas and Zec 1995, Nespor and Vogel 1986, Pak 2008, etc.). The phonology views syntactic structure only in terms of generic XPs—not VPs, DPs, NumPs, etc. If we were to take Dogon tonosyntax as a purely phonological problem, we might expect the tonal overlays to obey these general principles of prosodic phonology, but as I will argue through this study, reference to syntactic category is crucial for an understanding of tonosyntax, with certain syntactic categories triggering tonal changes while others do not. If, for example, we recast the examples in (8) with a numeral rather than an adjective, we find that no overlays are applied:

(9)

(Tommo So)

a.	/HL/	pállà	'cloth strip'	→	pállà néé	'two cloth strips'
b.	/LH/	gìnɛ́	'sheep	→	gìnɛ́ néé	'two houses'
c.	/H/	gámmá	'cat'	→	gámmá néé	'two cats'

Nouns retain their lexical tone before numerals.

Similar distinctions can be found between definite and demonstrative determiners, as the following examples from Tommo So show:

(10) a. gìnɛ́=gɛ (Tommo So)
house=DEF
'the house'

b. gìnɛ̀^{L} nɔ́ (Tommo So)
house this
'this house'

The demonstrative in (10b) triggers a {L} overlay on the noun, while the definite does not. One could try to explain the difference by claiming that toneless clitics cannot trigger

overlays (Tommo So contrasts H vs. L vs. Ø, with the latter found mostly on functional elements), but the facts remain the same in other Dogon languages where the definite carries its own tone. In an extreme example from Najamba (Heath 2011a), the definite and the demonstrative have the same phonological form *mó* but differ in that the definite triggers no tonal overlays while the demonstrative triggers {L}:

(11) a. pɛ̀gɛ́ mó (Najamba)
sheep DEF
'the sheep'

b. pɛ̀gɛ̀^{L} mó (Najamba)
sheep DEM.DIST
'that sheep'

Like the example from Irish mutation given above, the two functional elements have the same phonological form and are only differentiated from one another based on the morphophonological changes they trigger on the head noun. Theories that do not allow for reference to syntactic category (or, in the case of Irish, to morphosyntactic features or lexical identity) would phrase the two examples the same way, predicting the same phonological behavior in each.

On a larger scale, other theories would predict similar tonal behavior in VPs and DPs, again due to category insensitivity. However, as noted above, DP and VP tonosyntax differ drastically in the Dogon languages, with DP tone sensitive to relations between words and VP tone (or more accurately V tone) sensitive mainly to inflectional categories. The examples in (12) from Tommo So demonstrate that a verb will retain its lexical (or inflectional) tone whether on its own (12a), preceded by a subject (12b), or preceded by an object (12c):

(12) a. Jɔ̀g-áa=wɔ. (Tommo So)
break-PFV=be
'It broke.'

b. Tòndòó jɔ̀g-áa=wɔ. (Tommo So)
water.jar break-PFV=be
'A water jar broke.'

c. Ìyǎy=gɛ tòndòó jɔ̀g-áa=wɔ. (Tommo So)
girl=DEF water.jar break-PFV=be
'The girl broke a water jar.'

In all cases, *jɔ̀g-áa=wɔ* (from the stem /jɔ̀gɔ́/) retains its lexical /LH/ tone. Subjects and objects likewise retain lexical tone. In short, there is no interaction between DP arguments and the verb.

1.1.3 How Dogon tonosyntax differs from similar tonal phenomena

Tonal changes in phrasal contexts are well-documented, both in African languages and beyond. We may ask ourselves: In what ways does Dogon tonosyntax resemble phenomena in other languages, and in what ways does it differ? In this section, I will address the following common processes and phenomena: floating tones (§1.1.3.1), tone reduction (§1.1.3.2), tone spreading (§1.1.3.3), polarity (§1.1.3.4), and sandhi (§1.1.3.5). In every case, I show that while there may be commonalities, the Dogon system is fundamentally a different phenomenon. In what follows, I only provide relevant data to contrast Dogon tone with each system. Tonosyntax data patterns will be described in depth in Chapter 2. For a discussion of similar systems, see Chapter 5.

1.1.3.1 Floating tones

A common tonal phenomenon, particularly in the languages of Africa and Meso-America, is the presence of floating tones. These tones may be part of the lexical representation of a word or may be their own (tonal) morphemes. An example of the former can be found in Peñoles Mixtec (Otomanguean, Mexico; Daly and Hyman 2007, cited in Hyman 2007), where H, L, and Ø may form lexical contrasts. The two words in (13) both surface in isolation as Ø, but in a genitive construction, a difference emerges:

(13)

(Peñoles Mixtec)

a.	/kɨtɨ/	'animal'	kɨtɨ ditó	'uncle's animal'
b.	/nǰuši`/	'chicken'	nǰuši dìtó	'uncle's chicken'

In (13a), the possessor 'uncle' is pronounced with lexical Ø-H tone; the sequence of three unspecified tones is realized as level mid. In (13b), however, the possessor surfaces with a L tone on its first syllable, producing a falling contour on the unspecified noun 'chicken'. This difference is explained if 'chicken' is lexically specified as carrying a floating L tone, realized on the following word.

In a language like Igbo (Benue-Congo, Nigeria; Welmers 1970), floating tones are a property of the grammatical construction in which they are found rather than of an individual lexical item. For instance, the genitive construction is characterized by a H tonal morpheme between the two nouns, serving as the associative morpheme:

(14) a. àgbà ´ èŋwè → [àgbá èŋwè] (Igbo; Hyman and Schuh 1974:105)
jaw POSS monkey
'jaw of monkey'

b. áhà ´ òbòdò → [á$^{\downarrow}$há òbòdò] (Igbo; Welmers 1970:272)
name POSS town
'name of town'

The H tone associates to the left, turning L.L into L.H in (14a) and H.L into H.$^{\downarrow}$H in (14b).

This floating tone system differs from Dogon in at least two respects. First, in Igbo, the floating H simply concatenates with the lexical tone of the possessor; lexical contrasts are maintained. As the Tommo So examples in (8) showed, tonal overlays are neutralizing in the Dogon languages, completely replacing a word's lexical tone. I will address the possibility of a two-step reduction+floating tone analysis in the next subsection.

Second, floating tones are often local in their effects, combining with a word to their immediate right or left, as seen in Igbo. In the Dogon languages, tonal overlays can be non-local. For example, in Tommo So, a demonstrative can impose a {L} overlay on a noun, skipping over an alienable pronominal possessor intervening between itself and the target:

(15) gàmmà$^{\text{L}}$ ḿmɔ nɔ́ (Tommo So)
cat 1SG.POSS this
'this cat of mine'

If the {L} on the noun were a result of a floating tone introduced by the demonstrative, we might expect the L to surface on the immediately adjacent possessor. We could potentially posit a non-local target for a floating tone, e.g. the initial mora of the head noun, with rightward spreading towards the demonstrative, but this floating tone analysis will run into problems for more complicated cases of Dogon tonosyntax where the same syntactic category

triggers different tonal overlays depending on the exact make-up of the target. For further discussion, see especially Tiranige data in Chapter 3.

Finally, some Dogon languages with tonal overlays also have floating tones, with very different effects. One example comes from Ben Tey, where the 1sg possessive pronoun is analyzed by Heath (ms.) as simply a floating L tone. With other possessive pronouns, possessed nouns take either a {HL} or {L} overlay, depending on the final tone of the possessor. We can compare the following, with the noun *èɛ́* 'well':

(16) a. ú $^{\text{HL}}$ɛ́è̩ (Ben Tey)
2SG.PRO well
'your well'

b. $^{\text{L+HL}}$ɛ̌è̩ (Ben Tey)
1SG.POSS.well
'my well'

In (16a), the noun takes a {HL} overlay because the preceding possessive pronoun ends in a H tone. In (16b), there is no preceding possessor; the 1sg is equally associated with a {HL} overlay.[6] The floating L tone exponent of the pronoun concatenates onto the left edge of this possessive overlay rather than replacing the tone, lexical or grammatical. It would be quite difficult to predict the behavior of the 1sg possessor vs. other grammatical overlays in the language if both were the result of floating tones.[7]

[6]This {HL} overlay could be straightforwardly predicted if the 1sg were seen as LH rather than simply L.

[7]An alternative analysis is that the overlay for the 1sg is a more complex {LHL}, rather than a {HL} overlay and a floating tone. While this would relieve the need of having both floating tones and tonal overlays in the analysis, association conventions point to separate origins for the L and the {HL}: multitone overlays in Ben Tey associate from left to right by syllable, yielding outputs like *ú* ^{HL}*góːrò* 'your kola nut'. If {LHL} were an overlay, we might expect L.H.L as the output, but instead, the L of the 1sg shares the initial syllable with the H tone, suggesting that the L is not itself part of the overlay being mapped onto the target. Nevertheless, if one were committed to the idea of a {LHL} overlay, these results may be obtainable with an a highly ranked left alignment constraint on H tones. Following Heath (2012a), I will adhere to a floating tone analysis for the Ben Tey 1sg.

1.1.3.2 Tone reduction

We saw in the last subsection that Dogon tonal overlays differ in their behavior from floating tones. Another phrasal tone pattern to consider is reduction, where certain words in a phrase have their tones either deleted or reduced to an unmarked tone (often L). An example can be found in Akan (Kwa, Ghana; Marfo 2004), wherein the head noun (N1) in Noun+Noun and Noun+Adjective constructions has its H tones deleted. The result is a level stretch of L before any H tones in the second stem, as shown in (17):[8]

(17) a. sìká + bɔ́tɔ́ → sìkà bɔ́tɔ́ (Akan)
money + sack → purse/pocket

b. àsɛ́m + húnú → àsɛ̀m húnú (Akan)
story + useless → nonsense

In both examples, the H tones on the initial word are deleted and replaced with default L.

Marfo argues for a prosodic approach to the Akan data, claiming that noun-noun and noun-adjective sequences form "phrasal words", seemingly the equivalent of phonological phrases in the prosodic hierarchy, and that these phonological phrases are the domain of H tone deletion to satisfy the requirement that there be only a single H per phrasal word (culminativity). Corroborating evidence comes from other phonological processes, such as prefix deletion and diphthong simplification.

At first glance, the Akan facts hold true of Dogon compound nouns and N+Adj sequences as well; H tones in non-final words are replaced with L, as the following examples from Tommo So illustrate:

(18) a. sóm + jɛ̀mbɛ̀-ý → sòm^{L} jɛ̀mbɛ̀-ý (Tommo So)
horse + bag-DIM → saddlebag

b. gámmá + gɛ́m → gàmmà^{L} gɛ́m (Tommo So)
cat + black → black cat

[8] As noted below, the reduction occurs only on LH nouns, so it is not possible to illustrate the process with other tone patterns.

However, the prosodic phrasing account of Akan does not predict the correct results for Tommo So. Even though compound nouns and N+Adj constructions look the same on the surface in Tommo So and other Dogon languages, other contexts reveal their differences. For example, in Tommo So, there is phonologically-conditioned allomorphy of the inalienable pronominal possessor's overlay: it imposes {H} on words with one to two moras and {HL} one words with three or more moras. Compounds are treated as a single word for the purposes of this overlay:

(19) émmé $^{\text{HL}}$tírɛ̀ yàà-nà (Tommo So)
1PL.PRO grandmother
'our grandmother' (cf. *tìrɛ̀*^{L} *yàa-ná*)

Even though the initial stem in the compound has only two moras (in which case we would expect a {H} overlay), the whole compound is treated as a single word, taking a {HL} overlay mapping from left to right. N+Adj sequences, in contrast, resist this overlay. Instead, the adjective continues to impose its {L} overlay on the possessed noun, even in the presence of a possessor:

(20) émmé bàbè$^{\text{L}}$ gɛ́m (*bábè gɛ̀m) (Tommo So)
1PL.PRO uncle black
'our black (=dark-skinned) uncle'

Thus it cannot be the case that compound nouns and N+Adj sequences are recognized as the same phonological constituent by the grammar. Despite surface similarities, the Akan reduction account based on phrasing cannot be extended to Dogon.

A further, crucial difference between Akan and Dogon is that the Akan tone reduction facts are sensitive to the tonal make-up of initial word, such that H-deletion only occurs on

/L...H/ nouns. As shown in (9) above, the same overlays apply in Tommo So and other Dogon regardless of the lexical tone of the target.

Nevertheless, just because the domains differ (phonological phrases in Akan vs. syntactic contexts in Dogon) and Akan is phonologically conditioned in a way that Tommo So is not, we could still view the tonological process of reduction as being at play. For example, one might argue that the {L} overlay found before adjectives in Tommo So is the result of tone deletion.

Close inspection of the Tommo So tone system reveals a three-way contrast between H, L and Ø (McPherson 2011), with the latter being filled in by interpolation between surrounding tones. The fact that words with a {L} overlay surface with level L pitch indicates that they must be phonologically specified for L; that is, tone deletion cannot be responsible for these forms. We further cannot say that Dogon tonosyntax is a case of reduction (replacing marked H tones with unmarked L tones), since other overlays are phonologically marked, such as the {HL} overlay seen in (19) above, or the {LH} overlay found in Tiranige (Dogon) examples like the following:

(21) Ààmàdú $^{\text{LH}}$nàá (Tiranige)
Amadou cow
'Amadou's cow' (cf. /náá/)

One possibility is to consider Dogon overlays to be a combination of tone deletion and a construction-specific floating tone or tonal morpheme that spreads to fill the available syllables. This is the analysis pursued by Harry and Hyman (2014) in Kalabari (Ijo, Nigeria), which displays a system of phrasal tonal alternations similar to Dogon. In this language, tonal morphemes specific to phrasal contexts (e.g. Dem N) target only certain syllables of the word, leaving others unspecified and open to spreading from the preceding (unreduced) word. While this analysis could in principle work for Dogon tonsyntax, provided that tonal morphemes are specified in very specific morphosyntactic contexts or constructions, it runs

into difficulties in cases of competition; see §5.6. Further, Tommo So lacks any evidence for a reduction step (such as the remaining reduced syllables seen in Kalabari). Thus, in this study, I will use the term "tonal overlay" to represent the speaker's knowledge of tone patterns in their language—that a noun is pronounced with {L} tone before an adjective, or as {HL} after a possessor, without the need for specific association conventions deriving these outputs; the output is specified in the construction.

For further arguments against a floating tone analysis, see §1.3.1.1. For further discussion of Kalabari Ijo and how it could be envisioned in the construction-based analysis of this study, see Chapter 5.

1.1.3.3 Tone spreading

Thus far we have seen that neither floating tones nor tone reduction properly characterize Dogon replacive tone. In this section, I consider another common tonal phenomenon: spreading. Numerous Bantu languages share the phenomenon of H tone spreading, where a lexical or grammatical H tone can spread across one or more syllables within a particular domain. Luganda H-Tone Anticipation (Pak 2008) is an example of such a spreading rule. In this process, a word with a /HL/ tone pattern will spread its H tone leftward onto any toneless moras within a particular domain, stopping short of the initial mora of this domain. For example (Pak 2008:15):

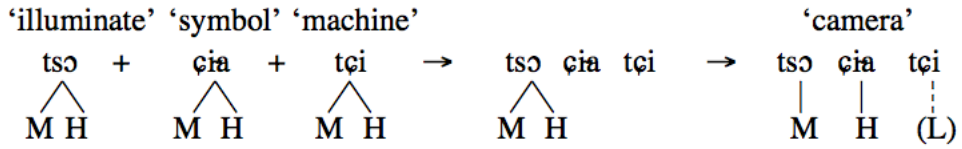
(22) a. omulenzi a-gul-ir-a Mukasa kaáwà (Luganda)
1.boy SBJ1-buy-APPL-IND 1.Mukasa 1A.coffee
'The boy is buying Mukasa some coffee.'

b. (òmùlènzì) (à-g**úl**-**ír**-**á** M**úkásá** kaáwà) (Luganda)

In this example, the H tone on the initial syllable of *kaáwà* 'coffee' spreads leftward in the V+O domain, stopping before the initial syllable of the verb.

While this example is leftward spreading, most tone spreading is rightward (Hyman and Schuh 1974). An example from outside of Africa comes from Shanghai (Zee and Maddieson 1979, as quoted in Hyman 2007), where in tightly bound constructions like compound nouns, non-initial tones are deleted and the final tone of the initial word shifts onto the following empty syllable (shifting = spreading plus delinking from the original TBU); any remaining syllables take a default L tone.

(23) Shanghai tone shift (Hyman 2007:508)



In this compound, the MH tones on 'symbol' and 'machine' are deleted. The final H of 'illuminate' spreads rightward onto 'symbol', subsequently delinking from its original host. 'Machine', out of reach of H spreading, receives a L by default.

In both of these examples, the resulting phrasal tones are determined by the phonological form of one of the words involved. This is not the usual case in Dogon tonosyntax. For example, in Jamsay, we find that the possessive overlay is {HL} regardless of the tone of the possessor (Heath 2008):

(24) a. Séydù ^{HL}déè (Jamsay)
Seydou father
'Seydou's father' (cf. /dèé/)

b. dɔ̀ɣɔ̌-n ^{HL}déè (Jamsay)
Dogon-AN.SG father
'a Dogon's father'

In (24a), *Séydù* ends in a L tone, and the possessed noun takes {HL}, just as it does when the possessor ends in a H tone, as in (24b); this cannot be a case of spreading.

Similarly, in Tommo So, the possessive overlay is {L} regardless of the final tone of the possessor:

(25) a. Háwà ^{L}bàà (Tommo So)
Hawa father
'Hawa's father' (cf. /báá/)

b. Sáná ^{L}bàà (Tommo So)
Sana father
'Sana's father'

Once again, example (25b) shows that the {L} overlay is not the result of spreading.

While the fundamental nature of Dogon tonosyntax is not tone spreading, we still find isolated cases of it in a couple of languages, such as Nanga. In Nanga, a possessed noun takes a {HL} overlay after a possessor ending in H and a {L} overlay after a possessor ending in L. This can be illustrated with the noun *túŋgúrí* 'stool' below:

(26) a. Sùmăylâ ^{L}tùŋgùrì (Nanga)
Soumaila stool
'Soumaila's stool'

b. yă-ŋ ^{HL}túŋgúrì (Nanga)
woman-AN.SG stool
'a woman's stool'

In (26a), where the possessor ends in a L tone, *túŋgúrí* 'stool' surfaces as all L. In (26b), where the possessor ends in a H tone, only the last syllable of the possessed noun is L; H is

associated with the other syllables. Either there are two allomorphs of the replacive overlay, {L} and {HL}, assigned by L-final and H-final possessors, respectively, or the final L on the possessed noun is replacive, with tone on the other syllables obliterated by spreading. Under the latter assumption, I take this spreading to be specified in particular morphological constructions rather than actively militated for by phonological alignment constraints. That is, these constructions are output-oriented, stating how a target should surface in context, rather than derivational (i.e. first tones are deleted, then tones spread and a default L is inserted) or otherwise phonologically governed. The difference between a spreading case like Nanga and a purely replacive case like Jamsay lies in the fact that the Nanga output has TBUs linked to the final tone of the possessor while the Jamsay output has TBUs linked only to the tone of the grammatical overlay. For further discussion of spreading-type languages, see §3.2.6 and cross-references therein.

1.1.3.4 Polarity and dissimilation

The preceding subsections have dealt with either the addition of a tone, the deletion of a tone, or the spreading of already existing tones; Dogon replacive tone does not fall neatly into any of these boxes. The next two subsections address phenomena wherein tones change form when placed in context. In this sense, these phenomena are closer to Dogon tonosyntax (where lexical tones change to grammatical overlays), but as we will see, the phenomena discussed here rely more heavily on phonological representations and are more local in their effects.

The first phenomenon to discuss is polarity. Hyman and Schuh (1974) differentiate between polarity and dissimilation, with polarity applying with underlyingly toneless syllables and dissimilation occurring when tones are specified. The surface effect is the same: the target takes on the opposite tone of the adjacent trigger. As such, I consider the two processes together here under the heading of polarity.

Typically, polarity is found with toneless suffixes and clitics, as the following example from Igbo (Igboid, Nigeria; Hyman and Schuh 1974) illustrates:

(27) a. gá: [àgá] 'going' (Igbo)

b. zà: [ázà] 'sweeping' (Igbo)

The gerundive prefix *a-* takes on the opposite tone of the verb stem to which it attaches.

Though logically possible, I have not seen any cases of phrasally-triggered polarity or dissimilation in the literature, e.g. on a possessed noun after a possessor. Even if such cases were to exist, it is clear that Dogon tonosyntax is not a matter of dissimilation, since languages like Jamsay or Tommo So apply the same overlay no matter the preceding tone.

1.1.3.5 Sandhi

The last type of phrasal alternation to discuss I will call **sandhi**, meaning specifically the Chinese-type replacement of one tone for another in a phrasal (typically non-final) context. One famous case comes from Xiamen (Min, China; Chen 1987), where the sandhi system forms a circular chain shift, as shown below:

(28) 24, 44 → 22 → 21 → 53 → 44

For example (Chen 1987:112):

(29) a.

	tsin	p'ang	'very fragrant'	(Xiamen)
Underlying tones:	44	44		
Surface tone:	22	44		

b.

	pih	lang	'sick person'	(Xiamen)
Underlying tones:	22	24		
Surface tone:	21	24		

The 44-toned word *tsin* 'very' in (29a) surfaces as 22 in non-initial position. However, the 22-toned word *pih* 'sick' surfaces as 21. Thus, it is not the case that 22 is not allowed in a sandhi environment; rather, each tone has a synchronically arbitrary alternant.

To a certain extent, Dogon tonosyntax is similar to this sandhi: lexical tone is replaced with an arbitrary tonal overlay in particular syntactic contexts. However, it differs in that the tonal overlay applied depends on the context, not on the underlying tone. It is morphosyntactically rather than phonologically driven. In Xiamen, the domains are broadly defined and the tonal changes specific to underlying form; in Dogon, the domains are narrowly defined and diverse, and the tonal changes apply broadly to any form that fits the context.

1.1.3.6 Replacive tone at the word level

While none of the regular phrasal alternations commonly found in tone languages adequately describes Dogon tonosyntax, we do find similar systems at the word level in a number of languages. Kalabari, like Dogon, has both phrase-level and word-level tonal alternations. In the verbal domain in Kalabari, transitive verbs are assigned a {LH} overlay when they are used intransitively (Harry and Hyman 2014:1):

(30)

(Kalabari)

a.	kán	'conquer'	kàán	'be conquered'
b.	ányá	'spread'	ànyá	'be spread'
c.	dîmà	'change'	dîmá	'change'

In every case, the lexical tones of the verb (/H/ in (a-b), /L/ in (c)) are replaced with the {LH} overlay (vowel lengthened in (30a) to accommodate the contour tone).

A more complicated case is found in Hausa (Chadic, West Africa; Newman 2000). Hausa plural formation is also characterized by replacive tonal overlays. However, it is a lexically-specified system; that is, nouns are lexicalized as belonging to one of more than fifteen patterns of pluralization. The table in (31) reproduces the first five lines of Newman's (2000:431) table of plural classes (macron indicates length; H is unmarked):

(31)

Major Class	*Example (sg.)*	*Example (pl.)*	*Gloss*
1. -OXI)^{H}	tāgà	tāgōgī	window
2. -ai)^{LH}	dàlīlì	dàlîlai	reason
3. -aXe)^{HLH}	damō	damàmē	land monitor
4. -(a)Xa)^{HLH}	sir̃dì	sir̃àdā	saddle
5. -aXu)^{HLH}	gurgù	guràgū	cripple

As this table shows, each plural class has both segmental and tonal material associated with it. The segmental material typically involves suffixation (and subsequent hiatus resolution) or infixation of a vowel, while the tonal component is non-concatenative: like Dogon, it is an overlay that affects the entire word.

In both Kalabari and Hausa, the tonal mechanism (replacive tone) is the same as Dogon, but the domain is different (word-level rather than phrase-level); this is in contrast to the Xiamen case above where the mechanism differed but the domain could be seen as similar (a

specific morphosyntactic domain). While the overlays in these other languages, then, do not belong to our conceptualization of DP tonosyntax (the central focus of this study), we do find a similar system in Dogon verb inflection, as first noted in (7). In this component, tonal overlays apply to single words (the verb) concomitantly with suffixation. The following table summarizes part of a Tommo So inflectional paradigm for the verb stem *káná* 'do', purposely formatted to resemble the Hausa plural table above:

(32)

TAN specification	*Schema*	*Example*	*Gloss*
Affirmative imperfective	-dɛ̀)^{HL}	kánà-dɛ	s/he does
Negative imperfective	-éélè)^{L}	kàn-éélè	s/he doesn't do
Affirmative perfective	-ì)^{L}	kàn-ì	s/he did
Negative perfective	-lí)^{L}	kànà-lí	s/he didn't do
Affirmative imperative	)^{H}	káná	do!
Negative imperative	-gú)^{L}	kànà-gú	don't do!

The superscripted tonal overlays apply only to the verb stem, with the suffixes taking their own lexically-specified tone. As we can see, the tonal changes in verbal inflection resemble those of Kalabari or of Hausa, though admittedly closer to the Kalabari system since every verb undergoes the same regular tonal changes and the changes are triggered by morphosyntactic categories rather than specific lexical classes of suffixes. The irregular Hausa data point to a much higher degree of lexicalization (and a much more intricate lexicon, with patterns and sub-patterns), but the same basic mechanism is at play. Since these changes take place at the word level rather than the phrase level, they are not the main focus of this study and will only be discussed incidentally, particularly in Chapter 4 on relative clauses.

1.1.4 Morphology without morphosyntactic features

In this study, I argue that phenomena like mutation or replacive overlays are in essence morphology, though they may not be the realization of any morphosyntactic feature. Put another way, these changes seldom contribute any meaning independent of the context, though in the Irish example above, the absence of lenition could be said to contribute gender information (feminine).

Consider the adjective vs. numeral case for Tommo So. With an adjective, the noun surfaces with all {L} tone, while with a numeral it is does not. What information, then, is the {L} overlay contributing that could not simply be gained from context (the presence vs. absence of an adjectival modifier)? Unless there is a morphosyntactic feature 'Modified' that an adjective but not a numeral contributes, the {L} overlay in this case does instantiate any morphological feature and does not give any additional meaning.

To take another case, a non-pronominal possessor in Tommo So also applies a {L} overlay to the following possessed noun *bàbé* 'uncle':

(33) Sáná ^{L}bàbè (Tommo So)
Sana uncle
'Sana's uncle'

We could suggest that the {L} overlay in this case is the realization of head-marking in possession, a tonal version of "possessed case" like that found in Finnish (Uralic, Finland; Pierrehumbert 1980). However, the {L} realization is specific to non-pronominal possessors. With pronominal possessors, including 3sg, the overlay in this case is {H}:

(34) wó ^{H}bábé (Tommo So)
3SG.PRO uncle
'his uncle'

If the possessive overlay carries meaning unto itself, we would expect some consistency across contexts. This is not the case unless {L} and {H} are treated as allomorphs of a tonal possessive morpheme.

I will argue that the morphophonological changes presented here have no independent existence outside of the phrasal contexts in which they are found. They are part and parcel of the construction, contributing no independent meaning, as has been argued for phenomena like theme vowels in European inflection (Booij 2010). The difference here is that the construction is a phrase rather than a word. The data presented here show that our domains for the application of morphology must be broadened to capture cases of context-specific phrasal morphophonological alternations. The framework I propose aims to do just that.

1.2 The framework

The framework I implement in this study takes a view that the lexicon and morphology are one and the same: "morphology" refers to idiosyncratic mappings between phonology, syntax, and semantics, and these mappings are stored in the lexicon; the mechanics of this view, inspired by Booij (2010), are discussed in §1.2.1. In §1.2.2, I argue for a constraint-based approach in which morphological constructions are implemented as constraints.

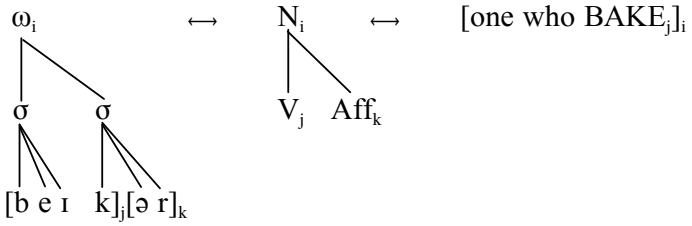
1.2.1 Construction Morphology

My framework is in many ways identical to Booij's (2010) theory of Construction Morphology. In both, morphology is implemented in the grammar by a set of lexically listed output-oriented **constructional schemas** that tie together phonological form with syntactic structure and semantics, schematized as follows:

(35) $\text{PHON}_i \leftrightarrow \text{SYN}_i \leftrightarrow \text{SEM}_i$

For example, the word 'baker', an agentive noun, is characterized by the constructional schema in (36):

(36) Lexical representation of *baker* (Booij 2010: Figure 1.3)



The phonological formula for the agentive, [ ]$_j$[ər]$_k$, is at the base of the PHON portion on the lefthand side. The segments form syllables (σ), which come together to form the word (ω). This morphophonological material corresponds to the morphosyntactic material in the middle. The word is designated as category N, made up of a verb V and an affix. This morphosyntactic material in turn corresponds to the semantic information [one who BAKE$_j$]$_i$, where BAKE$_j$ is indexed with the phonological material [beɪk] and the syntactic category V.

Using a notational shorthand, we can generalize the lexical representation in (36) to the following constructional schema for agentive nouns in English:

(37) [[X]$_{Vj}$[ər]]$_{Ni}$ ↔ [one who PRED$_j$]$_i$

In other words, any verb X concatenated with the phonological sequence [ər] becomes a noun with the agentive meaning.

I propose that this same constructional format is available from monomorphemes up through phrases. In other words, any time the learner must memorize material that does not fall out naturally from phonology, syntax, or semantics, the material is learned as a schema. Consider a monomorphemic word like *cat*. There is nothing inherent about the phonological

sequence [kæt] that indicates the syntactic category N nor the semantics of a small, furry, mammal with pointy ears and a long tail. These are idiosyncrasies of English that must be learned and stored in the lexicon. The case of the English agentive shows idiosyncrasies involving multiple morphemes; the concatenation of a phonological sequence [ər] corresponds to a syntactic process of deverbal derivation and agentive semantics. However, unlike the case of *cat*, this schema contains a variable corresponding to the syntactic category N, meaning that this constructional schema can be used to productively coin new words.

The use of the term "morphology" to refer to these cases is uncontroversial. The status of morphology at the phrase level is murkier. Booij (2010) does recognize multi-word constructions, in the form of constructional idioms, compounds, and complex numerals. In at least the first two of the cases, and possibly the third, the idiosyncrasies of the construction lie in the semantics. In other cases, idiosyncrasies lie in the use of particular lexical items. For example, Booij proposes the following constructional idiom for Japanese quasi-incorporation:

(38) $[\ [x]^{i}{}_{VN}\ [\text{suru}]^{j}{}_{V0}\ ]^{k}{}_{V0} \leftrightarrow [\ \text{perform action denoted by SEM}^{i}\ ]^{k}$ (Booij 2010:116)

This construction must be lexicalized, since verbal nouns (VN) cannot productively combine with other verbs to form these phrasal compounds. That is, it is an idiosyncratic property of the verb *suru* that it may cooccur with verbal nouns, and thus the construction as a whole must be lexicalized with this verb.

In this study, I take what I view as the logical next step, arguing that there is no a priori reason why the idiosyncrasies of a construction could not lie in any of the branches. That is, any time the mapping between phonological, syntactic, and semantic information does not follow straightforwardly from principles of those three components of grammar, whether at the word level or the phrase level, this idiosyncrasy is captured in the form of a morphological construction. This study focuses on phrasal constructions with **idiosyncratic phonology**.

Though the proposal involves constructions at the phrasal level, I must distinguish it from Construction Grammar (e.g. Lakoff 1987, Fillmore et al. 1988, Goldberg 1995, Boas and Sag 2012), a theory of grammar in which syntax is implemented by the unification of compatible constructions; in other words, constructions need not involve idiosyncrasy, as they are the very core of grammar itself. Booij (2010) views Construction Morphology as the morphological level of Construction Grammar, though the space between the two is more of a continuum than a strict cutoff. I do not adhere to this view. In this study, I propose that the grammar of a language consists of phonology, syntax, and semantics, with a constraint-based view of phonology (as in Prince and Smolensky 1993) and a generative view of syntax (such as that found in Chomsky 1981, 1995, Kayne 1994, or Cinque 2005); explicit semantic principles are not required to account for the data.[9] Constructions exist only in the case of idiosyncrasies, and whether word-level or phrase-level, I treat them as lexical morphology in the sense that they belong in the lexicon.

This view of morphology is novel and admittedly quite flexible in the ways the components of grammar may interact. While this flexibility is what allows us to account for the data, we must be careful not to extend the framework to the point of non-falsifiability. As Wolf (2007) points out in a critique of Green's (2006) lexicalist account of Celtic mutation as a morphological problem, there are plenty of logically possible linguistic patterns that are unattested, so how can the framework predict their nonexistence? Like Green, I appeal to diachrony: these kinds of idiosyncratic mappings result from the restructuring of once fully regular patterns. The learner may indeed be capable of learning "unnatural" patterns, but they are unlikely to arise from any diachronic path.

Wolf (2007) rejects the diachronic argument for two reasons, both of which I find unsatisfactory. The first is that we do not yet have a typological understanding of possible diachronic changes. This, in my view, is not a valid criticism of a lexical theory of morphology, but rather an invitation to discover the nature of the typology; just because we do

[9]Though for a possible semantic explanation of the controller vs. noncontroller distinction in Dogon tonosyntax, see §2.7.1.

not yet understand it does not mean it does not exist. Second, he gives an example of one so-called "possible but unattested" diachronic change, where initial syllable reduplication is reinterpreted by learners as "copy the first three segments" due to the higher proportion of heavy syllable-initial words in the lexicon; the apparent possibility of such cases is, to Wolf, a reason to dismiss the analysis as unrestrictive. However, in the Construction Morphology framework as proposed by Booij (2010), constructions simply consist of idiosyncratic mappings between the phonology, syntax, and semantics, mappings that need to be explicitly learned. To me, this means that diachrony will be shaped by the principles of phonology available in UG, of which "copy three segments" is not one. This straw man argument is not, in my eyes, a persuasive argument against a lexical approach to such phenomena.

A fuller typology of phrase-level morphosyntactic alternations is necessary to determine what should and should not be possible in this interpretation of Construction Morphology. The study of these phenomena is still in its infancy, or rather, many of the changes I would analyze as phrasal morphology are tucked away under headings of phonological analysis. I will address the question of possible phrasal alternations more fully in Chapter 5, where I survey related phenomena in other languages, but for the time being I make the following proposal: possible contexts for phrasal morphological alternations are restricted to natural phonological, syntactic, and semantic environments. In other words, in learning a restructured pattern, learners do not have access to any special tools outside of those provided by their phonological, syntactic, and semantic grammars. For this reason, we predict that phrasal morphological alternations will take place primarily in domains definable in syntactic terms like c-command, phonological terms like phrasing, or possibly even semantic terms (like scopal relations), though we lack evidence for the latter. Linear adjacency likewise appears to be a common requirement for these alternations, but I predict that the adjacent elements will always belong to the same phonological or syntactic constituent.

1.2.2 A constraint-based approach

In addition to its focus on semantically-regular morphophonologically-idiosyncratic phrases, the version of Construction Morphology I propose diverges from the traditional account in one other way: I take constructional schemas to be **constraints** in a constraint-based grammar. I call these constraints **construction constraints**. If a candidate word or phrase does not satisfy the requirements of the constructional schema, the construction constraint is violated, which may assist in ruling that candidate out. This aspect of the theory will be crucial for the case of Dogon replacive tone, where different constructional schemas can come into conflict with one another in any given phrase.

For replacive tone in the Dogon languages, the analysis requires the following four components:

(39)
1. A syntactic analysis
2. Construction constraints
3. Faithfulness constraints
4. An evaluation mechanism for resolving constraint conflict

The first component, a syntactic analysis, is motivated by my claim that the scope of tonal overlays is determined by c-command; a tone controller, like an adjective, can only impose its overlay on words that it c-commands. We need a syntactic analysis with hierarchical structure that correctly predicts the c-command facts, motivated by both tonal and non-tonal data. These hierarchical relations are referenced in constructional schemas, where overlays in the phonological branch of the schema are cross-referenced with c-commanded words in the syntactic branch.

These constructional schemas are implemented in the grammar as constraints on output form. To account for replacive tone, I propose a family of construction constraints of the following form:

(40) X^{T} CONT

This is shorthand for "Controller imposes tonal overlay {T} on c-commanded words", the description of the corresponding constructional schema. The schematic *controller* can be replaced with specific syntactic categories that trigger tonal overlays, like adjectives, demonstratives, or definite determiners, or with more functional categories like relative clauses or possessors (both contained in DPs in the current analysis). These constraints are penalized whenever a word c-commanded by the controller does not display the required phonological form.

Competing with these construction constraints are faithfulness constraints, the third component. In particular, I use the IDENT family of constraints (McCarthy and Prince 1995) for the feature tone (T), evaluated on an output-to-output (OO) basis (Benua 1997). Thus, a constraint IDENT-OO(T) would penalize any word that takes a tonal overlay (unless the tonal overlay is phonologically indistinguishable from lexical tone, a rare but attested occurrence).[10] As I will address in Chapter 2, I assess violations on the word level rather than the syllable or mora level since we do not find tonal overlays blocked on longer words but applied on shorter words; there is no ganging effect of multiple syllables. In addition, we find special faithfulness to DPs (both possessors and relative clauses, which I argue to be contained in a DP; see Chapter 4) in many Dogon languages, where these DPs fail to take a tonal overlay despite being c-commanded by a controller. I argue that these patterns can be understood as arising form the cyclic spellout of syntax, where the syntactic chunks known as **phases** are sent to morphophonology to receive their surface form (Chomksy 1999,

[10]This faithfulness constraint could be viewed as essentially each lexical item's construction constraint, assuming that lexical items are themselves word-level constructions. Thus, in a N Adj sequence, the competition is between whatever the lexical form of the noun and the idiosyncratic phonological demanded by the adjective.

Uriagereka 1999, etc.). However, unlike in traditional phase-based accounts, I propose that these chunks can have their morphophonology altered when they are concatenated with other spelled out material, but that this result is disfavored by the constraint family IDENT-OO$_{Phase}$. For further discussion, see §2.5.4.

The final component is a constraint-based framework that can combine the construction constraints and faithfulness constraints to evaluate potential outputs and select a winner. Many of the Dogon languages show surface variation in tonal outputs, and so we need a constraint-based theory that can predict multiple winners. In this study, I use Maximum Entropy grammar (Goldwater and Johnson 2003, Hayes and Wilson 2008), a stochastic version of Harmonic Grammar (Legendre et al. 1990), in which constraints are assigned weights rather than being strictly ranked. Nonetheless, for expository purposes, I first present the analysis in strict Optimality Theory (Prince and Smolensky 1993), which works well for non-variable data.

I argue that, with these four components, we can account for the complex tonal patterns in the Dogon languages in a straightforward and principled way. What is more, these same ingredients can also explain the variation found between Dogon languages, of which no two work in precisely the same way. The mechanism behind the variation is constraint ranking or weighting: the same or similar constraint sets (populated by construction constraints and faithfulness constraints) ranked or weighted in a different way can capture each of the grammars in the Dogon language family.

1.3 Past approaches to context-specific alternations

It is difficult to summarize the ways in which context-specific morphophonological alternations (phrasal morphology) have been dealt with in the past, simply because they have not previously been viewed as a unified phenomenon. Many different analyses have been proposed for specific cases, such as Celtic mutation or French liaison, but these have typically been viewed as isolated cases, unconnected to other similar phenomena. In this section, I

will review some of the major theories proposed to account for these difficult cases and show where each falls short for the Dogon languages.

1.3.1 Phonological accounts

We can split phonological accounts into two varieties: those in which prosodic units (word, phrase, etc.) are the triggers, and those in which they are not. Due to the non-concatenative nature of the phenomena under study, most accounts in the latter case propose floating autosegments to trigger morphophonological changes. I will address some of these theories first before turning to prosodic approaches.

1.3.1.1 Autosegmental accounts

When faced with a morphophonological change with no clear morphophonological trigger in its immediate environment, one promising analytical tool is the floating autosegment. This strategy is employed for Celtic mutations by Wolf (2007). For example, he argues that the quirky mutation triggers in Breton (Celtic, France); *e* 'that', *ma* 'that/if', and the progressive marker carry floating autosegmental features that dock locally onto the first segment of the following word. In a straightforward case of mutation, with uniform effects on all segments (e.g. lenition or provection, the two mutation systems in the language), only a single set of features would be necessary to account for the data. Since these triggers conditioned a "mixed mutation", combining both lenition and provection, a more complicated solution must be sought:

(41)

Breton mixed mutation (Wolf 2007:35)

b	→	v	*spirantization*
d	→	t	*devoicing*
g	→	ɣ	*spirantization*
gw	→	w	*deletion*
m	→	v	*spirantization*
z	→	z	*no change*

Clearly, a single floating autosegment cannot trigger spirantization, devoicing, and deletion, depending on the segment to which it docks.

Wolf proposes that these mutation triggers each carry four floating allomorphs, listed in (42):

(42) a. [+cont][+cor]

b. [-voi][+cor]

c. [+cont][-cor]

d. [+son][+cor]

Realization of floating features is motivated by a constraint MaxFlt, which penalizes the deletion of floating features. Allomorph selection is driven by the ranking of faithfulness constraints to various features. To understand this proposal, consider an input where the target of docking is the voiced coronal stop *d*. If Ident[cor] is highly ranked, allomorph (c) will not be chosen, as it would alter the coronality of *d*. Similarly, if Ident[cont] and Ident[son] outrank Ident[voi], allomorph (b) will be selected and devoicing occurs.

Coronal sonorants like *z*, on the other hand, do not devoice, since the docking of allomorph (a) induces no faithfulness violations; in this case, *z* surfaces unchanged. Allomorph (a) does produce mutations, though, in cases like initial *m*, where [-cor] docks vacuously and [+cont] spirantizes [m] to [v] (with nasal fricatives presumably ruled out by highly ranked markedness constraints). Allomorph (c) motivates the spirantization of *b* and *g*, while allomorph (d) accounts for the fact that initial coronal sonorants do not participate in mutation.

Let us consider how such an account with floating autosegments would work for Dogon tonosyntax. If we directly follow the Celtic proposal, every lexical item of particular syntactic categories (adjective, demonstrative, etc.) would need to carry a floating L tone. Already this is problematic, since Richness of the Base (ROTB, Prince and Smolensky 1993) presupposes the existence of adjectives or demonstratives not carrying this floating L.

Two avenues remain open: either consider the floating tones to be morphemes unto themselves, or import floating autosegments into a constructional approach, taking them to be an idiosyncratic phonological property of particular constructions. I have already raised my objections to the first proposal in §1.1.4, and I will not consider such an analysis further. The second proposal, that floating tones are a property of Phrasal Constructions, merits consideration, though §1.1.3.1 has pointed out some issues in treating overlays as the result of floating tones.

Under such an account, we could posit that the phonological branch of the N Adj construction in a language like Tommo So looks something like the following:

(43) Floating L in a N Adj construction

The {L} overlay is seen as an underlying floating L tonal morpheme, unassociated in the input with either the adjective or X (material c-commanded by the adjective). This configuration changes the fundamental nature of constructions as being output-oriented, since further (morpho)phonological constraints would be necessary to ensure that this L tone aligns to both the left and right edge of X, displacing any lexically linked tones.

Even accepting this conceptual change, this account runs into trouble in more complicated cases. For example, relative clauses impose the same {L} overlay on the head NP as adjectives, and thus we could consider there to be a construction analogous to (43) in which *Adjective* is replaced by *Relative clause*.[11] To account for an example like the following, we assume that alignment constraints motivate the spreading of the floating L across both the noun and the numeral (since both are c-commanded by the relative clause, with c-command determining the domain of the tonal overlay):

(44) {jàndùlù tààndù-gò}^{L} mànd-áá-dɛ̀=gɛ=mbe (Tommo So)
donkey three-ADV be.lost-PFV-IMPF.REL=DEF=PL
'the three donkeys that got lost' (cf. *jàndúlu tààndú-go*)

Problematically, if a pronominal possessor such as *ḿmɔ* 'my' is present in the head of the relative clause, it does not take a {L} overlay, despite intervening between the noun and the numeral:

(45) jàndùlù^{L} ḿmɔ tààndù-gò^{L} mànd-áá-dɛ̀=gɛ=mbe (Tommo So)
donkey 1SG.POSS three-ADV be.lost-PFV-IMPF.REL=DEF=PL
'my three donkeys that got lost' (cf. *jàndúlu tààndú-go*)

Both the noun and the numeral surface with L tone, while the possessor is unaffected. If this L were the result of spreading a single floating L autosegment, this would be a case

[11] For detailed syntactic discussion, see Chapter 4.

of crossing the association line of the possessor's H tone, widely accepted as impossible in autosegmental phonology (Goldsmith 1976, Sagey 1988). This situation is easily analyzed in the construction-based framework by assuming that constructions are indeed output-oriented, and words c-commanded by the relative clause must surface with all L tone. Each word is evaluated individually as to whether or not it satisfies this requirement. The tone of the possessor is protected by a highly-ranked indexed faithfulness constraint, but since the L tone on the surrounding words is not the result of a single multiply-linked tone, no association lines are crossed and the output is grammatical.

One could instead posit that a floating L is introduced at the edge of each c-commanded word, and faithfulness to the possessor's lexical tone suppresses its floating tone. However, when the tonal overlay of a construction is, say, {HL} rather than {L}, we find a single {HL} domain rather than a series of individually {HL}-toned words. We could in principle analyze these cases as assigning a floating HL to the first word and floating L tones subsequently, but the introduction of multiple floating tones that happen to form a cohesive tonal melody seems unnecessarily complicated and unlikely to hold any psychological reality for speakers.

1.3.1.2 Prosodic Phonology (Selkirk 1978 *et seq.*)

Naturally, since phenomena like Dogon tonosyntax involve phonological changes in phrasal contexts, proposals have been put forth in the framework of Prosodic Phonology (Selkirk 1978 et seq., Nespor and Vogel 1986, etc.). I will consider two proposals here, one for Welsh Soft Mutation (Hannahs 1996) and one for French liaison (Selkirk 1986) .

First, Welsh Soft Mutation is a more easily characterizable than the quirky Breton mutations considered in the last section. In essence, underlyingly voiceless consonants are realized as voiced, and underlyingly voiced consonants (stops and nasals) are realized as voiced fricatives; the exception is that the voiced velar stop *g* deletes in a soft mutation context, presumably due to a highly ranked constraint against the segment ɣ.

As Hannahs (1996) notes, Soft Mutation is not a monolithic phenomenon. Certain triggers are lexicalized, others more general. He focuses on what he terms "regular" soft mutation, not tied to any particular lexical items. Past accounts, such as Borsley and Tallerman (1996) or Borsley (1999), characterized the environment for regular soft mutation in syntactic terms, known as the XPTH (XP Trigger Hypothesis). That is, a mutable consonant will undergo soft mutation when immediately preceded by an XP of any category. I will address this specific proposal further in §1.3.2.1. As Hannahs points out, the XPTH requires a variety of stipulations to fully account for the data. In the interest of space, I will focus on two stipulations here: the immunity to mutation of the second NP in a coordinated structure and of the first word in a CP.

He reformulates the analysis of mutation triggers in terms of phonological constituents of the prosodic hierarchy (Selkirk 1986, Nespor and Vogel 1986), rather than basing mutations on the syntax directly. In particular, he argues that soft mutation occurs on the initial consonant of a phonological phrase directly preceded by another phonological phrase:

(46) $[...]_{\phi}\ [__...]_{\phi}$

In order to correctly account for the mutation facts, a few other stipulations must be made. First, restructuring occurs to phrase the verb and its direct object together into a single phonological phrase when the object occurs directly to the right of the verb; in this way, the verb does not trigger soft mutation on the initial consonant of the object.

Further, the two stipulations of the syntactic account, i.e. the exceptional nature of CPs and coordination (whose initial word fails to undergo soft mutation),[12] also require comment in a phonological account. Hannahs proposes the inclusion of a higher prosodic constituent, the Intonational Phrase (IP), to account for the behavior. Specifically, the environment in (46) must be modified such that both phonological phrases are contained within the same

[12]See §5.5.

IP. Assuming that the edge of CP coincides with an IP boundary, no mutation is predicted on its initial consonant, since no other phonological phrase could precede it within the IP. To account for the lack of mutation in coordinated NPs, Hannahs suggests that each NP in a coordinated structure may form its own IP, drawing on evidence from list intonation cross-linguistically. If the second NP is in its own IP, then by definition, mutation cannot take place.

As Green (2006) points out, while the prosodic phrasing approach does account for regular soft mutation under the assumptions of the theory, it resorts to positing prosodic constituents with no independent evidence from other phonological rules or intonation. Further, the proposal only accounts for regular mutation, characterizable in terms of regular prosodic phrasing, thus treating all other mutations in the language as a separate phenomenon. For this reason, he prefers syntactic accounts, to be discussed in §1.3.2, which in his view fit together more neatly with the other lexicalized/morphologized forms of soft mutation.

Another example of a prosodic account of phrasal alternations comes from French liaison (Selkirk 1986). French liaison is a case where (supposedly) underlying word-final consonants fail to delete before vowel-initial words in certain morphosyntactic configurations, as shown in (47), where liaison (pronounced) consonants are placed in square brackets in IPA (Bybee 2001):

(47) a. les enfants arrivent (French)
the children arrive
'the children are arriving'

b. les enfants[z] intelligents (French)
the children intelligent
'the intelligent children'

In (47a), the final *s* of the subject NP *les enfants* 'the children' elides before the verb, but it is preserved (pronounced as [z]) when followed by a modifying adjective, as in (47b).

Selkirk (1986) offers a prosodic analysis of liaison in which liaison is blocked (i.e. word-final consonants delete) at the right edge of small phonological phrases. These small phonological phrases are constructed off of X^{head} boundaries, boundaries inserted at the right edge of a head of a maximal projection. This formation of liaison domains is illustrated in the following example (Selkirk 1986:396):

(48) Phonological domains and French liaison

a. $_{S}$[[Ces [[très]$_{Det}$ [aimables]$_{A}$]$_{AP}$ [enfants]$_{N}$]$_{NP}$ [[en] [ont]]$_{Aux}$ [avalé]$_{V}$]$_{VP}$]]]
b. .....]$_{Xhead}$ .....]$_{Xhead}$
c. (_____) (_____)

The sentence parses into two small phonological phrases, one formed off of the head of the maximal NP projection *enfants* 'children', and one formed off of the head of the maximal VP projection *avalé* 'swallowed'. Crucially, Selkirk assumes a syntactic structure in which pre-nominal adjectives (in the specifier of NP) do not project a phrasal level. In this way, *aimables* 'lovable' phrases with *enfants* 'children', and the final *s* of the adjective is pronounced. However, at the end of the small phonological phrase, liaison is blocked, and the final *s* of *enfants* is elided, despite being linearly followed by a V-initial word.

Bybee (2001) argues against the prosodic approach, due both to the variable nature of liaison between prosodic constituents of arguably the same nature and to the failure of experimental work to confirm the existence of the small phonological phrase (Post 2000). She instead offers an approach to liaison similar to the framework proposed in this study, in which liaison occurs in constructions, lexicalized from high frequency of use. Some constructions, like *c'est à dire* 'that is to say', are entirely fixed, and others are more general, like [Noun+Plural+Adjective]. In Chapter 5, I will consider how French liaison could be accounted for using the same tools developed for Dogon replacive tone.

As I have already argued, an analysis relying solely upon phrasing to predict tonal overlays cannot account for Dogon tonosyntax. Overlays cannot be seen as an inherent property of

prosodic constituents, or we would expect adjectives and numerals to have the same effects, or NPs and VPs. We could ask, however, if the effects of tonal overlays could be bounded by prosodic constituents rather than syntactic structure (c-command). For example, rather than X standing for all words c-commanded by a controller, could we instead say X is all words preceding a controller in the same phonological phrase?

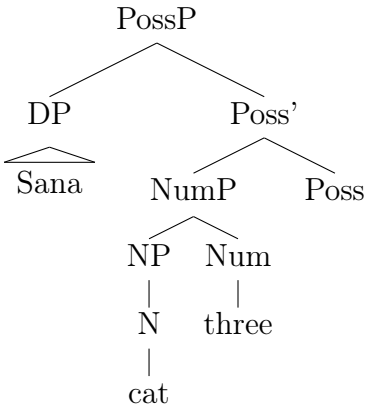
To answer this question, let us briefly turn to the data pattern motivating the c-command analysis. In Tommo So, the scope of a possessive tonal overlay is wider in the case of an alienable possessor than an inalienable one:

(49) a. Sáná ^{L}{gàmmà tàándù-gò} (Tommo So)
Sana cat three-ADV
'Sana's three cats'

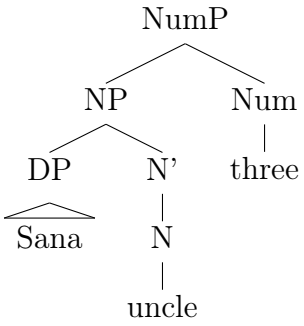
b. Sáná ^{L}bàbè tàándú-go (Tommo So)
Sana uncle three-ADV
'Sana's three uncles'

In (49a), the possessor's {L} overlay encompasses both the noun and the numeral, while in (49b), only the noun is L-toned. This data pattern is explained if we assume that alienable possessors are structurally higher than inalienable possessors (as argued in Español-Echevarría 1997, Suzuki 1997, Alexiadou 2003, among others). In particular, we can propose that an alienable possessor is in a PossP projection above the numeral, while the inalienable possessor is in the specifier of NP, structurally below the numeral:

(50) a.



b.



From the higher position in PossP, the alienable possessor c-commands both the numeral and the possessed noun; when in the specifier of NP, the inalienable possessor only c-commands the noun, leaving the numeral out of reach tonally.

From even an abstract point of view, it will be difficult to find a phrasing that correctly predicts these results under the standard view of edge-alignment. If a construction stated that a possessor assigns its overlay to every subsequent word within a phonological phrase, this means that the possessor must phrase together with the noun and numeral in the former case, and only with the noun in the latter. Given the identical structure of NumP in the two cases (NumP dominating an NP level), regardless of whether we choose the right or left edge of maximal projections for assigning phrase boundaries, the numeral and the noun will phrase in an identical fashion. To phrase the whole NumP together correctly predicts that 'cat' and 'three' should both take a {L} if in the same phonological phrase as the possessor, but this predicts the wrong result for an inalienable possessive construction, where 'three' is

out of reach of the possessor. Similarly, to phrase them separately (for instance, by inserting a phonological phrase boundary at the right edge of NP) predicts the correct behavior for the inalienable construction of (50b) but incorrectly phrases the numeral separately in the case of (50a).

While it is possible that with an adequate amount of restructuring rules, prosodic constituents could be construed to account for the domains of tonal overlays, nothing else in the system of Dogon tonosyntax suggests regular phrasal phonology. Further, a syntactic account requires no separate stipulations: c-command alone captures the difference between alienable and inalienable possessive constructions.

1.3.2 Syntactic accounts

In contrast to the accounts given above, which placed external sandhi and phrasal alternations purely in the phonological domain, other accounts let the syntax be directly responsible for the triggering environments. I will consider two proposals here: the XP Trigger Hypothesis (Borsley and Tallerman 1996 et seq.) concerning Welsh Soft Mutation and the Direct Reference account of Luganda High Tone Anticipation, given by Pak (2008). I consider how each proposal would fare in the test case of Dogon tonosyntax.

1.3.2.1 XP Trigger Hypothesis (Borsley and Tallerman 1996 et seq.)

The last subsection considered a prosodic account of Welsh Soft Mutation intended to replace the syntactic account proposed by Borsley and Tallerman (1996). Originally formulated as the NP Trigger Hypothesis (Harlow 1989), under which soft mutation was triggered by a preceding NP, the XP Trigger Hypothesis (XPTH) of Borsley and Tallerman (1996) extended the class of triggers to any preceding XP. However, it is more restrictive than the NP Trigger Hypothesis in that the preceding XP must c-command the target. For example, in the following sentence, the subject NP is an XP that c-commands the object, and hence the object undergoes mutation (Borsley 1999:271):

(51) Gwelodd [$_{NP}$ y dyn] [ddafad] (dafad) (Welsh)
saw the man sheep
'The man saw a sheep.'

The noun *dafad* undergoes soft mutation to become *ddafad*, triggered by the preceding c-commanding NP. When preceded by simply a verb (V), no mutation occurs (Borsley 1999:271):

(52) Mae 'r dyn wedi gweld [dafad] (Welsh)
is the man after see sheep
'The man has seen a sheep.'

The exact formulation of the XPTH has changed with time, being framed originally in Principles and Parameters and later in HPSG by Borlsey (1999) and Tallerman (2009). Under these latter accounts, the trigger is an XP complement that directly precedes the trigger. No matter the formulation, mutation is a process triggered by the presence of a phrasal constituent adjacent to its target. Syntactic category of target and trigger do not come into play.

It should by now be clear that syntactic category is a necessary ingredient in the analysis of Dogon tonosyntax, so a version of the XPTH (e.g. a tonal overlay is triggered by the head of an XP on all c-commanded words) is insufficient in the present case. As I have just indicated in this mock formulation, another difference between the XPTH of Welsh and the present analysis of Dogon tonosyntax is that the target(s) and the trigger of the morphophonological change in Dogon are both contained within the same XP. However, the two analyses share c-command as a common element, consistent with the prediction that phrasal alternations may often borrow structural relations from syntax in defining their domains of operation; see §5.3.2

1.3.2.2 Phases as phonological domains (Pak 2008)

Pak (2008) offers a different view of the phonology-syntax interface. She argues that phonology makes direct reference to syntactic structure, but not in the form of XPs or syntactic constituents of the sort. Instead, she proposes that syntactic structure is sent to the phonological component for spell-out in phases, defined by certain functional phases (often CP and vP, though under some theories DP as well). More precisely, the head of these XPs is known as the phase head, and it is its complement that is sent to PF to be spelled out; the phase head itself is spelled out phonologically with the next phase.

As an example, she gives Luganda High Tone Anticipation (HTA), described in §1.1.3.3 above. The data are repeated in (53):

(53) a. [$_{CP}$ omulenzi [$_{TP}$ a-gul-ir-a Mukasa kaawà]](Luganda)
1.boy SBJ1-buy-APPL-IND 1.Mukasa 1A.coffee
'The boy is buying Mukasa some coffee.'

b. (òmùlènzì) (à-g**úl-ír-á** M**úkásá** kaawà) (Luganda)

She explains the data pattern by claiming that CPs are phases, and preverbal subjects, here *omulenzi* 'boy', obligatorily occupy SpecCP. This means that the TP complement of the phase head C, is first spelled out, leaving the subject in SpecCP to be spelled out in a separate domain.[13] HTA takes place across the TP constituent but H cannot spread to the subject.

Her proposal is considerably more complex in the details, with phonological rules also able to apply to what she calls "linearization statements", which linearly order two nodes in a syntactic tree. Domains can also be split or joined by late linearization rules, sensitive to factors like speech rate.

[13] vP is not assumed to be a phase in this example.

Like prosodic phonology, this phase-based framework also assumes a high degree of category insensitivity–phonological rules apply to whatever domains are defined by phases without regard for syntactic category. However, the way Pak (2008) phrases this restriction leaves open the possibility for a system like Dogon. She states:

(54) "The phrasal phonology cannot override the basic syntactic constituent structure by e.g. assigning special status to an arbitrarily selected morphosyntactic feature or category label." (Pak 2008:9)

In the Dogon languages, tonal domains are congruent with syntactic structure, so while category information is necessary to trigger tonal overlays, it does not define any special domains. Nonetheless, the category-specific nature of Dogon tonal overlays leads me to hesitate labeling them as phrasal phonological rules; further, even if a trigger is contained within a phase, other information such as c-command or linear order still must be appealed to in order for the overlay to apply to the correct targets. Hence, I argue that a phase-based account on its own is insufficient to account for the Dogon overlays.

That said, I will argue for spell-out of phases in Dogon tonosyntax, with more deeply embedded phases sent first to the morphology. The output of this cycle is then protected from morphophonological changes at later cycles by the violable faithfulness constraint IDENT-OO(T)/PHASE; see §2.5.4. For example:

(55) [$_{DP}$ ìì^{L} gààlɛ̌y=gɛ] ^{L}bàbè^{L} kómmó (Tommo So)
child small=DEF uncle skinny
'the small child's skinny uncle'

As an inalienable possessive construction, the adjective *kómmó* 'skinny' c-commands the possessor DP 'small child'. However, this possessor does not take the adjectives {L} overlay; instead, it retains the tonosyntax it would have on its own, i.e. not as a possessor. I assume

that this embedded DP is first spelled out and sent to the morphology, where the optimal surface form is chosen by constraint evaluation; in the spell-out of later phases, this output form is protected by phase-based faithfulness. A similar argument will be made in Chapter 4 on relative clauses, where only the verb of the relative clause is visible to higher tonosyntactic controllers, a phenomenon that could be explained if the verb moves to the phase head.

Like all other constraints, phase-based faithfulness constraints too can be violated. Depending on the ranking of faithfulness and construction constraints, a language may alter the phonological output of a previous phase by applying new tonal overlays. Chapters 2 and 3 will present these cases more thoroughly.

1.3.3 Morphological and lexical accounts

The unusual and often idiosyncratic nature of many phrasal morphophonological alternations has led others to place them in the morphological or lexical domains. In this section, I consider Hayes's (1990) Precompiled Phrasal Phonology, Green's (2006) theory of listed allomorphy with morphological constraints, and cophonology theory (Anttila 2002, Orgun and Inkelas 2002, Inkelas and Zoll 2005, etc.).

1.3.3.1 Pre-compiled Phrasal Phonology (Hayes 1990)

One theory of which I am aware that could properly account for the Dogon facts is Hayes's (1990) Precompiled Phrasal Phonology. This theory was developed precisely to deal with those cases where prosodic phonology fell short and it was argued that more detailed syntactic information should be available to the phonology. Rather than reduce the falsafiability of the theory of the phonology-syntax interface by allowing any number of ways of connecting the two components, Hayes developed a theory to account for the residual cases unable to be accounted for using the prosodic hierarchy.

What he found was that these cases had a number of things in common with lexical phonology: the rules tend to be structure preserving, they are subject to morphological

restriction, and they can be ordered before lexical rules. This led him to develop a theory in which certain phonological rules take place in the lexicon, deriving allomorphs for certain syntactic contexts that can later be inserted when the syntax calls for their set of morphosyntactic features. In particular, the lexicon can list certain *instantiation frames*, which are essentially morphosyntactic environments to which phonological rules may make reference. For the Dogon languages, we could make an instantiation frame "/ [_ Adj]". A rule or constraint enforcing a {L} overlay could be tagged to occur in this instantiation frame. This will produce a L-toned allomorph of any word that can precede an adjective, and it is this allomorph that would be inserted into the syntax at spell out.

This theory is similar to Construction Morphology, except that the frames and the rules are split up rather than occurring simultaneously in a schema. Conceptually, I prefer an analysis in which the phonological form associated with a schema is coupled directly with the construction, rather than applying as a separate rule. Even if we expect that rules or constraints produce the outputted tone patterns, it is difficult to see how such rules could motivate {L}, {H}, and {HL} overlays through phonological principles (i.e. markedness and faithfulness) alone. Beyond this conceptual preference, Dogon tonosyntax also departs from the phenomena discussed by Hayes in not being structure-preserving. Lexical tonotactics of the majority of Dogon languages do not allow /L/ as a lexical tonal melody, and yet this is precisely the melody applied by most overlays. Thus, a theory accounting for Dogon and other similar phenomena must not be constrained to only lexical phonology. The framework proposed here allows for this flexibility.

1.3.3.2 Listed allomorphy (Green 2006)

Green (2006) takes a non-phonological view of Celtic consonant mutations, arguing that the phonological changes involved are too disjoint and too idiosyncratic to be plausibly driven by phonology alone. Instead, he puts forth an analysis in which words have listed allomorphs in various "mutation grades", and triggers are marked with a diacritic selecting a particular grade. This turns mutation into a lexical or morphological phenomenon similar to case

selection, as in prepositions that govern a particular case (rather than, say, case assigned by thematic role in the syntax).

Allomorph selection is driven by the constraint MUTATION AGREEMENT (MUTAGREE), which is violated when a trigger's mutation requirement is not realized on its target. For example, the feminine singular article is diacritically marked [+SM] for soft mutation. The input for a phrase like *y faner* 'the flag' contains both listed allomorphs for flag, one in the radical mutation grade and one in the soft mutation grade. MUTAGREE drives the selection of the soft mutation allomorph in Welsh:

(56)

Input: /ə$_{+\text{SM}}$ {baner$_{\text{RAD}}$, vaner$_{\text{SM}}$}/	MUTAGREE	IDENT(cont)
a. ə baner	∗!	
b. ☞ ə vaner		

Since both allomorphs are listed as possible inputs, neither candidate violates IDENT(cont). Candidate (a), which employs the allomorph marked as [RAD] for 'radical', violates MUTAGREE, which demands the allomorph marked as [SM]. Green proposes that syntactic position can also be marked with diacritics (e.g. the syntactic positions posited by the XPTH), though he does not give any illustrative tableaux.

This approach would work for simple examples of Dogon tonosyntax, if we assume every word has a listed allomorph with the various tonal overlays. For example, nouns could have allomorphs listed as [L], [HL], etc., and triggers would demand a certain allomorph; in Tommo So, adjectives would be marked [+L], inalienable pronominal possessors as [+HL], and a tonal version of MUTAGREE would select the correct allomorph. However, in a construction with both a possessor and an adjective, a single MUTAGREE constraint could not break the tie between the adjective's demands and the possessor's. In order to break the tie, MUTAGREE would have to be exploded into a family of MUTAGREE constraints, such that an adjective's agreement could outweigh a possessor's or vice versa.

Once we have done that, the theory resembles that proposed here. However, I contend that my framework provides a more straightforward solution, since the phonological form of a target is part and parcel of the construction with its trigger; in other words, there is no need for diacritics on lexical items or syntactic positions. This further allows for the possibility that a single trigger can demand different forms in different configurations. Such a situation holds in Yorno So, where a numeral does not impose any tonal overlays on its own (57a) but imposes {L} when a possessor is also present (57b):

(57) a. gɛ̀r^{n}ɛ́ kúlòy (Yorno So)
house six
'six houses'

b. gɛ̀r^{n}ɛ̀^{L} kúlòy wò-mɔ̀ (Yorno So)
house six 3SG-POSS
'his six houses'

The {L} overlay in (57b) cannot be attributed to the possessor on its own, which also triggers no tonal changes (cf. *gɛ̀r^{n}ɛ́ wò-mɔ̀* 'his houses'). If the numeral were marked with a [+L] diacritic, we would expect a {L} overlay in (57a); if it were marked [+RAD] or [+LEX] (for lexical tone), we would expect no tonal overlay in (57b). Instead, these data point to overlays being a property of the construction itself, with N Num a separate construction from N Num Poss. The framework of this study can easily account for these patterns, where a MutAgree analysis runs into trouble.

1.3.3.3 Cophonologies

Though I know of no analyses of phrasal morphophonological alternations using cophonologies (Anttila 2002, Orgun and Inkelas 2002, Inkelas and Zoll 2005, etc.), it is natural to ask whether such an analysis of context-specific phonology could be extended to the case of Dogon replacive tone. In cophonology theory, morphemes have associated with them a

phonological grammar (constraint ranking) that may differ from the general phonological grammar of the language. For example, Inkelas and Zoll (2007) report that in Turkish, different vowel-initial suffixes resolve vowel hiatus differently:

(58) a. /anla-ɯnʤa/ → [anlajɯnʤa] (Turkish)
understand-ADV
'having understood'

b. /anla-ɯjor/ → [anlɯjor] (Turkish)
understand-PROG
'understanding'

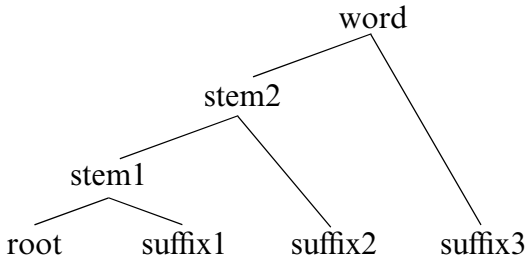
The addition of adverbial suffix in (58a) triggers epenthesis, while the addition of the progressive suffix in (58b) triggers vowel deletion. The authors analyze this behavior by positing two different cophonologies:

(59) a. *VV ≫ MAX-V ≫ DEP-C (Adverbial)

b. *VV ≫ DEP-C ≫ MAX-V (Progressive)

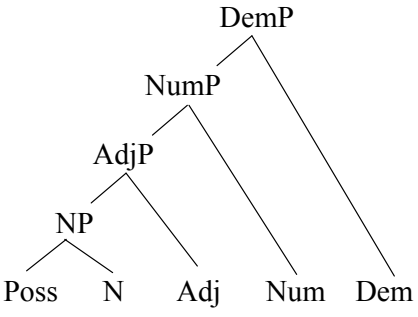
In morphologically complex words, word formation is assumed to progress serially, with a cophonology associated with an affix only able to affect the combination of that affix and its stem–nothing higher. For example, in the hierarchical structure below, cophonology 2 applies to the combination of stem1 and and suffix2; stem2 is then used as the input for suffix3, and so on (Inkelas and Zoll 2007:145):

(60)



This theory would, it seems, assume the same serial construction of phrases as it does of words, with the application of overlays progressing up the tree as each new modifier is added. The syntactic structure used in this study will be given in §2.4.2. For now, the following hierarchy will suffice for the discussion of cophonologies:

(61)



Here, the position of Poss represents an inalienable possessor. Let us suppose that each syntactic category is associated with a phonological grammar. For the sake of simplicity, I will assume a constraint that imposes overlays on c-commanded words, OVERLAY, taking the phonological content of the overlay as its argument. The following cophonologies can be determined:

(62) a. Possessor: OVERLAY(H) $\gg$ FAITH, OVERLAY(L)

b. Adjective: OVERLAY(L) $\gg$ FAITH, OVERLAY(H)

c. Numeral: FAITH ≫ OVERLAY(L), OVERLAY(H)

d. Demonstrative: OVERLAY(L) ≫ FAITH, OVERLAY(H)

Let us begin with a N Adj Num phrase. The phonological output N Adj would be calculated first, using the associated cophonology in (62b); this yields N^{L} Adj as the make-up of AdjP. AdjP Num would then be calculated, but since FAITH is high-ranked, no overlay is applied; thus, NumP consists of N^{L} Adj Num. When Dem is added to NumP, highly ranking OVERLAY(L) imposes {L} on the c-commanded words, yielding the correct output form {N Adj Num}^{L} Dem.

The first problem that arises with this theory has to do with 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 the phonology demands 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 (§2.5.4), but under cophonology theory, the fact that NP consists of two words should no longer be visible to Adj.

A more serious problem arises in the same configuration in Nanga. Like Tommo So, the possessor imposes an overlay {HL} and the adjective imposes an overlay {L}. However, the surface form of Poss N Adj is Poss ^{HL}N Adj; in other words, the overlay of hierarchically lower Poss resists the overlay of higher Adj, despite the fact that OVERLAY(L) ≫ FAITH in Adj's cophonology. This same problem would arise in any serial model of overlay application. In order to solve this problem while maintaining a cophonological analysis, constraints would need to be introduced that maintain faithfulness to an overlay (e.g. FAITH{HL}), which

would outrank the other constraints in Adj's cophonology. This seems to me to be a post hoc solution, lacking in theoretical elegance.

The framework proposed in this study uses global evaluation, which captures the full range of data found in the Dogon languages, avoiding these pitfalls of cophonologies.

1.4 Outline of the study

Chapter 2 uses Tommo So as an illustrative case to outline the framework proposed here. I lay out the data patterns in detail, then show how a combination of construction constraints and faithfulness constraints accounts for the surface tonal patterns of multi-word combinations in the DP. The analysis is first couched in Optimality Theory, then translated into maximum entropy grammar to account for surface variation.

Chapter 3 extends the analysis to the other Dogon languages in the sample. I provide brief summaries of the tonosyntactic system of each language, then give the constraints and weightings necessary to account for the tonal behavior. I end with a comparison of the grammars of all the languages and a discussion of the factorial typology of the complete constraint set.

In Chapter 4, I turn to relative clauses, where we find both DP tonosyntax and VP inflectional tone, sometimes interacting in interesting ways. After presenting the data in §4.2–4.3, I then motivate a syntactic analysis of Dogon internally-headed relative clauses in §4.4.3, whereby the internal head inherits the morphophonological properties of the external copy of the head, which then deletes. This unifies the tonal overlays found in relative clauses with those of simpler modifiers like adjectives. In §4.5, I show how relative clause construction constraints interact with other construction constraints. Section4.6 addresses remaining puzzles.

Chapter 5 considers the predictions made by the framework: How are phrasal phonological systems restructured and how are these restructured systems represented in the grammar? I show how phenomena from other languages fulfill these predictions, focusing in particular

on the tonal case of Kalabari (Harry and Hyman 2012) and the non-tonal cases of Celtic mutations and French liaison.

Chapter 6 summarizes.

CHAPTER 2

Tommo So tonosyntax

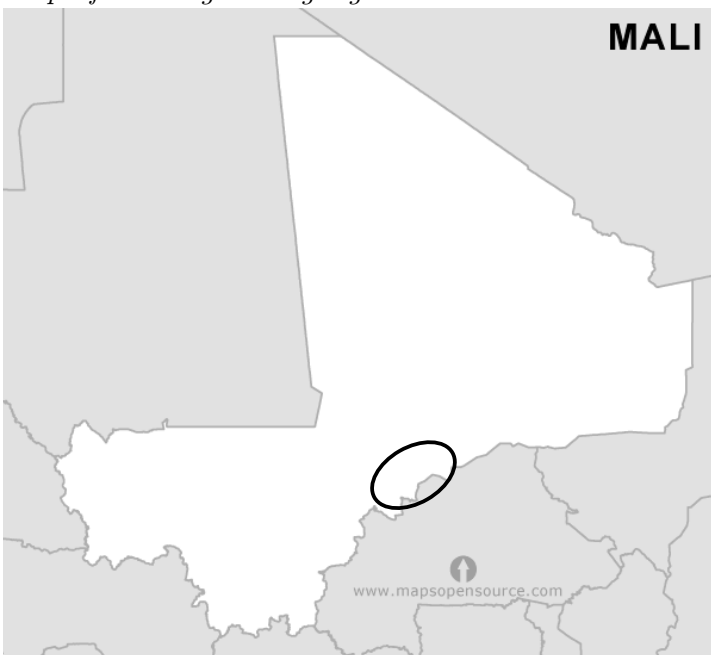
2.1 Introduction

This chapter describes the basic system of Dogon replacive tone, focusing on data from Tommo So. I first provide background on the Dogon language family in §2.2. I then describe the basic Tommo So data patterns in §2.3, defining the classes of **controllers** and **non-controllers** and illustrating their tonal effects. In §2.4, I make three main claims about Tommo So: that tonosyntax is category-sensitive, that tonal domains are determined by syntactic structure, and that constraint interaction is crucial to capturing the data patterns. With these basic claims in place, I turn to the constraint-based model in §2.5. Section 2.6 summarizes the full system of Tommo So tonosyntax, while §2.7 suggests its diachronic origins, including possible semantic principles underlying the controller vs. non-controller distinction. Section 2.8 discusses remaining issues.

2.2 Dogon languages

The Dogon language family is a group of about twenty languages spoken in east-central Mali, with slight spillover into neighboring Burkina Faso. This region is depicted in the following map in a black oval:

(1) *Map of the Dogon language area*



The exact genetic affiliation of the family has been the subject of much debate. Various hypotheses have grouped the languages with Gur/Voltaic (Baumann and Westermann 1948, Westermann and Bryan 1952, Bertho 1953, Greenberg 1963) and Mande (Delafosse 1952), but a more recent hypothesis suggests that it forms its own branch of Niger-Congo (Blench 2005); it is listed in the Ethnologue as a branch of Volta-Congo (Ethnologue 2014).

The Dogon languages were mostly unstudied until the founding of the Dogon Languages Project by Jeffrey Heath (University of Michigan) in 2005. Published descriptions of Toro So (Calame-Griaule 1968), Donno So (Kervran and Prost 1969), Togo Kan (Prost 1969), and Tommo So (Plungian 1995) were previously available, but tone marking in these works is sporadic and most do not claim to be complete descriptions. Since 2005, Heath and colleagues[1] have been working to write comprehensive reference grammars for all varieties.

[1]Brian Cansler (University of North Carolina, Dogulu Dom), Vadim Dyachkov (Moscow State University, Tomo Kan), Abbie Hantgan (Indiana University, Bondu So and an isolate Bangi Me), Steven Moran (University of Munich, Sangha So), Kirill Prokhorov (Humboldt University of Berlin, Ampari and Mombo)

I joined the project in 2008 to document Tommo So, a language with around 60,000 speakers (Hochstetler et al. 2004) living in villages across the plateau of the Bandiagara Escarpment. My data are based on 14 months of fieldwork (June 2008–May 2009, May–June 2010, January–February 2012), during which time I worked primarily with four consultants from the commune of Tédié. Their speech represents the northernmost dialect of Tommo So, considered by many Tommo So speakers to be the "purest" variety (Hochstetler, p.c.). Data from Tommo So and the other languages are drawn from a combination of elicitation and recorded texts.

Though the family comprises twenty languages, I focus here on a sample of ten for which sufficient tonal descriptions are available. These languages are listed in (2):

(2) 1.Ben Tey (Heath, 2012a)

2.Jamsay (Heath 2008)

3.Najamba (Heath, 2011a)

4.Nanga (Heath 2013a)

5.Tiranige (Heath, 2012b)

6.Togo Kan (Heath, 2011b)

7.Tommo So (McPherson 2013)

8.Toro Tegu (Heath, 2011c)

9.Yanda Dom (Heath, 2012c)

10.Yorno So (Heath, 2011d)

At the time of writing, all unpublished grammar manuscripts are publicly available at www.dogonlanguages.org. Most of these languages have by and large the same system of replacive tone, with interesting differences in melodic content, tonal scope, and conflict resolution when competitions arise between construction constraints. Tiranige, however, has taken its own path, with what often looks like a complete reversal of regular Dogon tone patterns. I argue that it can fit into the same system, and indeed it must, since Togo Kan shows surface variation between a more traditional Dogon-like pattern and a Tiranige-like pattern. See Chapter 3 for further discussion and analysis.

2.3 A brief sketch of the Tommo So data patterns

2.3.1 Controllers and non-controllers

In this section, I 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 §2.4.2 and beyond.

As indicated in the introduction, not all words in the Dogon languages trigger tonal overlays, and Tommo So is no exception. We can divide syntactic categories into two classes based on their tonal behavior: controllers, which trigger tonal overlays, and non-controllers, which do not. In Tommo So, numerals 'two' and above, definite determiners, plurals, and universal quantifiers are non-controllers:

(3) a. gámmá tààndú ‘three cats’ (N Num)

b. gámmá=gɛ ‘the cat’ (N Def)

c. gámmá=mbe ‘cats’ (N Pl)

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

In each case, a schematization is placed in parentheses after the form; none contain tonal overlays. Note that the plural and the definite are toneless enclitics in Tommo So, receiving surface pitch via interpolation (McPherson 2011).

Controllers (adjectives, the numeral ‘one’, demonstratives, and possessors), are given in (4). I illustrate the basic effect of relative clauses here, but due to their complicated nature, I leave a full treatment of their (tono)syntax to Chapter 4:[2]

(4) a. gàmmà^{L} gɛ́m ‘black cat’ (N^{L} Adj)

b. gàmmà^{L} túmɔ́ ‘one cat’ (N^{L} ‘one’)

c. gàmmà^{L} nɔ́ ‘this cat’ (N^{L} Dem)

d. Sáná ^{L}gàmmà ‘Sana’s cat’ (PossNonP ^{L}N)

e. mí ^{H}bábé ‘my uncle’ (PossIP $^{H(L)}$N)

[2]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 non-pronominal possessor (with undetermined alienability).

All post-nominal controllers (adjectives, the numeral 'one', demonstratives, and relative clauses) impose {L}. We know the noun in each case is specified with grammatical L tone and has not simply undergone tone deletion, since the word is realized with a stretch of level L—underspecified syllables in Tommo So are realized with linear interpolation between surrounding specified tones. Non-pronominal possessors (both alienable and inalienable) impose {L} as well, while pronominal inalienable possessors impose {H} or {HL}.[3]

As we saw in (4), possessive constructions are not uniform in Tommo So. Depending on factors like alienability of the possessed noun, phonological form of the possessed noun, and pronominal vs. non-pronominal status of the possessor, we find that either {L}, {H}, or {HL} overlays are applied; in one case, no overlays are applied at all.

First, all non-pronominal possessors impose {L}, regardless of whether the possessed noun is alienable or inalienable:

[3]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 (Inkelas 1998, Alderete 2001). For example, in Hausa, dominant suffixes cause tonal overwriting on the stem, while recessive ones do not, as shown in the following (Inkelas 2011):

(5) a. nè:má: + -ó: → né:m^{H}-ó: (Hausa)
seek VENTIVE
'seek here'

b. dáfà: + -wá → dáfà:-wá (Hausa)
cook VBL.N
'cooking'

In (5a), the ventive is a dominant suffix, imposing its {H} tone across the stem to which it is affixed. In (5b), on the other hand, the nominalizer *-wá* is a recessive suffix, causing no tonal changes on the stem. Similarly, then, we can think of controllers as being "dominant modifiers" and non-controllers as "recessive modifiers" with regards to phrasal tonology.

(6) a. Sáná ^{L}gàmmà
'Sana's cat'

b. Sáná ^{L}bàbè
'Sana's uncle'

The behavior of pronominal possessors depends on alienability. Inalienable nouns are preceded by a bare pronoun, which imposes {H} or {HL} depending on mora count of the possessed noun; nouns with 1-2 moras take {H} while nouns with three or more moras take {HL}:

(7) a. mí ^{H}bábé
'my uncle' (cf. /bàbé/ 'uncle')

b. mí ^{HL}tírɛ̀-àn-nà
'my grandfather' (cf. /tìrɛ̀-àn-ná/)

Alienable pronominal possessors are exceptional in most Dogon languages: 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. The paradigm of Tommo So alienable possessive pronouns is given in (8):

(8)

	Alienable possessive pronoun	Pronoun + *mɔ*
1sg	ḿmɔ	mí=mɔ
2sg	úwɔ	ú=mɔ
3sg	wómɔ	wó=mɔ
1pl	émmɛ	émmé=mɔ
2pl	éwɔ	é=mɔ
3pl	bémɛ	bé=mɔ

When placed after a noun, no overlays are applied:[4]

(9) a. gámmá ḿmɔ 'my cat' (< mí=mɔ)

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

I remain agnostic as to the best syntactic analysis of these post-nominal possessors.[5] However, as they are able to stand on their own as a headless possessive constructions (e.g. *ḿmɔ=gɛ* 'mine'), I consider them here to be morphologically more akin to non-pronominal possessors and treat them as such for the purposes of faithfulness; see §2.5.4.

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; see §2.8.1.2 for a brief discussion of compound tonosyntax.

[4]Rarely, the pronominal possessor is placed before the noun, in which case the possessed noun takes a {L} overlay. I will discuss this construction further at the end of this chapter in §2.8

[5]One possibility is that they are appositive phrases, translating to something like "the cat, which is mine". If this is the case, DPs in appositive phrases (ApposP) are not treated as controllers, in contrast with DPs in PossPs and NPs (§2.4.2) , or in RelModPs (§4.4.2).

The table in (10) summarizes the tonosyntactic behavior of possessives in Tommo So:

(10)

Schema	*When the* **possessed noun** *is...*	*Example*
Poss(ANonP) $^{\text{L}}$N	(any noun)	Sáná $^{\text{L}}$gàmmà 'Sana's cat'
Poss(INonP) $^{\text{L}}$N	(any noun)	Sáná $^{\text{L}}$bàbè 'Sana's uncle'
N Poss(AP)	(any noun)	gámmá ḿmɔ 'my cat'
Poss(AP) $^{\text{L}}$N	(any noun)	ḿmɔ $^{\text{L}}$gàmmà 'my cat'
Poss(IP) $^{\text{H}}$N	1-2 moras	mí $^{\text{H}}$bábé 'my uncle'
Poss(IP) $^{\text{HL}}$N	3+ moras	mí $^{\text{H}}$ánìgè 'my friend'

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

2.4 Key generalizations

Now that I have illustrated the basic system of tonosyntax in Tommo So, we can turn to key generalizations about how tonosyntactic overlays are applied. First, in §2.4.1, I show that the status of a word as a controller depends on its syntactic category. In §2.4.2, I argue that the domain of a controller's overlay is determined by syntactic structure. Finally, in §2.4.3, I argue that competitions between controllers are resolved by constraint interaction.

2.4.1 Tonosyntax is category-sensitive

The first component of the theory is summarized in (11):

(11) Syntactic category:

The status of a word as a tonosyntactic controller is determined by its syntactic category.

We have seen support for this claim in §2.3, where syntactic categories bifurcate into two classes:

(12)

a.	*Controller*	*Example*	
	Adjective	gàmmà^{L} gɛ́m	'black cat'
	Demonstrative	gàmmà^{L} nɔ́	'this cat'
	Possessor (DP)	Sáná ^{L}gàmmà	'Sana's cat'
	Pronoun	mí ^{H}bábé	'my uncle'
b.	*Non-controller*	*Example*	
	Numeral	gámmá néé	'two cats'
	Definite	gámmá=gɛ	'the cat'
	Plural	gámmá=mbe	'cats'
	Quantifier	gámmá kɛ́m	'any cat'

The syntactic labels Adjective, Demonstrative, DP (containing lexical material and coupled with the semantics of possession), and Pronoun (coupled with the semantics of possession) delineate controllers.[6] In contrast, the labels Numeral, Definite, Plural, and Quantifier delineate non-controllers. For semantic principles underlying these two classes, see §2.7.1.

Example (4) above noted that the numeral 'one' is a controller, in contrast to all other numerals. At first glance, this seems to be a counter-example to the claim (11). 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*, ho-

[6]DP relative clauses are also controllers and will be discussed in Chapter 4.

mophonous with the adverbial suffix in the language, *túmɔ́* 'one' does not; if it is added, the meaning changes to the adverb 'together' (*túmɔ́-go*), which is exactly the pattern we find when *-go* is added to adjectives (e.g. *díyɛ̀* 'big' vs. *díyɛ̀-go* 'a lot'). 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 is sufficient to determine controller status.

It is important to note that non-controllers, though they do not trigger overlays, can themselves be subject to overlays, as illustrated by examples in (13):

(13) a. gámmá néé
cat two
'two cats'

b. {gàmmà nèè}$^{\text{L}}$ nɔ̀=mbé
cat two DEM=PL
'two cats'

In (13b), the demonstrative imposes {L} on both the noun and the numeral.[7] The domain of a controller's overlay is taken up in the next subsection.

The linear order of elements in the DP is given in (14), with the controllers underlined:

(14) DP/Pronoun N Adjective Numeral Demonstrative Definite Plural Quantifier

[7]The L tone on the demonstrative before the plural is due to a regular phonological process of tone shift, not a tonosyntactic overlay.

This linear order 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 distinguish 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, Selkirk 2009), where phrasing is purported to be category-insensitive.

2.4.2 Tonal domains are determined by syntactic structure

The next major piece of the analysis depends on the following claim:

(15) Syntactic structure:

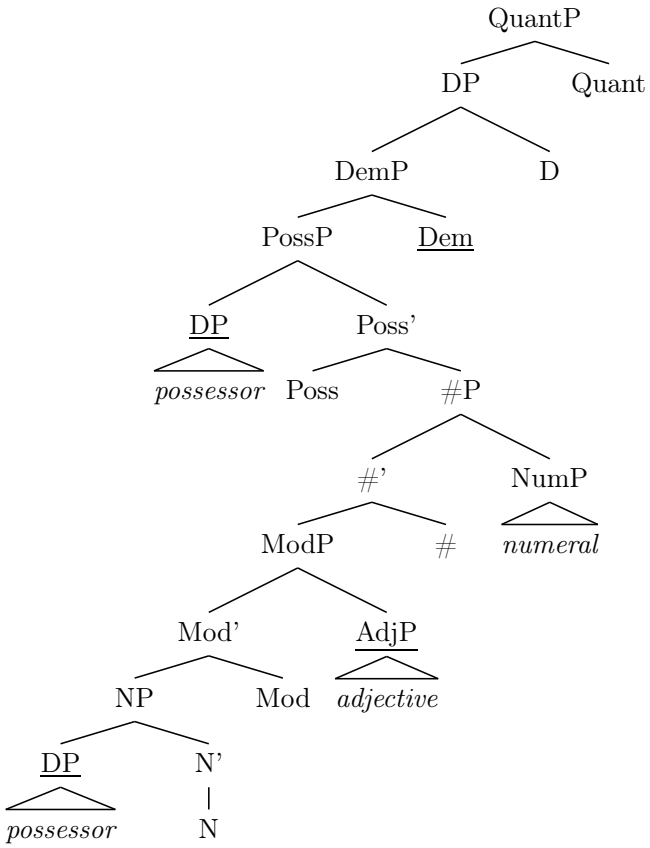
The domain of a controller's overlay is determined by syntactic structure: a controller can only target words that it **c-commands**, or itself.

Most commonly, controllers target c-commanded words; "self-control" will be discussed further in §2.5.

The linear order in (14) arises from the following syntactic structure, in which controllers continue to be underlined:[8]

[8]The tree contains both a DemP and a DP projection, the former for demonstratives and the latter for definites. In most languages, the two cannot co-occur, but in those languages that do allow both together, the order is always Dem Def. I am not following principles of Antisymmetry here (Kayne 1994) for the sake of simplicity; the attested linear orders could be derived under Antisymmetry through movement.

(16)



I have employed general X-bar theory here for the sake of concreteness; any syntactic framework that encodes hierarchical relationships between words (Chomsky 1995, Cinque 2005, Kayne 1994, among many others) should in principle be able to account for Dogon data equally well. Adjectives (AdjP) are given in the specifier of a functional ModP projection; numerals (NumP) are given in the specifier of a functional #P projection, though nothing in the following analysis hinges on this exact structure. Finally, possessive DPs are shown in two locations in this tree, once in the specifier of NP and once in the specifier of a functional PossP projection. These two locations are crucial for explaining tonal differences between alienable and inalienable possession; I return to this point shortly.

Since the head noun is the most deeply embedded in this tree, all other DP elements c-command the noun and would be able to affect its tone. It is clear, then, that c-command itself is not the trigger of tone control; it simply defines the targets for controllers, whose

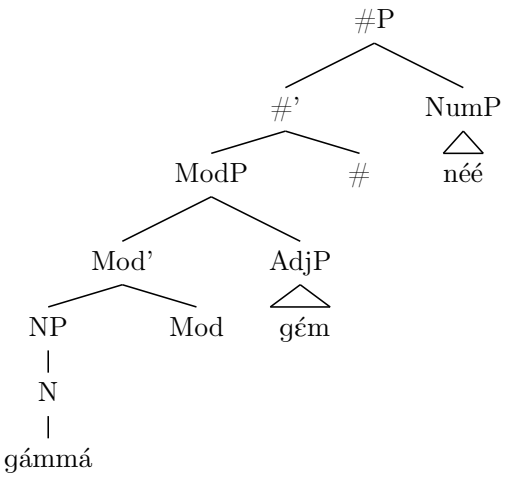
status as such is determined by their syntactic category (as argued in §2.4.1). Consider the following examples:

(17) a. N^{L} Adj Num
gàmmà^{L} gɛ́m néé
cat black two
'two black cats'

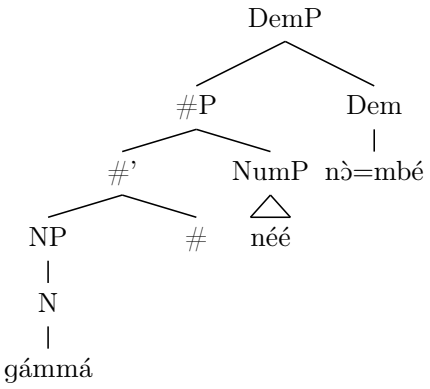
b. {N Num}^{L} Dem
{gàmmà nèè}^{L} nɔ̀=mbé
cat two this=PL
'these two cats'

Both examples contain the numeral, a non-controller, and one controller. In (17a), this controller is the adjective, which imposes its {L} overlay only on the noun. In (17b), the controller is a demonstrative, which imposes its {L} overlay on both the noun and the numeral. These tonal domains fall out naturally from c-command:

(18) a.



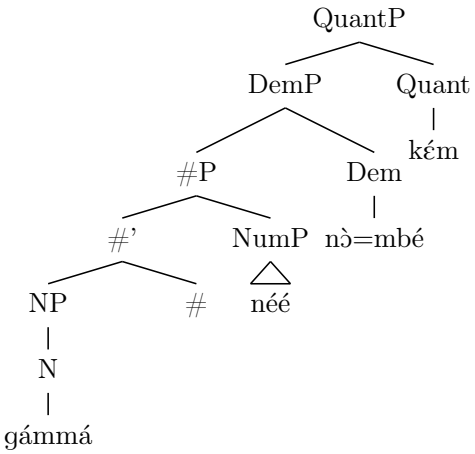
b.



The numeral in (18a) is not c-commanded by the adjective, whereas in (18b), it is c-commanded by the demonstrative. If the demonstrative were followed by the universal quantifier *kɛ́m*, this quantifier would not take the demonstrative's {L}, since Quant is not c-commanded by Dem:

(19) a. {N Num}^{L} Dem Quant
{gàmmà nèè}^{L} nɔ̀=mbé kɛ́m
cat two this=PL all
'both of these cats'

b.

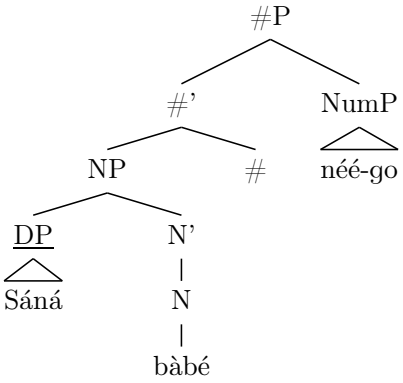


Thus far, we have only seen cases of right-to-left control, where c-command could be seen as simple linear order (a controller controls everything to its left). With possessors, we find clearer evidence for the domains of tone control being determined by syntactic structure. Recall that the tree in (16) had two locations for possessors. Following proposals

by Español-Echevarría (1997), Suzuki (1997), Alexiadou (2003), and others, I place the inalienable possessor in the specifier of NP, which gives it a close syntactic relationship with its possessed noun; the specifier of PossP hosts the alienable possessor. When the possessor is in the low syntactic position (specifier of NP), it only c-commands the noun. Hence, the only viable target for the inalienable possessor's {L} overlay is the noun. This is confirmed by a PossINonP (inalienable nonpronominal) N Num configuration, where the possessor is the only controller:[9]

(20) a. PossINonP ^{L}N Num
Sáná ^{L}bàbè néé-go
Sana uncle two-ADV
'Sana's two uncles'

b.



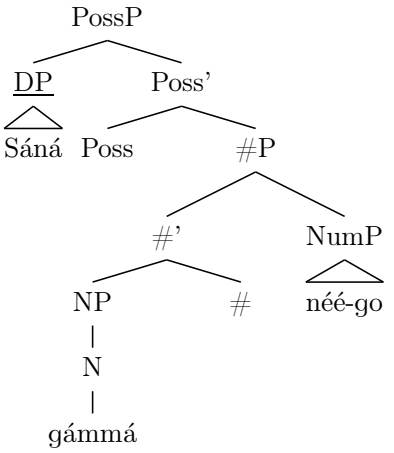
The noun takes a {L} overlay, but the numeral remains tonally free, since it is not c-commanded by the possessor.

In contrast, an alienable possessor in the specifier of PossP c-commands both the noun and the numeral, hence both are contained in the possessor's tonal domain:

[9]Numerals can optionally take an adverbial suffix *-go*; consultants report no change in meaning.

(21) a. PossANonP ^{L}{N Num}
Sáná ^{L}{gàmmà nèè-gò}
Sana cat two-ADV
'Sana's two cats'

b.



The possessor's {L} overlay extends through the numeral, since the possessor c-commands both N and Num. This example has the same linear order as (20), and yet the tonosyntactic patterns differ. Clearly, tonal domains cannot be determined by linear order alone. I argue that c-command is the deciding factor.[10]

The distinction between alienable and inalienable possession is not based on tonal domains alone. Additional differences include a different series of possessive pronouns for alienable and inalienable possession and the optional inclusion of a possessive particle *mɔ* following the possessor in alienable but not inalienable possession; this particle could be the realization of the Poss head, active for alienable possessors in the specifier of PossP but not for inalienable possessors, in the specifier of the possessed noun's NP. See McPherson (2013:§7.6) for further discussion and examples.

[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. This theory predicts that if such a coordinated structure were possible, both coordinands would take the controller's overlay, but we are unable to empirically test this claim. However, for relative heads consisting of coordinated NPs, see §4.6.1.

2.4.3 Tonosyntactic conflicts are resolved by constraint interaction

Here, I motivate the final claim in the analysis: a constraint-based framework is necessary to account for the data patterns. I propose an analysis in which the tonal effects of each controller are encapsulated in a morphological constraint. The main claim of this section is as follows:

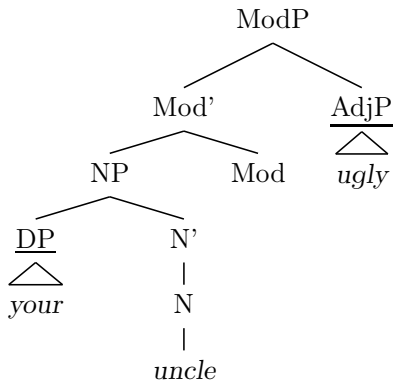
(22) Constraint interaction:

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, I 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 §2.5.5, I give evidence that it is the latter form of evaluation that is required for Tommo So tonosyntax.

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 and, relatedly, b) different languages resolve tonosyntactic conflicts differently. Consider the following syntactic configuration with an inalienable pronominal possessor and an adjective:

(23)



Both the possessor and the adjective c-command the noun. The adjective also c-commands the possessor. Hence, the possessor has one potential target and the adjective has two. The outcomes of this competition for Tommo So and two other Dogon languages, Jamsay and Nanga, are given in (24):[11]

(24) a. PossIP ^{L}N^{L} Adj (Tommo So)
ú bàbè^{L} mɔ̀ŋjú
2SG.PRO uncle ugly
'your ugly uncle'

b. {PossIP N}^{L} Adj (Jamsay)
{ù lèjù}^{L} mɔ̀ŋú
2SG.PRO uncle ugly
'your ugly uncle' (/ú/, /lèjé/)

c. PossIP ^{HL}N Adj (Nanga)
ú ^{HL}lésî mɔ̀sí
2SG.PRO uncle ugly
'your ugly uncle' (/lèsí/)

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 ≫ POSSESSOR), while in Nanga, the reverse is true (POSSESSOR ≫ ADJECTIVE); additional constraints are needed to account for the difference between Tommo So and Jamsay.

[11]The Jamsay example in (24b) contains an idiosyncratic segmental change on the possessed noun, with final /e/ changing to /u/ when possessed. A construction-based account is able to handle these cases of lexical idiosyncrasies by using sub-schemas that specify a particular lexical item instead of a syntactic category like N. See §3.3.2

The next section fleshes out the details of this constraint-based theory.

2.5 Analysis

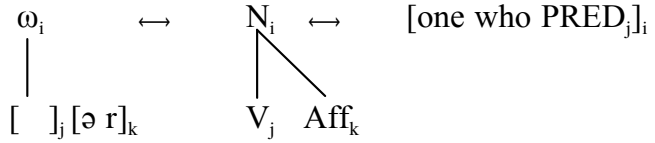
With these basic generalizations in place, we can now turn to the formal analysis. In this study, I adopt a hybrid model that combines morphological constructions (in the sense of Booij's 2010 Construction Morphology) with constraint-based models of morphology (such as Realization Optimality Theory, Aronoff and Xu 2010, Xu 2011, or the FIAT-STRUC constraints of MacBride 2004).

2.5.1 Constructions

The analysis relies on the notion of morphological constructions. I follow the format of constructions in Booij's (2010) formulation of Construction Morphology, though I depart from his framework by assuming that constructions are learned only in the case of idiosyncrasies and that all constructions are implemented in them morphological component. In other words, while Booij views Construction Morphology as the morphological branch of Construction Grammar (CxG) (Lakoff 1987, Fillmore, Kay, and O'Connor 1988, Goldberg 1995, Boas and Sag 2012 etc.), I assume generative syntax and use constructions only in those cases of idiosyncratic mappings between phonology, syntax, and semantics. These constructions, which can consist of a single word or multiple words, are stored in the lexicon.

I adopt Booij's notion of constructional **schemas**, which combine phonological, syntactic, and semantic information. For example, the constructional schema for the English agentive is given again in (25) (Booij 2010:8):

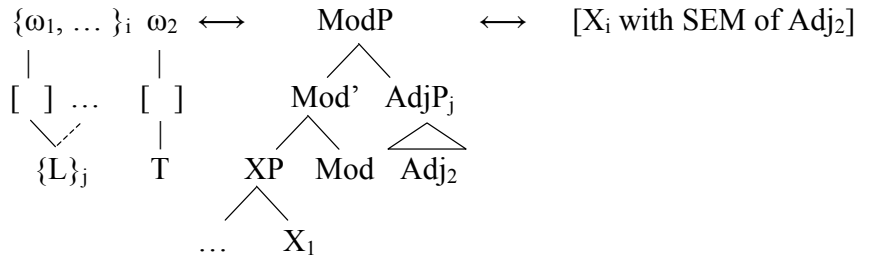
(25) Constructional schema for the English agentive construction, as in "singer"



In this schema, the phonological representation is on the left. A constituent is associated with the segmental material of the stem [ ]$_j$ and the string of segments [ər], associated with the syntactic label "affix". In the syntactic branch (the middle), the whole word is a noun, coindexed with the constituent in the phonological branch. The noun branches into a verb stem, coindexed with the empty segmental material, and an affix, coindexed with [ər]. Finally, the semantic branch on the right has its entirety (the agentive reading) coindexed with the noun/, while the verb stem is coindexed with the semantic placeholder PRED.

Since morphology typically deals with word construction, almost all literature on Construction Morphology (as opposed to Construction Grammar) deals with word-level morphology. Booij (2010) discusses some multi-word constructions, such as the case of complex numerals. These typically involve idiosyncratic semantics and regular phonology, but I propose that constructions can have the opposite as well, i.e. regular semantics and idiosyncratic phonology; the semantic branch of a schema is not privileged. Thus, for Dogon tonosyntax, we can create multiword constructions for DP modifiers in which the semantics are entirely regular but the phonological branch contains tonosyntactic overlays.

(26) Constructional schema for Dogon adjectival modifiers, as in "black cat"



The phonological branch shows ω_i (and other c-commanded words, represented by ...) associated to their regular segmental material [ ] and a {L} overlay, while the controller (ω_j) retains its lexical tone T. Importantly, this {L} overlay is morphologically tied to its trigger, shown here by coindexation with the adjective. The syntactic branch shows XP (material c-commanded by AdjP, which has received the features of Adj, including tone control, by

percolation) and ModP, containing the trigger, AdjP, in its specifier. The semantic branch has the regular semantics for an adjective. Constructions of this same format exist for all controllers in Tommo So, with their associated overlay ({L}, {H}, {HL}).

In this framework, the overlay is an idiosyncratic phonological property of a morphological construction, not the instantiation of a morphosyntactic feature or tonal morpheme unto itself. The output form is specified, with c-commanded words taking the overlay in place of their own lexical tone; this mirrors what I view to be a psychologically plausible learning process, whereby speakers learn what form words take in a particular context, as opposed to applying a two-step process of reduction plus association of a tonal morpheme (as is argued for Kalabari by Harry and Hyman 2014; see §5.2.2). However, the tonal overlay is grammatically associated with its trigger, through coindexation. As a result, we do find instances of reabsorption of the overlay by its controller (self-control) in those cases where it is blocked from applying to its desired targets. I will discuss this phenomenon further in §2.5.3.

2.5.2 Construction constraints

I combine the notion of morphological constructions with constraint-based approaches to morphology by interpreting constructional schemas as **construction constraints**. For example, the schema in (26) can be reinterpreted as the constraint X^{L} ADJ, which favors outputs in which words c-commanded by an adjective (=X) take a {L} overlay. I assume that a violation is assessed for every **word** that does not take the {L} overlay, since we never find cases of partially applied overlays, which would suggest that evaluation should be carried out at a syllabic or moraic level.

Following McCarthy and Prince (1993), Pater (2007), and others, I propose a universal constraint format that can take language-specific syntactic categories as its argument:

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

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 find 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*.

The specifics of the c-command construction 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 construction constraint for a numeral, since nowhere in the learning data did speakers experience tonal overlays associated with a numeral. Constructional schemas and their associated constraints are only learned based on evidence of idiosyncratic phonological/syntactic/semantic patterns. For Tommo So, we find the following set of construction constraints, corresponding to the examples in (4):

(28) Tommo So Construction Constraints

a. X^{L} ADJ: Words c-commanded by an adjective take {L}.

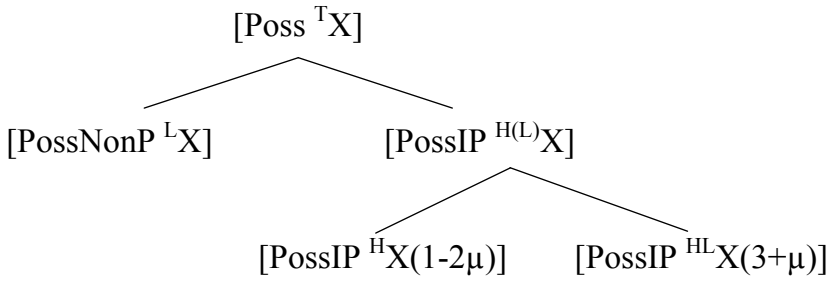
b. X^{L} DEM: Words c-commanded by a demonstrative take {L}.

c. POSS ^{T}X: Words c-commanded by a possessor impose a tonal overlay {T}.

Following Booij (2010), I assume a hierarchical strucure of the lexicon, with more general constructional schemas branching into more specific subschemas. Thus, a general construc-

tional schema [Poss ^{T}X] branches into subschemas for nonpronominal possessor and pronominal possessors. The inalienable pronominal branch[12] [PossIP $^{H(L)}$X] would itself branch into two subschemas, one for words with two moras (which take {H}) and one for words with three or more (which take {HL}). Such a hierarchy is presented in (29):

(29) Hierarchical structure of Tommo So possessive constructions



The question arises: Are all subschemas separate constraints, or only the top level (here, [Poss ^{T}X])? In principle, the most elegant answer would be that all constructional (sub)schemas are constraints, since each poses its own demands. However, subschemas should not be allowed too much freedom, since we never find a case in Dogon tonosyntax like PossIP ^{H}X(1-2μ) $\gg$ X^{L} Adj $\gg$ PossIP ^{HL}X(3+μ), where subschemas pattern differently with respect to other constructions. Though this could be an accidental gap, I suspect its absence is more principled.

If the strength of a constraint depended on its frequency of use, then this result might be expected: the most general schema will be called upon with greater frequency than any subschema, since the invocation of a subschema will necessarily also invoke the most general schema. But this result cannot be enforced in algorithms for weighting or ranking constraints. To approximate this situation, and to simplify the analysis of Tommo So and the other nine Dogon languages in Chapter 3, I include only the top level constraint in the grammar and

[12]Schemas for alienable pronominal possessors are assumed to be absent, or to be a special subschema with appositional syntax.

assume that all subschemas of this general constraint apply to forms meeting their structural descriptions. Thus, a form PossIP N(2μ) will violate Poss $^{\mathrm{T}}$X if the noun does not take a {H} overlay, while a form PossNonP N will violate it if the noun does not take {L}. Other cases of subcategorization and subschemas will be discussed in Chapter 3.

A simple tableau is given below showing the interaction between X$^{\mathrm{L}}$ Adj and general Faith for *gàmmà*^{L} *gɛ́m* 'black cat' in Tommo So. The precise identity of Faith (Ident-OO(T)) will be discussed in greater detail in §2.5.4. For the sake of illustration as in introducing the constraint-based analysis, I will use Optimality Theory with strict ranking:

(30)

Input: /gámmá gɛ́m/		X$^{\mathrm{L}}$ Adj	Faith
a.	gámmá gɛ́m	*!	
b. ☞	gàmmà$^{\mathrm{L}}$ gɛ́m		*

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

2.5.3 On the implementation of construction constraints

I make the following assumptions regarding the implementation of construction constraints:

(31) a. Controllers cannot "see" words they do not c-command; the only possible targets are c-commanded words (as per construction constraints) or themselves.

b. Tonal overlays are coindexed with their controller (i.e. $\{\mathrm{L}\}_{Dem}$ is distinct from $\{\mathrm{L}\}_{Adj}$).

c. A tonal overlay deletes both lexical **and** grammatical tones associated with a word (i.e. a word that has taken an overlay is stripped of its ability to control other words).

d. Two or more homophonous overlays can be realized on the same target, at the cost of a violation of UNIFORMITY (McCarthy and Prince 1995).

First, we can address (31a). Constructional schemas and their corresponding construction constraints state that overlays are applied to c-commanded words. In addition, by virtue of being coindexed with the controller (and hence being a part of it at an abstract level), I assume that overlays may also be reabsorbed by their controller. Any other words are effectively invisible to the controller and will not take the tonal overlay. Though it would be possible to make a constraint to this effect (e.g. *OUTOFBOUNDS), I will take this as a general assumption of that GEN does not generate any candidate in which overlays apply to any "invisible" words. To simplify the exposition, I leave consideration of candidates violating *SELFCONTROL to §2.5.5.

Claims (31b) and (31c) can be illustrated together. With regards to claim (31b), many of the more complicated patterns of tonal interaction are explained when homophonous overlays have hidden structure in the form of coindexation. Here, let us consider a simpler case like N Adj Dem, where both the adjective and the demonstrative seek to impose a {L} overlay on c-commanded words. The demonstrative c-commands both the noun and the adjective. By receiving the demonstrative's {L} overlay, the adjective loses both its lexical tone and its own {L} overlay, rendering its construction constraint X^{L} ADJ moot (since there is no longer a {L} to dock to c-commanded words). The surface form for this configuration is one in which the adjective loses its own overlay and the demonstrative's {L} applies to both the noun and the adjective. The following tableau for *{gàmmà gɛ̀m$_1$}^{L2} nɔ́$_2$* 'this black cat' illustrates this outcome. The adjective, *gɛ́m* 'black' is subscripted with 1, and its {L} overlay

is indicated L1. The demonstrative, *nɔ́* 'this', is subscripted with 2, and its {L} overlay is indicated L2:

(32) a. {N Adj$_1$}^{L2} Dem$_2$
{gàmmà gɛ̀m$_1$}^{L2} nɔ́$_2$
cat black this
'this black cat'

b.

Input: /gámmá gɛ́m$_1$ nɔ́$_2$/	X^L ADJ	X^L DEM	FAITH
a. ☞ {gàmmà gɛ̀m$_1$}^{L2} nɔ́$_2$			**
b. gàmmà^{L1} gɛ̀m$_1{}^{L2}$ nɔ́$_2$		*!	**
c. gàmmà^{L1} gɛ́m$_1$ nɔ́$_2$		*!*	*
d. gàmmà^{L2} gɛ́m$_1$ nɔ́$_2$	*!	*!	*
e. gámmá gɛ́m$_1$ nɔ́$_2$	*!	*!*	

The winning candidate in (32) is candidate (a), in which the demonstrative imposes its {L} overlay on both the noun and the adjective. X^L ADJ incurs no violations because the adjective's {L} overlay has been overwritten by the demonstrative. X^L DEM likewise incurs no violations, but this time because it has fully satisfied the construction by applying {L} to both c-commanded words. Low-ranked FAITH is violated twice, once for each word marked with {L}. Candidate (b) is not audibly distinct from candidate (a). It loses because L2 from the demonstrative has not applied to the noun, incurring one violation of X^L DEM; once again, X^L ADJ is fully satisfied because the adjective has taken an overlay (rendering its constraint moot).[13] Candidate (c) satisfies the adjective's constraint through overlay

[13]The application of L1 to the noun could be seen as a violation of a DEP constraint, penalizing the insertion of grammatical tones, since this form is not possible under assumption (31b) above. Alternatively, X^L DEM could assess a violation for the adjective in this form, since it does not delete its associated grammatical tone, and thus does not fully satisfy the demonstrative's overlay requirements.

application, but X^L DEM incurs two violations for each c-commanded word left uncontrolled. Candidate (d), homophonous with (c), imposes L2 on the noun, incurring one violation of X^L ADJ and one violation of X^L DEM, since the adjective is left uncontrolled. Fully faithful candidate (e) maximally violates both construction constraints.

The final assumption, (31d) above, is that under certain circumstances, two homophonous overlays can apply to the same target, but this violates UNIFORMITY (McCarthy and Prince 1995):

(33) UNIFORMITY: Assess a violation whenever any overlay in the output is coindexed with more than one controller in the input.

Thought of another way, the same surface {L} overlay can be tagged as exponing two separate underlying {L} overlays, similar to what Dyła (1984) proposes for Polish case syncretism. We can illustrate UNIFORMITY violations in a Tommo So PossANonP N Dem sequence, such as the following:

(34)

PossANonP$_1$	^{L1}N^{L2}	Dem$_2$
Sáná$_1$	^{L1}gàmmà^{L2}	nɔ́$_2$
Sana	cat	this

'this cat of Sana's'

Both the possessor and the demonstrative impose {L}. For reasons to be made clear in the next subsection, the demonstrative cannot control the tone of the possessor, despite c-commanding it. Since neither controller takes an overlay itself, both retain the ability to impose their overlays on c-commanded words.[14] Rather than letting one {L} take precedence

[14]This is in contrast to the N Adj Dem example in (32), where the only conceivable UNIFORMITY-violating candidate is N^{L12} Adj$_1$ Dem$_2$, which would be ruled out by a violation of X^L DEM since the adjective retains lexical tone; candidates like N^{L12} Adj^{L2} Dem are conceptually problematic, since by virtue of taking the demonstrative's {L2} overlay, the adjective would no longer have {L1} to impose on the N.

over the other, the two homophonous overlays coexist on the noun, tied to two different underlying sources. This choice is exemplified in the following tableau (omitting, for now, candidates in which the possessor takes the demonstrative's overlay):

(35)

Input: /Sáná$_1$ gámmá nɔ́$_2$/		Poss ^{TX}	X^L Dem	Uniformity	Faith
a. ☞	Sáná$_1$ ^{L1}gàmmà^{L2} nɔ́$_2$		*	*	*
b.	Sáná$_1$ ^{L1}gàmmà nɔ́$_2$		**!		*
c.	Sáná$_1$ gàmmà^{L2} nɔ́$_2$	*!	*		*
d.	Sáná$_1$ gámmá nɔ́$_2$	*!	**		

Candidate (a) violates Uniformity, since both L1 and L2 apply to the noun, but it incurs only a single violation of X^L Dem (for the possessor, which does not take the demonstrative's overlay). The noun in candidate (b) takes only L1, thus incurring two violations of X^L Dem; candidate (c) takes only L2, incurring one violation of PossNonP X^L and one of X^L Dem. Candidate (d), which is fully faithful, does not satisfy either of the construction constraints.

In Tommo So, the grammar could also be constructed such that candidate (b) or (c) is the winner (with Uniformity more highly ranked); the surface forms in the language are ambiguous as to which analysis is correct. We will see in Chapter 3 that in Nanga, winning candidates that violate Uniformity are crucial to the analysis.

2.5.4 Faithfulness and phases

Until now, I have referred to faithfulness as general Faith. Specifically, however, I argue that the Dogon data motivate an analysis using output-to-output faithfulness constraints in the Ident-OO family (McCarthy 1995, Benua 1997). General Faith in the tableaux above

can be replaced with IDENT-OO(T), which assesses a violation for any word that surfaces with tone other than that found in its isolation form. We will motivate this decision shortly.

General IDENT-OO(T) is rather low ranked; if it were not, overlays would not apply at all. However, consider the following with *bàbé* 'uncle':

(36) a. PossIP ^{H}N
mí ^{H}bábé
1SG.PRO uncle
'my uncle'

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'

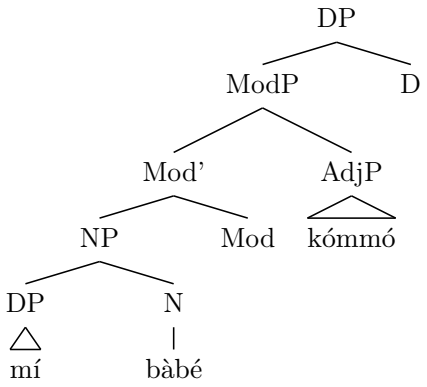
The tree in (16) shows that an adjective c-commands both the noun and its inalienable possessor (in the specifier of NP), but it only applies its overlay to the noun.

I argue that this greater faithfulness to possessors is not accidental. The only other place we see resistance to overlays in the Dogon languages is with relative clauses, the focus of Chapter 4. These two locations are consistent with a hypothesis of **phase-based faithfulness**, a form of cyclic spell out (Chomsky and Halle 1968, Bresnan 1971, Kiparsky 1985, Halle and Kenstowicz 1991, Odden 1993, Chomsky 1999, Pak 2008). As Pak (2008:11) notes, phase theory has been used by many researchers to deal with questions of phrasal phonological alternations (Seidl 2001, Dobashi 2004, Henderson 2005, Kahnemuyipour 2005, Cheng and Downing 2007, Kratzer and Selkirk 2007, Scheer 2008, among others). The basic

idea behind the theory is that certain functional projections, often vP, DP, and CP, 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).

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 **morphophonological material** of this "lexical compound" should be inalterable by other higher morphophonological demands.[15] I assume that once a phase has been spelled out, the phonological output of the phase 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':

(37)



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

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

X^{L} ADJ seeks to impose {L} on all c-commanded words: the head noun *bàbé* 'uncle' and the possessor DP *mí*.[16]

I suggest that because the possessive DP has been spelled out already as a phase, it is subject to an indexed faithfulness constraint, IDENT-OO/PHASE, capturing the idea that phases should ideally preserve the phonological form assigned to them in the previous cycle of spell-out. However, since constraints are violable, in some Dogon languages it is possible to undo what has been spelled out in an earlier phase. An interesting asymmetry we find in many languages is greater faithfulness to nonpronominal possessors than pronominal possessors. To account for this fact, I propose alongside general IDENT-OO(T)/PHASE a more specific IDENT-OO(T)/PHASE-LEX, for phases containing lexical material. The result is that unfaithfulness to phases with lexical material are doubly penalized.

When we look at phase-based faithfulness constraints, it becomes clear why output-to-output faithfulness must be used in place of input-to-output faithfulness: the possessive phrase, spelled out at an earlier level, may contain its own tonosyntactic overlays. Consider the following examples:

(38) a.

N^{L}	Adj=Def
àn-nà^{L}	póó=gɛ
male-HUM.SG	fat=DEF

'the fat man' (/àn-ná/)

b.

[N^{L}	Adj=Def]$_1$	$^{L1}N^{L2}$	Adj_2
[àn-nà^{L}	póó=gɛ]$_1$	^{L1}bàbè^{L2}	kómmó$_2$
male-HUM.SG	fat=DEF	uncle	skinny

'the fat man's skinny uncle'

[16]It is an open question whether morphophonology can see the internal structure of spelled out material or if it really is treated as a lexical compound, even from the standpoint of morphology and phonology.

(38a) shows a N Adj phrase in which the adjective imposes a {L} overlay on the noun. In (38b), this phrase acts as a possessor of 'uncle'. By virtue of being in an embedded DP, it is sent to spell-out first, where construction constraints apply and the adjective 'fat' imposes {L} on 'man'. This phrase 'the fat man' is then reinserted into the specifier of NP. When the next phase head is reached (at D) and the material below it is sent to spell-out, the modifying adjective 'skinny' c-commands both the noun and the possessor DP but is only able to control the tone of the noun due to phase-based faithfulness for the possessor. As we can see, it is not the underlying form of the possessor that surfaces *àn-ná póó=gɛ* but its output form from the previous cycle, including the {L} overlay imposed by the adjective *póó* 'fat'.

The work of IDENT-OO(T)/PHASE is illustrated in the following tableau of (38c), where general FAITH is replaced by IDENT-OO(T):

(39)

Input: /mí bàbé kómmó/	*SELFCONT	IDENT-OO(T)/PHASE	X^{L} ADJ	POSS ^{T}X	IDENT-OO(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. Note that because the possessor in this tableau is pronominal, only the general IDENT-OO(T)/PHASE constraint is required.

2.5.5 LOCALITY, *SELFCONTROL, and cumulativity

In this section, I point out an interesting theoretical consequence of the analysis, namely that even idealized non-stochastic outputs require that constraints be weighted to account for cumulativity effects.

Thus far in the analysis, I have only considered candidates in which c-commanded words take an overlay. Based on the assumption in (31a), however, controllers may also absorb their own tonal overlays in a process of **self-control**. By virtue of taking an overlay, the controller's construction constraint is rendered moot.[17] From the standpoint of the construction constraint, then, it is equally good to impose one's overlay on c-commanded words as it is to apply it to oneself. In Tommo So, though, as in nearly all Dogon languages, self-control is 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:

(40) *SELFCONTROL: Assign a violation to any controller that takes its own coindexed overlay.

This constraint can be thought of like Wolf's (2007) constraint against tautomorphemic docking of floating features NOTAUMORDOC. In Tommo So, this constraint is very powerful. Thus far in the analysis, *SELFCONTROL would be undominated in all tableaux, ruling out

[17] Admittedly, the self-control case is less natural than a case involving an overlay from another controller. In a case like $\{\text{N Adj}_1\}^{L2}$ Dem_2, the demonstrative's {L2} wipes out both the lexical tones and the {L1} overlay associated with the adjective. However, in a case $\text{N Adj}_1{}^{L1}$ Dem_2, the adjective's {L1} overlay would have to "wipe itself out" by undergoing self-control, despite the fact that the overlay is present in the output. Perhaps this problem could be more elegantly solved by viewing overlays as objects that must associate and proposing a constraint against bidirection association.

candidates like *gàmmà*^{L1} *gɛ́m*$_1$ *nɔ̀*$_2{}^{L2}$ 'this black cat' in tableau (32) or *Sáná*$_1$ ^{L1}*gàmmà nɔ̀*$_2{}^{L2}$ in tableau (35), where the demonstrative in each case takes its own overlay.

In reality, a controller does at times reabsorb its own overlay. Tommo So variably shows one such case, illustrated in (41a) with the other possible variant in (41b):

(41) a.

N	PossAP	Dem^{L}
gámmá	ḿmɔ	nɔ̀^{L}
cat	1SG.POSS	this

'this cat of mine'

b.

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

(=a)

Because *ḿmɔ* 'my' is a possessive DP, it is protected from the demonstrative's {L} overlay by phase-based faithfulness. This leaves two possible options: 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, a single violation of X^{L} DEM would not penalize this candidate to the extent that we find variation—something more is needed.

When we look across the Dogon language family, we find that overlays are almost always blocked when the targeted word is non-adjacent to the controller. I use the constraint LOCALITY, which penalizes forms in which a tonal domain is not **structurally** adjacent to its controller. This constraint can be though of as the structural equivalent of LINEARITY (McCarthy and Prince 1994). I define LOCALITY as follows:

(42) LOCALITY: Assess a violation whenever the surface domain of a tonal overlay is not structurally adjacent to its controller.

The form in (41b) violates LOCALITY because the demonstrative's overlay skips over an intervening PossP level[18] and applies to NP. The resulting form can be easily captured with strict OT ranking:

(43) *SELFCONTROL, IDENT-OO(T)/PHASE ≫ X^L DEM ≫ LOCALITY, IDENT-OO(T)

However, even if we set (41a) as the only possible outcome, constraint ranking is unable to create a grammar capable of capturing the data patterns. The problematic rankings involve X^L DEM and *SELFCONTROL. The following example and mini tableau shows that *SELFCONTROL must outrank X^L DEM:

[18]Or ApposP level, under the view that alienable pronominal possessors are appositives.

(44) a. PossIP_1 N^{L2} Adj_2
mí$_1$ bàbè$^{\text{L2}}$ nɔ́$_2$
1SG.PRO uncle this
'this uncle of mine'

b.

Input: /mí$_1$ bàbé nɔ́$_2$/	IDENT-OO(T)/PHASE	*SELFCONT	X^{L} DEM	POSS TX
a. ☞ mí$_1$ bàbè$^{\text{L2}}$ nɔ́$_2$			*	*
b. mí$_1$ bàbé nɔ́$_2$			**!	*
c. mí$_1$ $^{\text{H1}}$bábé nɔ́$_2$			**!	
d. mí$_1$ $^{\text{H1}}$bábé nɔ̀$_2{}^{\text{L}}$		*!		
e. {mì$_1$ bàbè}$^{\text{L2}}$ nɔ́	*!			

In this example, X^{L} DEM cannot be fully satisfied by applying {L} to all c-commanded words, since this would create a violation of phase-based faithfulness. The other way to fully satisfy the construction constraint would be for the demonstrative to reabsorb its own overlay, as in candidate (d); this would also allow the possessor to impose {H} on the possessed noun, thus satisfying both construction constraints. However, this form is blocked by high-ranked *SELFCONTROL.

Nevertheless, this same ranking predicts the wrong winner for the N PossAP Dem, assuming high-ranked LOCALITY that would rule out the form N^{L} PossAP Dem:

(45) a.

N	PossAP	Dem^{L}
gámmá	ḿmɔ	nɔ̀^{L}
cat	1SG.POSS	this

'this cat of mine'

b.

Input: /gámmá ḿmɔ nɔ́/	Locality	Ident-OO(T)/Phase	*SelfCont	X^{L} Dem
a. ☹ gámmá ḿmɔ nɔ̀^{L}			∗!	
b. ☞ gámmá ḿmɔ nɔ́				∗∗
c. $\{\text{gàmmà m̀mɔ̀}\}^{\text{L}}$ nɔ́		∗!		
d. gàmmà^{L} ḿmɔ nɔ́	∗!			∗

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

The assertion that no constraint ranking can generate candidate (a) in the last tableau in the context of the rest of the grammar was confirmed algorithmically; the Recursive Constraint Demotion algorithm (Tesar and Smolensky 1993) in the OTSoft software package (Hayes, Tesar, and Zuraw 2013) is unable to find a ranking that fits the data. This is because the outcome in (45a) is the result of constraint **cumulativity**, where the combined penalty of more than one violation of lower weighted constraints can outweigh a single violation of a more heavily weighted constraint. The existence of cumulativity effects even under idealized conditions lends support to constraint weighting rather than ranking.

The framework I employ here is Harmonic Grammar (Legendre et al. 1990), which has two main varieties capable of treating stochastic effects: Noisy Harmonic Grammar (Boersma and Pater 2008) and Maximum Entropy (maxent) Grammar (Goldwater and Johnson 2003, Wilson 2006, Hayes and Wilson 2008). Here, I use maxent, though the two frameworks predict largely the same results. In this theory, constraints are weighted, and candidates

receive a "harmony score" (also called "penalty" or simply "score") equal to the sum of its constraint violations multiplied by the constraint weights. To give a simple example, consider the following maxent mini tableau:

(46)

/bab/	p	score	*[+VOI]# 27	IDENT(VOICE) 13
a. bap	∼1	13		1
b. bab	∼0	27	1	
c. pap	∼0	26		2

This tableau illustrates a simple final devoicing situation. Candidate (a) violates IDENT(VOICE) alone. Since this constraint has a weight of 13, 13x1 yields a harmony score of 13 for candidate (a). Candidate (b) incurs one violation of *[VOI]#, with a weight of 27, yielding a harmony score of 27. Candidate (c) incurs two violations of IDENT(VOI), for a harmony score of 26.

Rather than yielding a winner, maxent yields a predicted probability for each candidate. First, the "harmony" score ($\mathcal{H}$) of each candidate is calculated by summing the violations of each constraint multiplied by constraint weight:

(47) $$\mathcal{H}(\text{x}) = \sum_{i=1}^{n} w_i C_i(\text{x})$$

Here, C_i(x) indicates the number of times that a candidate x violates the i^{th} constrainst, w_i is the weight of the i^{th} constraint, and $\sum_{i=1}^{n}$ is equal to summation across all constraints (1, 2, 3... N). Next, the probability of a given candidate is calculated with the following formula:

(48) $\text{p(x)} = \frac{1}{Z} e^{-\mathcal{H}}$, where $\text{Z} = \sum e^{-\mathcal{H}}$ for all candidates in the tableau.

In the basic tableau above, the probability for candidate (a) is calculated by taking e^{-13} (candidate (a)'s harmony score), then multiplying this number by $1/(e^{-13} + e^{-27} + e^{-26})$; this yields a probability of ∼1. The correct weights in a maxent grammar (here, 27 and 13) are fitted to the data by standard algorithms running in publicly available software.[19]

Cumulativity effects for a N PossAP Dem sequence in Tommo So are illustrated by the following maxent tableau:

(49)

/N PossAP Dem/	*p*	*Score*	Id(T) 7	Id(T)/Ph-Lex 1.9	Id(T)/Ph 38.5	X^L Dem 25.1	*SelfCont 37	Linearity 19.7
a. N PossAP Dem^L	1	44	1	0	0	0	1	0
b. N PossAP Dem	0	50.2	0	0	0	2	0	0
c. N^L PossAP Dem	0	51.9	1	0	0	1	0	1
d. {N PossAP}^{L} Dem	0	54.3	2	1	1	0	0	0
e. N^L PossAP Dem^L	0	70.8	2	0	0	0	1	1
f. {N PossAP Dem}^{L}	0	98.3	3	1	1	0	1	0

Jäger and Rosenbach (2006) distinguish between two types of cumulativity: **counting cumulativity**, where two or more violations of a weaker constraint overpower a single violation of a stronger constraint, and **ganging-up cumulativity**, where violations of more than one weaker constraint overpower a stronger constraint. We find evidence for both kinds of cumulativity in this example. Looking at the tableau in (49), candidate (b) loses to candidate (a) (more precisely, receives a vastly lower probability) due to counting cumulativity. Two violations of weaker X^L Dem for candidate (b) add up to a greater penalty than one violation

[19]Here and elsewhere I have used the Maxent Grammar Tool software (Wilson, Hayes and George 2008) to arrive at constraint weights. This software uses the same input files as OTSoft, but the file may include observed frequencies of output candidates rather than a categorical 1 (winner) or 0 (loser).

of *SelfControl. Candidate (c) is similar in penalty score to candidate (b), but in this case, it loses to candidate (a) due to ganging-up cumulativity: violations of X^L Dem and Linearity together add up to a greater penalty than one violation of the stronger constraint *SelfControl.

These constraint weights are fitted to idealized data, with only one winner, (41a), for the input N PossAP Dem. In the next section, I will present the set of weights that accurately accounts for Tommo So tonosyntactic patterns, including cases of variation.

2.6 The full analysis

By this point we have established all of the elements needed for a full analysis of Tommo So tonosyntax. In §2.4, I presented evidence for the three main requirements of our theory: the need for syntactic category, syntactic structure, and constraint interaction in the analysis of tonal overlays. The preceding subsections of §2.5 fleshed out a constraint-based theory built on a foundation of morphological constructions and showed that a Harmonic Grammar framework, such as maxent grammar, is better equipped to deal with the data patterns.

2.6.1 Constraints and weights

To implement the analysis, I 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 maxent grammar tool, which fitted the constraints with weights. The full set of constraints and weights for Tommo So is given in (50):[20]

[20]These weights were calculated from an input containing basic relative clause data and the constraint X^L Rel, which receives a weight of 16.5. I will discuss relative clauses further and incorporate cases of competition with possession in calculating constraint weights in Chapter 4.

(50)

Constraint	*Weight*
IDENT-OO(T)	7.8
IDENT-OO(T)/PHASE-LEX	2.2
IDENT-OO(T)/PHASE	42.9
POSS ^{T}X	15.3
X^{L} ADJ	22.9
X^{L} DEM	27.6
*SELF-CONTROL	41.8
UNIFORMITY	7.5
LOCALITY	14.6

These weights give us information about Tommo So's tonosyntactic grammar. First, IDENT-OO(T)/PHASE-LEX, the more specific version of IDENT-OO(T)/PHASE, has a weight of only 2.7, near zero compared to all of the other constraint weights. This tells us that phases with lexical material are treated no differently than phases without; in other words, non-pronominal and pronominal possessors are equally faithful. The large weight of IDENT-OO(T)/PHASE translates into undominated status: a possessor is **never** subject to tonosyntactic control.[21]

However, a large weight does not always mean that the constraint is undominated; as we have seen, a winning candidate can violate *SELFCONTROL so long as the cumulative score of weaker constraints outweighs this violation. Nonetheless, since the weight is so large, it takes exceptional cases for a controller to absorb its own overlay.

IDENT-OO(T) has the smallest weight of any "active" constraint (IDENT-OO(T)/PHASE-LEX being so weak that it can be removed from the grammar with little to no effect).[22] The sole duty of this general faithfulness constraint is to militate against unmotivated tonal

[21]I have found one case of overlays applying to possessors in Tommo So, and that is when a possessive NP is head of a relative clause. See §4.5.3 for further discussion.

[22]Nevertheless, it would outweigh markedness constraints such as *H or *L and forces words to surface with their citation forms when not motivated to do otherwise by a construction constraint.

changes; whenever a tonal overlay is actively demanded by another constraint with a larger weight (e.g. X^{L} ADJ), IDENT-OO(T) acquiesces and the overlay is applied. The situation is similar for UNIFORMITY; its small weight makes it such that if conditions are right to apply two overlays to the same target (the two are homophonous and both controllers have lexical tone), then UNIFORMITY may be violated.[23]

In the following subsections, I give sample tableaux for cases with one, two, and three controllers, respectively.

2.6.2 One controller

Thus far, we have seen OT tableaux for cases of a single controller combined with a noun. Here, I show how these simplest cases of tonosyntax can be accounted for with weighted constraints.

First, consider the simple case of a noun with an inalienable pronominal possessor. Since construction constraints all outweigh general IDENT-OO(T), the pronominal possessor is able to impose {H}:

[23]If we remove UNIFORMITY from the model, maxent predicts 50/50 probabilities for forms like PossNonP ^{L1}N^{L2} ^{L1}Adj and PossNonP ^{L1}{N Adj}, where it has been trained on a probability of 1 for the latter. The former is conceptually problematic, since an adjective controlled with L1 should have no L2 to assign to the noun. With a constraint militating against spurious overlays, the grammar should have no problem. UNIFORMITY is especially required by Nanga, discussed in the next chapter, and I have included it for Tommo So for the sake of consistency.

(51) a. PossIP $^{H(L)}$N
mí ^{H}bábé
1SG.PRO uncle
'my uncle'

b.

/mí bàbé/	*p* Obs	*p* Pred	*Score*	ID(T) 7.8	ID(T)/PH 42.9	POSS ^{T}X 15.3	*SELFCONT 41.8
a. mí ^{H}bábé	1	∼1	7.8	1	0	0	0
b. mí bàbé	0	∼0	15.3	0	0	1	0
c. ^{H}mí bàbé	0	∼0	92.5	1	1	0	1

Candidate (a) wins, which satisfies POSS ^{T}X by applying a {H} overlay to the possessed noun. This incurs one violation of IDENT-OO(T), but since this faithfulness constraint has a smaller weight than POSS ^{T}X (violated by fully faithful candidate b), candidate (a) ends up with the smallest penalty score. Candidate (c) satisfies POSS ^{T}X by self-control, which earns it not only a violation of *SELFCONTROL but also a violation of phase-based faithfulness, since the controller in this case is a possessor.

A similar situation holds when the single controller is non-possessive, like an adjective. Because X^{L} ADJ outweighs IDENT-OO(T), the {L} overlay applies to the noun. Self-control incurs a violation of *SELFCONTROL, but not of phase-based faithfulness, since the controller is not a possessor:

(52) a. N^{L} Adj
bàbè^{L} kómmó
uncle skinny
'skinny uncle'

b.

/bàbé kómmó/	*p* Obs	*p* Pred	*Score*	Id(T) 7.8	X^L Adj 22.9	*SelfCont 41.8
a. bàbè^L kómmó	1	∼1	7.8	1	0	0
b. bàbé kómmó	0	∼0	22.9	0	1	0
c. bàbé kòmmò^L	0	∼0	49.6	1	0	1

Candidate (a) has the lowest penalty score (7.8). With the equation in (48), it is predicted to have a probability of nearly 1, compared to candidates (b) and (c) with much larger weights.

This model can also handle cases with one controller but two possible targets, as in a N Num Dem sequence, where Dem seeks to impose {L}:

(53) a. {N Num}^{L} Dem
{bàbè nèè-gò}^{L} nɔ=mbé
uncle two-ADV this=PL
'these two uncles'

b.

/bàbé néé-go nɔ=mbé/	*p* Obs	*p* Pred	*Score*	Id(T) 7.8	X^L Dem 27.6	*SelfCont 41.8	Locality 14.6
a. {bàbè nèè-gò}^{L} nɔ=mbé	1	∼1	15.6	2	0	0	0
b. bàbé nèè-gò^L nɔ=mbé	0	∼0	35.4	1	1	0	0
c. bàbé néé-go nɔ^L=mbe	0	∼0	47.7	1	0	1	0
d. bàbè^L néé-gó nɔ=mbé	0	∼0	49.6	1	1	0	1
e. bàbé néé-go nɔ=mbé	0	∼0	55.2	0	2	0	0

The winning candidate (a) sees the demonstrative's {L} overlay imposed on both c-commanded words, N and Num. Applying only to the numeral, as in candidate (b), incurs a violation of X^L DEM, while applying it only to the noun, as in candidate (d), incurs both a violation of X^L DEM as well as a violation of LOCALITY (for skipping over the numeral). Candidate (c) contains self-control, adding 41.8 to the penalty score. Finally, fully faithful candidate (e) maximally violates X^L Dem, yielding a total penalty score of 55.2.

If the numeral were not c-commanded by the controller, as in a configuration like N Adj Num, then it would not take an overlay. Since doing so would not satisfy the adjective's construction constraint, it would just incur a spurious violation of IDENT-OO(T) and be harmonically bounded by the form N^L Adj Num.

Finally, the most interesting case with one controller is the configuration N PossAP Dem, which has the variable outputs N^L PossAP Dem and N PossAP Dem^L. In (49), I showed how maxent could account for an idealized set of data in which only the latter output form is attested. There, the weight of LOCALITY was very high to rule out the form N^L PossAP Dem. When we train the model on these variable data, we notice that the weight of LOCALITY comes down considerably. The other constraint weights remain more or less the same.

(54) a. N^L PossAP Dem ∼ N PossAP Dem^L
gàmmà^L ḿmɔ nɔ́ ∼ gámmá ḿmɔ nɔ̀^{L}
cat 1SG.POSS this
'this cat of mine'

b. *Tableau for N^L PossAP Dem ∼ N PossAP Dem^L*

/gámmá ḿmɔ nɔ́/	*p* Obs	*p* Pred	*Score*	Id(T) 7.8	Id(T)/Ph-Lex 2.2	Id(T)/Ph 42.9	X^L Dem 27.6	*SelfCont 41.8	Locality 14.6
a. gámmá ḿmɔ nɔ̀^{L}	.6	∼.6	49.6	1	0	0	0	1	0
b. gàmmà^L ḿmɔ nɔ́	.4	∼.4	50	1	0	0	1	0	1
c. gámmá ḿmɔ nɔ́	0	∼0	55.2	0	0	0	2	0	0
d. {gàmmà m̀mɔ̀}^{L} nɔ́	0	∼0	60.7	2	1	1	0	0	0
e. gàmmà^L ḿmɔ nɔ̀^{L}	0	∼0	72	2	0	0	0	1	1
f. {gàmmà m̀mɔ̀ nɔ̀}^{L}	0	∼0	110.3	3	1	1	0	1	0

Candidates (a) and (b) are very close to one another in weight, which translates into non-zero probability for each form. The model was trained on a probability of 0.6 for candidate (a) and 0.4 for candidate (b), and as we can see, maxent matches these frequencies quite well (predicted frequencies: 0.597 and 0.400). Once again, the balance between these two candidates arises since the combined weights of X^L Dem and Locality (42.2) is almost equal to the weight of a single violation of *SelfControl (41.8). Just like in the idealized scenario in (49), candidate (c) is ruled out due to counting cumulativity. Candidates (d) and (f) each violate the strongest constraint, Ident-OO(T)/Phase as well as Locality; the combined penalty score of these two violations alone outweighs the total penalty for the winning candidates. Candidate (e), on the other hand, is harmonically bounded by candidate (a), which has a proper subset of candidate (e)'s violations.

2.6.3 Two controllers

When only a single controller is present, constraint conflicts are typically between faithfulness and the controller's construction constraint. If we add a second controller, we also find conflicts between construction constraints. If all were equally weighted (and in the absence of phase-based faithfulness), we would find that the highest controller in the syntactic tree would win, since it c-commands the most words and thus can rack up the highest number of violations. However, if a lower controller's construction constraint has a larger weight, it can overpower a syntactically higher controller. In Tommo So, this is rarely the case; the only known case of a lower controller having unique control over a higher controller involves relative clauses and will be discussed in Chapter 4. In a number of cases, though, I analyze a single overlay as being linked to more than one controller in violation of UNIFORMITY.

We can first examine a configuration involving non-homophonous overlays: PossIP N Adj, where the possessor seeks to impose {H(L)} and the adjective {L}. As we have seen, this surfaces in Tommo So as PossIP N^{L} Adj; the higher controller (the adjective) takes precedence over the possessor:

(55) a.

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

'my skinny uncle'

b. *Tableau for PossIP N^L Adj*

/mí$_1$ bàbé kómmó$_2$/	*p* Obs	*p* Pred	*Score*	Id(T) 7.8	Id(T)/Ph 42.9	Poss ^{T}X 15.3	X^L Adj 22.9	*SelfCont 41.8	Uniformity 7.5	Locality 14.6
a. mí$_1$ bàbè^{L2} kómmó$_2$	1	∼ 1	46	1	0	1	1	0	0	0
b. mí$_1$ ^{H1}bábé kómmó$_2$	0	∼0	53.6	1	0	0	2	0	0	0
c. mí$_1$ ^{H1}bábé kòmmò$_2{}^{L2}$	0	∼0	57.4	2	0	0	0	1	0	0
d. {mì$_1$ bàbè}^{L2} kómmó$_2$	0	∼0	58.5	2	1	0	0	0	0	0
e. mí$_1$ bàbé kómmó$_2$	0	∼0	61.1	0	0	1	2	0	0	0
f. mì$_1{}^{L2}$ ^{H1}bábé kómmó$_2$	0	∼0	96	2	1	0	1	0	0	1
g. {mì$_1$ bàbè kòmmò$_2$}^{L2}	0	∼0	108.1	3	1	0	0	1	0	0
h. ^{H1}mí$_1$ bàbè^{L2} kómmó$_2$	0	∼0	123.2	2	1	0	1	1	0	0
i. ^{HL1}{mí$_1$ bàbè^{L2}} kómmó$_2$	0	∼0	130.7	2	1	0	1	1	1	0
j. ^{HL1}{mí$_1$ bàbè} kómmó$_2$	0	∼0	146.1	2	1	0	2	1	0	0

The inalienable possessor has as its target only the noun; the adjective has both the noun and the possessor. If the adjective were to be fully satisfied, it would incur a violation of phase-based faithfulness, as in candidate (d), resulting in a higher penalty score. Both candidates (a) and (b) show overlays applying only to the noun, from the adjective in (a) and the possessor in (b). Applying the adjective's {L} overlay results in one violation of the possessor's construction constraint and one violation of the adjective's construction constraint (for the uncontrolled possessor), while applying the possessor's overlay results in two violations of the adjective's construction constraint. If the two were weighted equally, it would result in a tie. Instead, the lower weight of the possessor's construction constraint gives candidate (a) a lower penalty score, allowing it to surface as the winner. Candidates with self-control are ruled out (c, g-j), since the combined weights of *SelfControl and

IDENT-OO(T) result in a score higher than that of winning candidate (a). Fully faithful candidate (e) is ruled out from two violations of X^{L} ADJ combined with a violation of POSSIP $^{H(L)}X$. Candidate (f) suffers from a combination of a LOCALITY violation (the adjective skips the noun and applies {L} to the possessor), as well as a violation of phase-based faithfulness.

When the competing overlays are homophonous, it becomes more difficult to determine which controller is responsible. Based on the assumptions in §2.5.3, I assert that when only one controller retains lexical tone, it is this controller that is responsible for the {L} overlay; when more than one retain lexical tone, the overlays in the resulting form are multiply indexed in violation of UNIFORMITY.

For a case of the former, we can re-envisage tableau (32), for the output form $\{N\ Adj_1\}^{L2}$ Dem_2 in maxent:

(56) a. {N Adj$_1$}^{L2} Dem$_2$
{gàmmà gɛ̀m$_1$}^{L2} nɔ́$_2$
cat black this
'this black cat'

b. *Tableau for {N Adj}^{L} Dem*

/gámmá gɛ́m$_1$ nɔ́$_2$/	*p* Obs	*p* Pred	*Score*	Id(T) 7.8	X^{L} Adj 22.9	X^{L} Dem 27.6	*SelfCont 41.8	Uniformity 7.5	Locality 14.6
a. {gàmmà gɛ̀m$_1$}^{L2} nɔ́$_2$	1	~ 1	15.6	2	0	0	0	0	0
b. {gàmmà^{L1} gɛ̀m$_1$}^{L2} nɔ́$_2$	0	~0	23.1	2	0	0	0	1	0
c. gámmá gɛ̀m$_1{}^{L2}$ nɔ́$_2$	0	~0	35.4	1	0	1	0	0	0
d. gàmmà^{L12} gɛ́m$_1$ nɔ́$_2$	0	~0	42.9	1	0	1	0	1	0
e. gàmmà^{L1} gɛ̀m$_1{}^{L2}$ nɔ́$_2$	0	~0	43.2	2	0	1	0	0	0
f. gàmmà^{L1} gɛ́m$_1$ nɔ̀$_2{}^{L2}$	0	~0	57.4	2	0	0	1	0	0
g. gàmmà^{L1} gɛ́m$_1$ nɔ́$_2$	0	~0	63	1	0	2	0	0	0
h. gàmmà^{L2} gɛ́m$_1$ nɔ́$_2$	0	~0	72.9	1	1	1	0	0	1
i. gámmá gɛ́m$_1$ nɔ́$_2$	0	~0	78.1	0	1	2	0	0	0

Candidate (a) is the winner, in which the demonstrative's {L2} overlay is applied to both the noun and the adjective. Though candidate (b) is close in weight in this tableau, it is conceptually problematic, since the adjective would have no {L1} overlay to apply; the same applies to candidate (e). Candidates (c) and (h) include a {L2} overlay on only one of the demonstrative's c-commanded words. However, candidate (h) is substantially worse because it violates Locality while at the same time incurring a violation of X^{L} Adj, since the adjective has its lexical tone but has not imposed its overlay on the noun. Candidate (d) likewise incurs one violation of X^{L} Dem, but the adjective's constraint is satisfied since the {L} overlay on the noun is doubly indexed to both the adjective and demonstrative. Unlike

the next case with a possessor, however, this candidate loses because it still incurs a violation of X^{L} Dem and there is a viable candidate that fully satisfies this constraint (candidate a). In candidate (g), the demonstrative's {L} is not realized at all, and these two violations of X^{L} Dem add a great deal to the penalty score; fully faithful candidate (i) maximally violates both construction constraints. Finally, candidate (f) satisfies X^{L} Dem but at the cost of *SelfControl.

When the competition is between a possessive controller and a non-possessive that c-commands the possessor, the winning candidate is one in which the surface {L} is doubly indexed on the noun. This is because both controllers retain lexical tone: the possessive controller due to phase-based faithfulness and the non-possessive controller since it is not c-commanded by the controller. With their lexical tones in place, each controller's overlay remains active (unlike the adjective in (56), which had its tone replaced by the demonstrative). Consider the following example with a non-pronominal inalienable possessor and a c-commanding adjective:

(57) a. PossINonP$_1$ ^{L1}N^{L2} Adj$_2$
Sáná$_1$ ^{L1}bàbè^{L2} kómmó$_2$
Sana uncle skinny
'Sana's skinny uncle'

b. *Tableau for PossINonP $^{L1}N^{L2}$Adj*

/Sáná$_1$ bàbé kómmó$_2$/	*p* Obs	*p* Pred	*Score*	Id(T) 7.8	Id(T)/Ph 42.9	Id(T)/Ph-Lex 2.2	Poss ^{T}X 15.3	X^{L} Adj 22.9	*SelfCont 41.8	Uniformity 7.5	Locality 14.6
a. Sáná$_1$ ^{L1}bàbè^{L2} kómmó$_2$	1	∼ 1	38.2	1	0	0	0	1	0	1	0
b. Sáná$_1$ bàbè^{L2} kómmó$_2$	0	∼0	46	1	0	0	1	1	0	0	0
c. Sáná$_1$ ^{L1}bàbè kómmó$_2$	0	∼0	53.6	1	0	0	0	2	0	0	0
d. Sáná$_1$ ^{L1}bàbè kòmmò$_2$^{L2}	0	∼0	57.4	2	0	0	0	0	1	0	0
e. {Sànà$_1$ bàbè}^{L2} kómmó$_2$	0	∼0	60.7	2	1	1	0	0	0	0	0
f. Sáná$_1$ bàbé kómmó$_2$	0	∼0	61.1	0	0	0	1	2	0	0	0
g. Sànà$_1$^{L2} ^{L1}bàbè kómmó$_2$	0	∼0	98.2	2	1	1	0	1	0	0	1
h. {Sànà$_1$ ^{L1}bàbè}^{L2} kómmó$_2$	0	∼0	110	2	1	1	0	0	1	1	0
i. ^{L1}Sànà$_1$ bàbè^{L2} kómmó$_2$	0	∼0	125.4	2	1	1	0	1	1	0	0
j. ^{L1}{Sànà$_1$ bàbè} kómmó$_2$	0	∼0	148.3	2	1	1	0	2	1	0	0
k. ^{L1}{Sànà$_1$ bàbè} kòmmò$_2$^{L2}	0	∼0	152.1	3	1	1	0	0	2	0	0
l. {^{L1}{Sànà$_1$ bàbè} kòmmò$_2$}^{L2}	0	∼0	167.1	3	1	1	0	0	2	2	0

Phase-based faithfulness rules out any candidate in which the possessor takes an overlay, either from the adjective or from self-control (candidates e, g-l). *SelfControl likewise rules out candidates in which the adjective takes its own overlay (d, k-l). This means that the winning candidate will see both controllers with their lexical tone, which leaves both construction constraints (Poss ^{T}X and X^{L} Adj) active. Fully faithful candidate (f) maximally violates both. Candidates (b) and (c) apply only the adjective's overlay and only

the possessor's overlay, respectively. The latter is worse, since two violations of X^L ADJ outweigh the combination of a single violation of each construction constraint. The winning candidate (a) has the {L} overlay on the noun doubly indexed to both the possessor and the adjective, resulting in only a single violation of X^L ADJ (for the uncontrolled possessor). This violates UNIFORMITY, but since this constraint's weight is smaller than the weights of either construction constraint, candidate (a) ends up with the lowest penalty score and is chosen as the winner.

2.6.4 Three controllers

A grammar 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 (58):

(58) a. PossANonP$_1$ ^{L1}{N Adj$_2$}^{L3} Dem$_3$
Sáná$_1$ ^{L1}{gàmmà gɛ̀m$_2$}^{L3} nɔ́$_3$
Sana cat black this
'this black cat of Sana's'

b. PossINonP$_1$ {^{L1}{N} Adj$_2$}^{L3} Dem$_3$
Sáná$_1$ {^{L1}{bàbè} kòmmò$_2$}^{L3} nɔ́$_3$
Sana uncle skinny this
'this skinny uncle of Sana's'

c. PossIP$_1$ {N Adj$_2$}^{L3} Dem$_3$
mí$_1$ {bàbè kòmmò$_2$}^{L3} nɔ́$_3$
1SG.PRO uncle skinny this
'this skinny uncle of mine'

The example in (58a) involves an alienable non-pronominal possessor, which c-commands both the noun and adjective, imposing {L}. The demonstrative c-commands the noun, adjective, and possessor, but the latter is protected by phase-based faithfulness. Because the two overlays are homophonous, the noun and adjective can take both simultaneously, in violation of UNIFORMITY. The adjective's {L} overlay is suppressed by higher tone control from both the possessor and the demonstrative.

In (58b), 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 audibly non-distinct from that of (58a), but only the noun is co-indexed with both the possessor and the demonstrative. The adjective's construction constraint continues to be rendered moot by the application of the higher {L} overlay from the demonstrative.

Finally, in (58c), the inalienable pronominal possessor seeks to impose {H} on the possessed noun, but because this cannot co-exist with the demonstrative's {L} overlay by violating UNIFORMITY, it goes unrealized. The larger weight of X^{L} DEM relative to $POSS^{T}X$ justifies the suppression of the possessor's overlay.

For tableaux illustrating these cases, see the complete output of the maxent grammar in Appendix A.

2.7 The development of tonosyntax

Now that we have seen the modern state of tonosyntactic patterns, I will address two issues related to its development in Tommo So and the other Dogon languages. First, I will revisit the controller vs. non-controller distinction, suggesting semantic principles that may either be or have been at its core. Next, I sketch out a diachronic path from regular phrasal phonology to the system we see today.

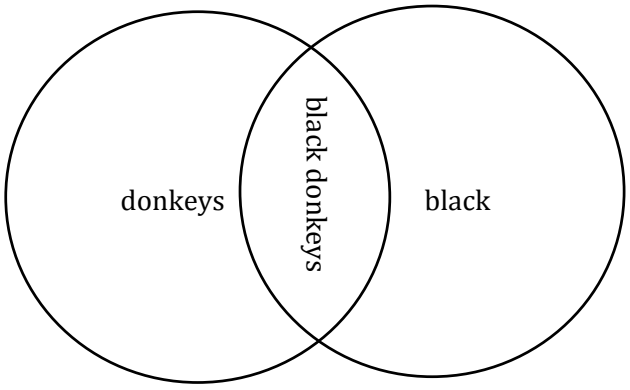
2.7.1 Reference restriction: a semantic explanation

In Heath and McPherson (2013), we argue that controllers form a natural class: They are **reference restrictors** in a set theoretic sense. We state our claim as follows (Heath and McPherson 2013:276):

(59) Reference restriction is the basis for tonosyntactic control

NP-internal modifiers that belong to stem-classes or to syntactic or functional categories that include and exclude specific individuals of a reference set, and no other modifiers, control tone overlays on (at least) the noun.

Take, for example, adjectives. A common noun like "donkey" indicates an open set including all donkeys, while a noun modified by an adjective, like "black donkeys", restricts this set to a smaller subset including all donkeys that are black in color while excluding donkeys of any other color. "Young donkeys" excludes middle-aged or old donkeys, "pretty donkeys" excludes average or ugly donkeys, etc. This can be represented by the Venn diagram below:



(60)

The other controllers similarly restrict reference. Possessive phrases like "my donkeys" or "the mayor's donkeys" bifurcate the open set "donkey" into those belonging to the possessor

and all others. Relative clauses, like "the donkey that went on a rampage", refer to specific donkeys (the one(s) that rampaged, here most likely a specific donkey in the discourse), while deictic demonstratives like "this" or "that" pick out a particular donkey to the exclusion of others.

The non-controllers do not form a natural class in and of themselves but rather are the residue left over once reference restrictors have been picked out. Consider first the plural. "Donkeys" could denote the set of all possible donkeys; it does nothing to break the open set "donkey" down into specific subsets. The universal quantifier 'all' works in a similar fashion, though it is explicit in the fact that it excludes no donkeys. Another modifier, like "all black donkeys" or "all donkeys with a broken leg", would be required to restrict the reference of the set 'donkey'. Numerals are a little trickier. While a phrase like "three donkeys" cannot contain all donkeys, it does not explicitly exclude any donkeys either; each and every donkey has an equal chance of being one of the three. Therefore we do not consider it to be a reference restrictor, and consequently it is not a tone controller in the Dogon languages.

Further support for our reference restriction analysis comes when we look at so-called "borderline" cases (Heath and McPherson 2013:279). These are, in particular, the numeral 'one' and the definite determiner. Both of these elements receive variable treatment in Dogon, with some languages treating one or the other as a controller and others grouping them with non-controllers.

First, in many languages, including Tommo So, the numeral 'one' acts as a tone controller while numerals two and above do not.[24] For instance, we find data like the following:

[24]Differentiation of 'one' and other numerals is attested in other African languages, such as Kalabari and Igbo, where 'one' is treated as a N (Larry Hyman, p.c.). Such an analysis could be proposed for Dogon as well, with N 'one' forming a N+N compound (which involves a {L} overlay on the initial noun stem), or the numeral 'one' could be treated morphologically as an adjective (which also imposes {L} on a noun stem), as argued in §2.4.1 above.

(61)

a.	jàndùlù^{L} túmɔ́	'one donkey'	/jàndúlu/	(Tommo So)
	gàmmà^{L} túmɔ́	'one cat'	/gámmá/	(Tommo So)
b.	jàndúlu néé	'two donkeys'		(Tommo So)
	gámmá néé	'two cats'		(Tommo So)

The examples in (61a) show that both a /LH/ noun 'donkey' and a /H/ noun 'cat' take a {L} overlay with the numeral 'one', while the same nouns in (61b) retain their lexical tones. Ben Tey and Nanga work similarly in distinguishing 'one', a controller, from two and above, non-controllers. Other languages, like Yorno So, treat 'one' like any other numeral, which cause no tonal changes on the noun:

(62) péjú túrú (Yorno So)
sheep one
'one sheep'

While this sort of variation is interesting on its own, more informative are those languages that actually have two separate 'one' forms, one that controls tone and one that does not. Languages that behave in this way include Najamba, Jamsay, and Togo Kan. In general in the Dogon languages, the word for 'one' can be derived from one of two cognate sets, which we abbreviate as *TUNX (cf. Tommo So *túmɔ́*, Togo Kan *túnɔ́*, Ben Tey *tùw^{n}ɔ́*, etc.) and *TURU (cf. Tommo So *túru*[25], Jamsay *túrú*, Togo Kan *túrú*, etc.). Generally speaking, *TURU probably began its life with more of a cardinality function, like other numerals, and not surprisingly most of its modern day reflexes are not controllers. *TUNX, on the other hand, most likely had its origin in pragmatic functions like 'a single', 'only', etc., and as such, its modern day reflexes are more likely to be controllers.

[25]This form is only found in composite numbers, like *pɛ́lu-go túru-go sígɛ́* '11' (literally 'one more than ten'). It is never used on its own to mean 'one'.

The languages with modern reflexes of both 'one' forms help shed light on this analysis. Take, for example, Togo Kan. In Togo Kan, we find the *TURU reflex *túrú*, which has a regular cardinality function; it is the most natural form used in response to questions like 'how many'. The cardinality function of 'one' acts like other numerals with respect to reference restriction. Saying 'one donkey' or 'one sheep' does not exclude any members of the open set 'donkey' or 'sheep' from being designated as the animal in question. Hence is comes as no surprise that this 'one' form is not a controller:

(63) péjú túrú (Togo Kan)
sheep one
'one sheep'

Here, both 'sheep' and 'one' retain lexical tone.

Togo Kan also has a *TUNX reflex, *túnɔ́*, used primarily to introduce actors in a discourse ("After that, a certain sheep walked into the courtyard.") The discourse function implies that there is a particular sheep in question, and all members of the open set 'sheep' are not under consideration. It is much closer to an adjectival or demonstrative reference restrictor, and with this function comes the tonal designation as a controller:

(64) pèjù^{L} túnɔ́ (Togo Kan)
sheep one
'one sheep, a certain sheep'

Jamsay shows a similar system, in which the strict cardinality version *túrú* 'one' is not a controller while the restrictive functional version *túmnó* 'single, a certain' is:

(65) a. pééjú túrú (Jamsay)
sheep one
'one sheep'

b. pèèjù^{L} túmnó (Jamsay)
sheep single
'a certain sheep'

However, Jamsay also shows an interesting innovation that we argue supports the idea that reference restriction is used to distinguish controllers from non-controllers. The cardinality reflex *túrú* has a form with HL tone, *túrù*, which is used exclusively to refer to one member of a pair of body parts (e.g. hands, feet, ears, etc.). In this function, it acts as a tone controller:

(66) èné mà nùmò^{L} túrù (Jamsay)
3SG.REFL POSS hand one
'one of his (own) hands'

In this example, lexically LH-toned *nùmó* 'hand' surfaces with a {L} overlay controlled by the numeral 'one'. Though the numeral here does have a cardinality function, specifying the number of hands in question, it also has a mild reference restricting function, since specifying one of a pair of body parts necessarily excludes the other. Thus, it seems that this reference restricting property in Jamsay was enough for speakers to generalize tone control to *túrù* in this context.

For one potential counter-example to the *TURU vs. *TUNX pattern, see Heath and McPherson (2013:283).

With this distinction in mind, let us return to those languages with only one lexical form of 'one' and look into the tone controlling properties of each. The languages in my sample

with only one form of 'one' are given in the following table, along with the form of the word and its tonal behavior:[26]

(67) *Tonal behavior of 'one' Dogon languages with only one form*

Language	'One'	Reflex of...	Controller?
Ben Tey	*tùwⁿɔ́*	*TUNX	Yes
Nanga	*tùmâ*	*TUNX	Yes
Tommo So	*túmɔ́*	*TUNX	Yes
Toro Tegu	*túrú*	*TURU	No
Yorno So	*túrú*	*TURU	No

We can see a perfect correlation between the cognate form *TUNX and *TURU and tone control, wherein all reflexes of *TUNX are controllers and all reflexes of *TURU are non-controllers. It seems, then, that in these languages, the historical origins of the numeral 'one' continue to influence their tonal behavior, despite the fact that the same word can be used in both restricting and non-restricting ways. Since the semantics of 'one' in terms of reference restriction are less clearcut than other cardinal numerals or modifiers, it is not surprising that we find variation in tonal treatment between languages.

The other difficult case is the definite determiner. In eight languages (including Tiranige), the definite is not treated as a controller, while in two, Nanga and Toro Tegu, it is. Again, we argue that this inconsistent treatment reflects fuzzier semantic judgments on whether or not a definite determiner restricts reference. While the reference restricting quality of demonstratives is clear, excluding all members of a set not deictically referred to, definites resist such a clear analysis. A phrase like 'the donkey' may pick out a referent that is salient in the discourse, as in the situation where only one donkey and other non-donkey entities are under discussion. Though this may serve to restrict reference in the conversation, it does

[26]In Tiranige, *tòòmà* 'one' is a reflex if *TUNX, but it is not a tone controller. However, in this language, all numerals are themselves {L} following a noun, so this is not particularly informative to the discussion at hand.

nothing to restrict the open set 'donkey'. If more than one donkey were being discussed, the phrase 'the donkey' could not be used, as it does not unambiguously pick out which donkey is intended (compared to a reference restrictor, like 'this donkey' or '(the) black donkey', which can shift the discussion to a particular donkey).

Given this lack of clear reference restriction, it is expected that the Dogon languages should not treat the definite as a tone controller. However, demonstrative determiners often evolve into definites (Greenberg 1978, Diessel 1999), and the Dogon languages are no exception. In this process of this evolution, tone control may be lost, but two languages have preserved it: Nanga and Toro Tegu.

In Nanga, there are two distinct series for demonstratives and definites, both inflected for animacy/number:

(68)

	Animate sg.	Animate pl.	Inanimate sg.	Inanimate pl.
Demonstrative	*wǒ-ŋ*	*wòó-yè*	*ǹgú*	*yěy* ∼ *ńgú-yè*
Definite	*nɛ́*	*búù*	*gú*	*ý*

Both definites and demonstratives act as tone controllers, imposing {L} on a preceding noun like *ńdô* 'house':

(69) a. ǹdò^{L} ǹgú (Nanga)
house this
'this house'

b. ǹdò^{L} gú (Nanga)
house DEF
'the house'

A plausible evolutionary scenario for Nanga is that inanimate demonstratives first developed into inanimate definites via semantic bleaching; tone control status was maintained. To fill out the paradigm, animate definite forms were innovated from third person pronouns (*ńnɛ́* 3sg and homophonous *búù* 3pl), and these inherited controller status via paradigm uniformity with the inanimate definites.[27]

Not all languages took the same evolutionary path. In Najamba, definites and demonstratives are tonally and segmentally identical, pointing to a clear common origin, but Najamba definites lost their status as controllers, presumably as they lost their ability to restrict reference:

(70) a. pɛ̀gɛ̀^{L} mó (Najamba)
sheep that
'that sheep'

b. pɛ̀gɛ́ mó (Najamba)
sheep DE
'the sheep'

Once again, like the numeral 'one', the borderline reference restricting semantics of the definite determiner leads to variable tonal treatment of the category across the Dogon languages.

Thus, we see that the distinction between controllers and non-controllers in Tommo So and the other Dogon languages is not an arbitrary choice but a principled division. Whether semantics are still at play in the modern languages or whether the torch has been passed to syntactic category alone (as I have argued in this chapter) remains an open question.

[27]This is in contrast to a case from Kalabari (Harry and Hyman 2014), where a possessive pronoun *ání* 'its' developed a demonstrative function but retained the tonal effects of a possessor rather than taking on those of a demonstrative. See Chapter 5 for further discussion of Kalabari.

2.7.2 Phrasal phonology, restructured

I argue that the resemblance between Dogon tonosyntax and patterns of phrasal stress or reduction is non-coincidental, since it most likely has diachronic origins in such a system. I suspect that overlays began as de-emphasis of modified words, more closely akin to the English Compound Stress Rule rather than the Nuclear Stress Rule, as it is the head of the phrase that is de-emphasized (in what follows, boldface indicates emphasis):

(71) a. gámmá **gɛ́m**
cat black
'black cat'

b. **Sáná** gámmá
Sana cat
'Sana's cat'

This may have been accompanied by intonational raising of H tones in emphasized words, resulting in a pitch disparity between the deemphasized H tone. For example, in (71a), the H tones of *gámmá* 'cat' would end up lower than those of *gɛ́m* 'black'. Tonal contrasts became harder to hear in de-emphasized words, and eventually children reinterpreted them as L-toned. Note that at this stage, triggering environments could still have been phonological, but it was phonologically-conditioned H tone lowering (as proposed by Marfo 2004 for Akan).

I suggest that the distinction between reference restrictors and non-reference restrictors could date back to this system of phrasal stress; reference restrictors were more heavily emphasized than non-reference restrictors, and this eventually translated into the system of overlay controllers and non-controllers. A parallel effect in some languages, like Tommo So, is the loss of lexical tone on functional elements like the definite and plural. Since neither restrict reference, the tone of preceding words was not de-emphasized. Instead, due to their

light, monosyllabic nature, these functional elements had their tone reduced until it was no longer phonologically specified. See (3) for Tommo So examples.

Many Dogon languages have {HL} as an overlay with possessors, which precede the modified noun; modifiers that follow the noun uniformly impose {L}. This could be the result of phonologized H carryover onto a reduced word. A possible diachronic path for a Jamsay (Heath 2008) possessive phrase is given in (72) for *íné-n* ^{HL}*dérè* 'a person's older sibling':

(72) ∗íné-n dèré → ∗**íné-n** dèré → ∗íné-n ^{L}dèrè → íné-n ^{HL}dérè

In step two, the possessor *íné-n* 'person' is more heavily stressed. In step three, this is reinterpreted as {L} on the possessed noun. Presumably at this stage, there is slight phonetic H carryover onto the following L tone, a phenomenon that can be seen in modern Tommo So. In the last step, this H carryover was phonologized as a {HL} overlay. We find three general options in the Dogon languages with regards to this phonologization. First, some languages, like Tommo So, retain {L} overlays in possession, i.e. there is no phonologization of carryover. In languages like Nanga, a {HL} overlay has only developed after H-final possessors, exactly those environments where we expect carryover. Finally, languages like Jamsay have generalized the {HL} overlay to all possessors, regardless of final tone. This is arguably due to a higher number of H-final words in the language such that possessed nouns surfaced more commonly with {HL} tone than {L} tone and the pattern was divorced from phonological environment. See Chapter 3 for in-depth treatments of other Dogon languages.

This reduction account of tonosyntactic overlays is plausible: the same thing appears to be currently happening in Tommo So with defocalized perfective verbs. A special morphological form of the perfective is used when another constituent in the sentence is focalized, thus de-emphasizing the verb. Some consultants pronounce these verbs with clear LH tone in isolation (e.g. *kàn-í* 'he did') but heavily reduced in context. Many speakers, however, sim-

ply pronounce them as L-toned in all contexts (e.g. *kàn-ì*), possibly from a reinterpretation of the reduced form.

It is unclear what happened in the development of the Dogon languages to trigger restructuring of the tonal system. In other words, what information was lost such that learners posited syntactic triggers of tonal overlays rather than phrasal reduction? Unfortunately, we may never know.

2.8 Remaining issues

This chapter has shown how a model combining morphological constructions and weighted constraints can capture the full range of Tommo So tonosyntax, from one controller, to two, to three. Here, I address a few remaining issues, both in the data and in the model.

2.8.1 Data issues

2.8.1.1 Possessive particle *mɔ*

Rarely in Tommo So, we find cases where a possessive clitic *=mɔ* intervenes between a non-pronominal possessor and the possessed noun. In my data, this clitic is only found in alienable possessive constructions, suggesting that *=mɔ* may be the realization of the head of PossP, absent in the case of inalienable possessors which are in the specifier of the possessed noun's NP. Found only with older speakers, this construction is variable in its tonosyntax; in some cases, the possessive {L} overlay is applied and in others, we find no tonal interactions:

(73) a. PossNonP=POSS ^{L}N
Mɔ́ɔ́lu=mɔ ^{L}jàw
Mori=POSS war
'the war of Mori (village name)' (/jáw/)

b. PossNonP=POSS N
Bèŋjù-Ámbìɛ̀m=mɔ úndɔ́=gɛ
Benju-Ambiem=POSS ash=DEF
'the ashes of Benju-Ambiem'

This variation could be accounted for with LOCALITY, the same constraint that motivates the variation between N PossAP Dem^{L} and N^{L} PossAP Dem. In this case, the possessive clitic is the element that intervenes between the controller and the target. We will see this system again in Jamsay, where the possessive marker is standard and an overlay is never allowed to apply. Why it is that the clitic is not allowed to take the overlay along with the noun, making the tonal domain adjacent to the possessor, is unclear.

2.8.1.2 Compounds

In McPherson (2013b), I describe two classes of compound nouns in Tommo So: canonical compounds, in which all non-final stems are overwritten with {L}, and pseudo-genitive compounds, in which the first stem acts like a possessor, imposing {L} on the following stem. For example:

(74) a. gàmmà^{L} íí
cat child
'kitten'

b. bìlím ^{L}kɛ̀ɛ̀^{n}-kɛ̀ɛ̀^{n}
manure RED-bug
'dung beetle'

I argue that the overlay in the former, though resembling the type of overlay found in a N Adj construction, is the result of lexical tonotactics rather than tonosyntax. In short, because these compounds are a single N head for the purpose of syntax, their tonal patterns must obey regular tonotactics for nouns. The only way to ensure that the concatenation of stems will yield a legal tonal melody (with a single H stretch) is to overwrite non-final stems with L.

Evidence that canonical compounds are treated as a single noun comes from cases where one of the stems in the compound is an adjective. For example, the kinship term *nàà-díyɛ̀* (written here as a single word) literally means 'big mother' and carries the same surface tone as a N Adj sequence would. However, when this compound is possessed, we find no evidence of an adjectival tone overlay. Contrast (75a) and (b):

(75) a. PossIP ^{HL}N
émmé ^{HL}náà-dìyɛ̀
1PL.PRO mother-big
'our aunt (mother's older sister)'

b. PossIP N^{L} Adj
émmé bàbè^{L} kómmó
1PL.PRO uncle skinny
'our skinny uncle'

The compound in (75a), despite containing an adjectival stem, takes a single overarching {HL} overlay. With the regular N Adj construction in (75b), the adjective's {L} overlay applies to the noun in place of the possessive overlay. Though not contained in my data set, I predict that the sequence *émmé nàà*^{L} *díyɛ̀* would literally mean 'our big mother'. The example in (75a) contains one other piece of evidence that canonical compounds are a single N for the purposes of tonosyntax (rather than having visible internal structure): *nàà-díyɛ̀* takes a {HL} overlay, characteristic of words with three or more moras, rather than the {H} overlay we find on *náá* 'mother' alone. As we will see in the next chapter, it is a language-specific parameter whether or not tonosyntax is sensitive to the internal structure of compound nouns.

Pseudo-genitive compounds, however, behave exactly as possessive constructions when it comes to tonosyntax. Interestingly, despite the "possessed" noun being alienable, tonosyntactic evidence points to compounds coopting the inalienable possessive construction:

(76)

[N$_1$	^{L1}N]^{L2}	Adj$_2$
bìlím$_1$	^{L1}kɛ̀ɛ̀^{n}-kɛ̀ɛ̀^{nL2}	bánu$_2$
manure	RED-bug	red
'red dung beetle'		

Both the adjective and the possesor retain lexical tone, as we saw with inalienable possessive constructions as in (57). The use of this construction rather than an alienable possessive construction makes sense if the language seeks to give the stems in a compound noun a tight syntactic relationship with one another.

2.8.1.3 Pre-nominal alienable possessive pronouns

This analysis of pseudo-genitive compounds sets the stage for one other puzzling feature of Tommo So tonosyntax. Recall from §2.3 that alienable pronominal possessors typically

follow the possessed noun and trigger no tonal overlays. In some cases, however, we find that the possessor can precede the noun, and from this position, it imposes a {L} overlay:

(77) a. wómɔ gìnɛ̀^{L}=gɛ (Tommo So)
3SG.POSS house=DEF
'his house' (cf. /gìnɛ́/)

b. bémɛ ìì^{L}=gɛ (Tommo So)
3PL.POSS child=DEF
'their child' (cf. /íí/)

Though speakers report no change in meaning between the two configurations, the preceding form appears only to be licensed in the presence of a determiner, one of the potential environments for adjective-numeral inversion in the language (see §3.3.7). So while speakers offered the form in (77a), an equivalent form without a determiner **wómɔ gìnɛ̀^{L}* was rejected as ungrammatical. The syntactic motivation for this inversion is unclear.

While non-pronominal alienable possessors c-command both the noun and an adjective and impose {L} on both, the domain of a pronominal's {L} overlay extends only as far as the noun:

(78) PossAP$_1$ ^{L1}N^{L2} Adj$_2$
wómɔ$_1$ ^{L1}jàndùlù^{L2} pílu$_2$
3SG.POSS donkey white
'his white donkey' (cf. /jàndúl/)

I suggest that these domains are explained if this unusual configuration is a pseudo-genitive compound containing a possessive pronoun rather than a pronominal possessive construction proper. Under this analysis, the possessive pronoun (possibly in ApposP) is in the specifier of NP rather than in PossP, thus giving it reign only over the noun. This compounding view

also lends support to the idea that alienable possessive pronouns are actually nominal rather than pronominal from a syntactic point of view, since I have no cases in my data of regular pronouns employed in a compound noun.

The basic syntax of alienable pronominal possessors that follow the possessed noun remains unclear. Their separability from the possessed noun and their lack of tonal effect make it clear that these are not regular (canonical) compounds. They most likely originated as appositive construction (e.g. "cat which my thing"), but this has become the regular way to express alienable pronominal possession, not only in Tommo So but in most of the Dogon language family. See Chapter 3 for data from other languages.

2.8.2 Modeling issues

2.8.2.1 Subschemas, constraints, and phonological realization

Before ending this chapter, I briefly return to the issue of phonological realization in the constructional framework. As stated in §2.5.1, I take constructions to be output-oriented, with the desired surface phonological form specified in the phonological branch of the schema. This is in contrast to a suggestion made by Booij (2010) that phonology be implemented using co-phonology theory (Anttila 2002, Orgun and Inkelas 2002, Inkelas and Zoll 2005, etc.).

In most cases, the surface form is straightforward: c-commanded words surface with L tone. However, the realization of inalienable nouns after pronominal possessors is more complex, both because the exact overlay depends on the phonological structure of the possessed noun and because the {HL} overlay is uniformly applied left to right (HLL...). In answer to the first problem, I propose that a general constructional schema PossIP $^{\mathrm{H(L)}}$X for inalienable nouns is subdivided into two sub-schemas, one subcategorized for nouns with one to two moras and one for nouns with three or more moras, as argued in §2.5.2. When an inalienable noun like *bàbé* 'uncle' is placed after a pronominal possessor, it is passed through the subschema for one to two moras, where it receives a {H} overlay; a word like *ánígé* 'friend'

would pass through the other subschema and receive {HL}. The concept of subschemas was proposed by Booij (2010) and provides a means for allomorphic variation and subcategorization within the framework of Construction Morphology. Within the constraint-based framework proposed here, I am including only a single constraint for the most general constructional schema; subcategorization is built into constraint evaluation (i.e. if the possessor is a pronoun and the inalienable possessed noun has two moras, assess a violation if it does not take {H}). This prevents different tonosyntactic interactions depending on the length of the word.

Turning to the second problem, namely automatic association of the overlay {HL}, I propose that associations are fully specified in the constructional schema. Specifically, in Tommo So, the phonological branch of the construction specifies a H tone associated to the first mora of the possessed noun and L tones subsequently. Other languages, such as Nanga, may specify different associations (e.g. H(H...)L). This full specification is consistent with the output-oriented nature of the theory.

We know that, in Tommo So, neither the choice between {H} and {HL} nor the direction of association can be left to the phonology broadly speaking since we do find {HL} overlays on words with only two moras (e.g. in verbal inflection) and there is no evidence for automatic tone mapping in lexical tone (e.g. both LHH and LLH words are robustly attested).[28] An example of a verb with {HL} is given in (79a), and examples of LHH and LLH words are given in (79b)-c:

(79) a. gɛ́-dɛ̀^{HL} 'he says' ({HL} overlay associated with affirmative imperfective)

b. kògódó 'shell, husk'

c. kɛ̀bɛ̀lɛ́ 'shard'

[28]Though see §5.6 for further discussion.

Thus, following Heath and McPherson (2013), I support the view that the phonological realization of overlays is determined tonosyntactically.

2.8.2.2 Self-control: an alternative analysis

In this chapter, I have analyzed forms like N PossAP Dem^{L} as being self-control, namely, a controller taking its own overlay. An alternative hypothesis is that in addition to the general c-command constructions, the language contains specific **local** constructions, consisting of bigrams (or perhaps trigrams) and an associated phonological change. In this case, we could propose a local construction constraint like $\textsc{PossAP Dem}^{\text{L}}$, stating specifically that demonstratives are L-toned following an alienable pronominal possessor.

This analytical move would also be able to account for the data, but would introduce a second order of potential constraints into the model. The number of potential bigram constraints is much larger than the number of c-command constraints, so in order to constrain the model, I have chosen to account for as much as possible using c-command constraints. In Chapter 3, we will see one language where local constraints may be necessary: Tiranige.

2.8.2.3 Null overlay: Phonologically regular constructions?

The last issue pertains to what gets lexicalized as a construction. In §2.5.1, I argued that multiword sequences can be lexicalized as constructional schemas if they have idiosyncratic phonology. This suggests that sequences with regular phonology should have no schemas associated with them. That is, while X^{L} Adj exists as a construction constraint, X Num with no associated overlay does not.

Nevertheless, there are a couple of data patterns in the Dogon languages that could suggest the existence of constructional schemas with no associated overlays; both pertain to N PossAP sequences. In Tommo So, we could avoid the need for a Locality constraint if a constructional schema existed for N PossAP, in which the noun is actively specified as having lexical tone (as opposed to this simply being the default state of affairs). While the

analysis works as is in Tommo So, with LOCALITY accounting for this case of variation, in Nanga, we find a case that is unanalyzable without a constraint enforcing lexical tone. In brief, numerals in Nanga impose {L} when in the presence of a possessor. This is visible in a PossIP N Num string, which has one possible output {PossIP N}^{L} Num. However, N Num PossAP surfaces without overlays. LOCALITY cannot account for this, as the noun and the numeral are adjacent. If X POSSAP existed as a construction constraint requiring words c-commanded by the alienable pronominal possessor to surface with lexical tone, then this output would be accounted for.

Because all other possessors precede the possessed noun and impose tonal overlays, it is plausible that a constructional schema could exist for the alienable pronominal possessor, specifying both the lack of tonal overlay and the unusual linear order. This is the only case that I am aware of where lexical tone on a noun resists overlays without an explanation like LOCALITY.

Further evidence for constructional schemas enforcing lexical form comes from Irish (Green 2006), where a numeral triggers lenition and a possessive pronoun triggers no mutation. In a form Poss Num N, the possessor's enforcement of lexical form suppresses the numeral's mutation. In the absence of a construction constraint for lexical form, nothing would stop the numeral from triggering lenition on the noun.

2.9 Summary

In this chapter, I have laid out a framework capable of handling the complicated tonosyntactic grammar found in Tommo So. When constructional schemas, encoding tonal overlays based on syntactic structure, are implemented as weighted constraints, the complexities of tonosyntax can be reduced to the interactions of relatively simple factors.

In the next chapter, I will show that this framework goes beyond capturing the data patterns for Tommo So: the same set of constraints can account for tonosyntactic grammars in eight other Dogon languages. One language, Tiranige, requires further modifications to

the analysis, as its system of tonosyntax differs considerably from other languages in the family.

CHAPTER 3

Tonosyntax across the Dogon languages

3.1 Introduction

The last chapter described how a framework combining constraint-based grammar with phrase-level morphological constructions, can adequately account for Tommo So tonosyntax. In fact, Tommo So is just one of ten Dogon languages on which sufficient data are available to understand the tonosyntactic system. The same framework, with only a few modifications, is also able to model these other nine languages, lending further support to the theory developed in this study.

The languages in my sample are listed in (1), tentatively grouped into sub-families (following the classifications of the Dogon Languages Project):[1]

[1]Classifications available online at the time of writing at www.dogonlanguages.org.

(1)

Eastern Dogon

a. Toro Tegu
b. Jamsay
c. Tommo So
d. Yorno So
e. Togo Kan

Beni-Walo-Nanga subgroup

f. Ben Tey
g. Nanga

Western Dogon

h. Yanda Dom
i. Najamba
j. Tiranige

Languages in the Beni-Walo-Nanga sub-group are more closely related to one another than to other languages in the Eastern family. With the exception of Tommo So, data on which come from my own field notes, all language data are from the work of Jeffrey Heath; Jamsay has a published grammar available (Heath 2008) and all other languages have unpublished grammar drafts, available at the time of writing on our project website at www.dogonlanguages.org.

The genetic affiliations here do little to reflect the similarities and differences between tonosyntactic systems. For example, the Western Dogon language Najamba has the most straightforward tonosyntax that could be viewed as the basic system from which most other languages, including those in Eastern Dogon, deviate. However, closely related Tiranige has the most divergent tonosyntactic system, relying only very little on c-command to define tonal domains. This is similar to the case of umlaut restructuring in Swiss German dialects, reported in Kiparsky (1982), where the territories with restructuring are scattered throughout the language area, rather than all belonging to one geographic region. In other words, various dialects can restructure linguistic patterns in similar ways, leading to the Dogon situation with a fairly uniform morphophonology in noncontiguous related languages.

In the remainder of this chapter, I first briefly introduce the novel tonosyntactic patterns found in the other languages in §3.2. Section 3.3 runs through these languages one by one, summarizing the data patterns and applying the constraint-based analysis. Finally, §3.4 discusses on the factorial typology of the core constraint set.

3.2 Overview of novel patterns

When we look at the other Dogon languages in the sample, we find several novel patterns of tonosyntax not represented in Tommo So. Some of these differences fit easily into the existing analytical framework, while others require new mechanisms. In this section, I inventory the novel patterns, referring the reader to §3.3 for full treatments of the data in those languages displaying the phenomenon.

3.2.1 Additional controllers

The inventory of controllers—possessors, adjectives, demonstratives, relative clauses—is nearly invariant across all of the languages in the sample for which c-command is operative (for the system of Tiranige, see §3.2.3 and §3.3.8). We find one additional controller in Nanga and Toro Tegu: the definite determiner. For example, we can compare the demonstrative and definite in Nanga:

(2) a. ǹdɔ̀^{L} ŋ̀gú (Nanga)
house this
'this house' (/ńdô/)

b. ǹdɔ̀^{L} gú (Nanga)
house DEF
'the house'

Both have the same effect on the noun.

No special analytical devices are required to account for a controlling definite; in these two languages, X^L DEM simply needs to be broadened to X^L DET, encompassing either definite or demonstrative determiners. For more data and discussion, see §3.3.4 for Nanga and §3.3.5 for Toro Tegu.

3.2.2 Contingent controllers

Another phenomenon that we find is what I call the "contingent controller" (Heath: "relay effects"), wherein the numeral, a non-controller, takes on tone control capabilities in the presence of a trigger. Interestingly, the trigger of contingent control need not be a controller itself (hence why I do not use the term "relay", which suggests a sort of handing-off of control).

In Yorno So, numerals are non-controllers:

(3) a. N Num (Yorno So)
ìjú tàán
dog three
'three dogs'

b. N Num (Yorno So)
nàá kúlòy
cow six
'six cows'

However, possessors of all sorts (prenominal or postnominal, alienable or inalienable, pronominal or nonpronominal) cause the numeral to impose {L} on c-commanded words. Data like the following show that the trigger of contingent control need not c-command the numeral to have an effect and may itself take the numeral's overlay:[2]

[2]We can reconstruct that 'six mothers' would be *náá kúlòy*, based on other N Num forms, but the example is not explicitly given in Heath (2011d).

(4) a. PossIP ^{L}N (Yorno So)
mú ^{L}nàà
1SG.PRO mother
'my mother' (cf. /náá/)

b. {PossIP$_1$ N}^{L2} Num$_2$ Def (Yorno So)
{mù$_1$ nàà}^{L2} kúlòy$_2$ gɔ̀-m
1SG.PRO mother six DEF-PL
'my six mothers'

The inalienable pronominal possessor *mú* is c-commanded by the numeral, visible in the fact that it takes its {L} overlay.

In Togo Kan, all structurally higher words (e.g. demonstrative) trigger the numeral's ability to impose {L}, while at the same time assigning a {LH} overlay to the numeral itself.

Analytically, contingent controllers require more complicated phrasal constructions, indicating not only the typically controller-controllee relationship but also the presence of the trigger. See §3.3.7 for a discussion of Yorno So and §3.3.9 for Togo Kan and the difficulties that arise in this analysis.

3.2.3 Linear order vs. c-command

In all of the Dogon languages in the sample, c-command defines the domain of tone control in at least some of the cases. For most languages, Tommo So included, c-command is the only such determinant. In Tiranige non-possessive constructions, however, **linear adjacency** is responsible for tonal overlays. In fact, in most cases, it is the c-commanding element that takes a tonal overlay. Morphological constructions and their corresponding constraints therefore encode adjacency rather than c-command. They are often, though not obligatorily, more specified than c-command constraints in that the syntactic category of both the trigger and target is specified. For illustrative examples and analysis in Tiranige, see §3.3.8.

3.2.4 Interaction between phonology and morphology

In one instance, we find a potential case where a late level phonological process affects the choice of possessive overlay. Yanda Dom has a phonological process of Rhythmic Tone-Raising, which raises the tone of certain functional elements to H if the preceding word is all L. This process is mirrored in tonosyntax of possessives, with the possessive overlay as {H} after an all L possessor and {L} otherwise. Rhythmic Tone Raising, described by Heath as a phonological rather than tonosyntactic rule, appears to feed a tonosyntactic choice between overlays, suggesting that phonology and morphology may need to operate in parallel in order to achieve the correct results. See §3.3.6 for further discussion and examples.

3.2.5 Syntactic structure of possessives

In all languages with an alienable vs. inalienable distinction, the alienable possessor always takes wider tonosyntactic scope. However, tonal evidence points to two different locations of the alienable possessor's PossP, depending on the language. In Tommo So, we saw PossP above both AdjP and NumP in the syntactic tree. In a language like Toro Tegu, on the other hand, the numeral is always outside the scope of the possessor, suggesting (following Dobler 2008) that PossP is above AdjP but below NumP. The examples in (5) highlight this difference:

(5) a. Sáná ^{L}{gàmmà nèè-gò} (Tommo So)
Sana cat two-ADV
'Sana's two cats' (/gámmá/, /néé-go/)

b. m̀ ^{HL}árzàgà tààlí́ (Toro Tegu)
1SG.PRO animal three
'my three animals' (/àrzàgá/)

I take this to be a language-specific syntactic parameter; languages are absolutely consistent in which pattern they display (NumP above or below PossP).

These differences in syntactic structure affect the analysis only insofar as the assessment of violations; languages with a higher PossP will have wider c-command domains and more opportunities to assess violations on c-commanded words. I will point out the influence of syntactic structure where pertinent in the discussion of individual languages below.

3.2.6 Factors influencing the possessive overlay

While the Dogon languages share many of these similarities in structure, there is a wide array of factors that can affect the phonological content of the possessive tonal overlay, with each language showing a different set of active factors. In this section, I ignore alienable possessive pronouns that follow the possessed noun and do not interact tonally; the factors discussed here **only** affect the contents of the overlay for those constructions in which an overlay is imposed.

Possessive overlays can be sensitive to the form of the possessor or the form of the possessed noun, where "form" can refer to syntactic, semantic/lexical, or phonological factors. I will give a brief description of each attested factor here to provide an overview of the ways in which Dogon languages differ from one another; for data and discussion, follow the cross-references to the treatments of individual languages below.

We find two languages, Ben Tey and Toro Tegu, in which the syntactic structure of the possessor affects the choice of tonal overlay (in both languages, {L} and {HL}). Both languages distinguish between possessors made up of only a singular noun or N Adj sequence (Heath: "core NP") and possessors containing anything more: numerals, determiners, universal quantifier, or even a plural particle. Conjoined nouns are also treated as more complex. This phenomenon can be accounted for by assuming subschemas for the syntactic branch (SYN) of a morphological construction, coindexed to different phonological outcomes (PHON). See §3.3.1 for Ben Tey and §3.3.5 for Toro Tegu.

In Nanga and Ben Tey, the possessive overlay is determined by the final tone of the possessor: if the possessor ends in a H tone, then the possessive overlay is {HL}; if it ends in a L tone, then the possessive overlay is {L}. As mentioned above, syntactic structure is also a factor in Ben Tey, and we find the effects of final tone only for core NP possessors. These effects can be captured in the construction-based model either by assuming subschemas for the phonological branch (one for H-final possessors and one for L-final possessors, with overlays fully specified) or by building autosegmental spreading into the schema. For formalization, see §3.3.1 for Ben Tey and §3.3.4 for Nanga.

Similarly, the possessive overlay may be sensitive to the entire tonal form of the possessor, not just the final tone. This effect is displayed in Yanda Dom. Unlike most languages in the sample, Yanda Dom allows lexically /L/ words.[3] We find that if the possessor is all L-toned, then the possessive overlay is {H(L)}; if there is a H tone anywhere in the possessor, the possessive overlay is {L}. There are some complicating factors in the analysis of this construction, but these facts could be accounted using phonological subschemas of the possessive construction, as with final tone dependency; see §3.3.6.

Possessive overlays can also depend on the phonological form of the possessed noun, though they never involve the tone of the noun (logical, perhaps, since the tone will be completely overwritten).[4] Instead, in Tommo So and Togo Kan, we find that the **prosodic weight** (i.e. the mora count) of the possessed noun can determine which overlay the word receives. In both languages, a noun with one or two moras (though typically two due to word minimality requirements) takes a {H} overlay while longer words take {HL}. This was illustrated in §2.3 for Tommo So in §3.3.9 below for Togo Kan. In neither language can we find a purely phonological motivation for the choice between {H} and {HL} (since

[3]For useful discussion of whether /L/ could be analyzed as /L+H/, see Heath (2012c:62-63). In short, there are two classes of ostensibly /L/ nouns, with differing behavior with regards to suffixes. While it is tempting to distinguish the two classes by the presence of a floating H, this representation is inconsistent with the identical behavior of the two classes with regards to definite determiners, in contrast to nouns with an overt H tone anywhere in the stem.

[4]However, see §5.6 for putative cases in which a construction subcategorizes for a feature that is lost on the surface.

HL is found on bimoraic words in both languages); hence, I analyze this as another case of phonological subcategorization.

Finally, while tonosyntactic overlays are, as I have argued, a very general process, applying to any words in the appropriate syntactic configuration, a number of languages do have lexical exceptions in possession. Unsurprisingly, all of these exceptions are found with inalienable nouns, those nouns that are highly unnatural to use without a possessor. This means that in a certain sense, the possessed form of the noun is more basic, and with many tokens in the learning data of Poss N, this sequence could begin to form its own subschema for individual words. In this way, lexical exceptions arise. Languages with sporadic lexical exceptions are Jamsay and Togo Kan, discussed in §3.3.2 and §3.3.9, respectively. The existence of lexical exceptions can be accounted for by assuming subschemas for particular lexical items that will apply because they are the more specific case; if no subschema exists for a lexical item, then it follows the general pattern of possession in the language. Yanda Dom shows evidence of two tonal classes as opposed to a handful of exceptions, suggesting a different analysis; see §3.3.6.

3.2.7 Floating tones

Though not tonosyntactic in nature, floating tones are attested in three of the languages (Ben Tey, Tiranige and Togo Kan). In Ben Tey, the 1sg possessive pronoun is a tonal morpheme consisting of a single floating L, which concatenates with the possessed noun carrying the possessive {HL} overlay (yielding a {L+HL} tone sequence). In Tiranige and Togo Kan, the floating tone is associated with the definite. Tiranige has an overt definite article *rì* associated with the floating tone, whose realization is determined by the preceding word through tone polarity. In Togo Kan, the definite is purely a tonal morpheme, a floating L that associates to the right edge of the preceding word.

No special analytical machinery is necessary to account for floating tones, whose realization I assume is regulated by the phonological component (i.e. after tonal overlays have

applied). Section 3.3.1 presents data on Ben Tey, while Tiranige and Togo Kan are treated in §3.3.8 and §3.3.9, respectively.

3.3 The other nine languages

Here I show that the same set of constraints used for Tommo So, suitably weighted, can account for nearly all of the Dogon grammars (see also Anttila and Cho 1998 and Anttila 2002 for constraint-based analyses of variation within a language group). Tiranige and Togo Kan require reference to additional constraints and will be considered after the other eight languages.

Comparative constraint weights for these eight Dogon languages (including Tommo So) are given in (6). Tommo So and Nanga, shown in bold in the table, require constraint ganging in the analysis:

(6)

Constraint	**Tommo So**	Najamba	Jamsay	Yorno So	**Nanga**	Ben Tey	Toro Tegu	Yanda Dom
IDENT-OO(T)	7.8	8.4	6.8	8.4	7.1	6.6	7.4	6.9
IDENT-OO(T)/ PHASE-LEX	2.2	2.5	7.8	23.5	8.5	8.7	2.4	2.0
IDENT-OO(T)/ PHASE	42.9	22.9	7.8	7.3	20.6	27.5	28.7	35.7
IDENT-OO(T)/ PREFIX	–	–	–	–	–	–	–	13.7
POSS ^{T}X	15.3	18.0	14.2	17.9	21.0	22.1	23.0	13.8
X^{L} ADJ	22.9	17.5	28.5	30.9	14.0	22.7	16.2	20.9
X^{L} DEM	27.6	15.6	15.2	16.1	15.4	12.9	13.9	20.6
X^{L} NUM/POSS	0	0	0	15.7	13.7	0	0	0
*SELFCONTROL	41.8	30.3	24.2	23.1	20.0	27.5	29.3	35.4
UNIFORMITY	7.5	7.9	9.9	7.9	11.7	19.2	9.3	21.5
LOCALITY	14.6	15.3	35.7	2.4	12.8	3.3	3.2	20.8

These ten constraints (eleven, in the case of Yanda Dom) do a near-perfect job of modeling six of the languages (Tommo So, Najamba, Jamsay, Yorno So, Ben Tey, and Toro Tegu) and a very good job of modeling the most complex language, Nanga. We lack a deep understanding of Yanda Dom tonosyntax, but the constraint set proposed here does a fairly good job of modeling what we do know.

Tiranige requires a different approach to tonosyntax, and Togo Kan varies between this system and the more typical Dogon system, suggesting that both sets of constraints are active in its grammar.

I will first give brief illustrations of the seven additional languages in §3.3.1-3.3.7, highlighting in each case how the grammar accounts for one or two interesting data patterns. I then turn to the analysis of Tiranige in §3.3.8. I show that linear adjacency constraints are responsible for non-possessive patterns, while the more typical c-command constraints account for possessive constructions. Finally, Togo Kan is shown to be by-and-large a "typical" Dogon language, with the addition of a Tiranige-like constraint responsible for variation between the two data patterns. However, Togo Kan data patterns are very hard to capture precisely, and the difficulties will be discussed in §3.3.9.

After each language, I will summarize the important points or data patterns this language has introduced, if applicable (the points raised by a language may have already been introduced by an earlier language, in which case they will not be repeated).

3.3.1 Ben Tey

The complexities of Ben Tey arise not so much from constraint interaction but from allomorphy of the possessive overlay. As described above in §3.2.6, possessors in Ben Tey impose either {HL} or {L}, depending on both the syntactic and phonological structure of the possessor. A syntactically simple possessor, consisting maximally of N Adj, imposes {HL} if the final tone of the possessor is H and {L} if the final tone of the possessor is L, shown below for the noun *ìséè* 'village':

(7) a. ár^{n}à-m ^{L}ìsèè (Ben Tey)
man-SG village
'a man's village'

b. yǎ-m ^{HL}ísèè (Ben Tey)
woman-SG village
'a woman's village'

The same effect is found with pronominal possessors: *ú* ^{HL}*ísèè* 'your (sg.) village' vs. *úù* ^{L}*ìsèè* 'your (pl.) village', with the exception of the 1sg. We find that the 1sg in Ben Tey is one case of floating tones in the Dogon languages. In Ben Tey, the 1sg pronoun is a tonal morpheme L that concatenates with a {HL} overlay, with the following results (for monosyllabic, bisyllabic, and trisyllabic nouns):

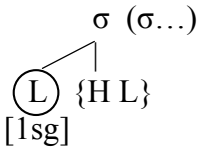
(8) a. $^{L+HL}$ɛ̌ɛ̀ (Ben Tey)
1SG.well
'my well' (cf. /ɛ̀ɛ́/)

b. $^{L+HL}$kǎrà (Ben Tey)
1SG.mat
'my mat' (cf. /kàrá/)

c. $^{L+HL}$tǔŋgùrùm (Ben Tey)
1SG.stool
'my stool' (cf. /túŋgúrúm/)

In every case, the 1sg floating L links to the first syllable of the possessed noun. The H of the {HL} possessive overlay also links to this syllable, with L tones subsequently. Interestingly, as (8b) shows, this can lead to contour tones on light syllables, a pattern that does not occur lexically in Ben Tey. The following autosegmental diagram represents this situation:

(9) Ben Tey 1sg floating tone association



The floating L of the 1sg, shown in a circle, associates to the initial syllable of the possessed noun, creating a rising tone when it combines with the H of the {HL} overlay. The L of the overlay is shown unassociated here, but following general principles of association, I assume it associates to following syllables if they are present (avoiding the creation of a LHL "bell-shaped" tone) but will associate to the initial syllable if that is the only option (as in (8a)).

The fact that the overlay is {HL} after the 1sg is a pattern that speakers need to explicitly learn and formalize in its own subschema, since it does not follow from general principles of overlay assignment in Ben Tey. From a functional perspective, the fact that the overlay is {HL} rather than {L} is understandable, since otherwise the floating L tone would be inaudible, very likely leading to a loss of morphological person/number information.[5]

Returning to nonpronominal possessors, if the possessor is complex, it always imposes {HL}, even if it ends in L, as in (10):

(10) [nùú yěy kù] ^{HL}íŋjɛ̀-m (Ben Tey)
person two DEF dog-AN.SG
'the two people's dog' (/ìŋjɛ̌-m/)

The effects of non-1sg simplex or pronominal possessors, shown in (7) and the following discussion, look like simple tone spreading, a process common to many African languages. We could propose a single {L} possessive overlay with the final H on the possessor spreading to the initial syllable of the possessed noun. However, this spreading can only be a property of the possessive construction: it has no support elsewhere in the phonology of the language. For example, the same 2sg pronoun used before a verb shows no spreading of its H tone:

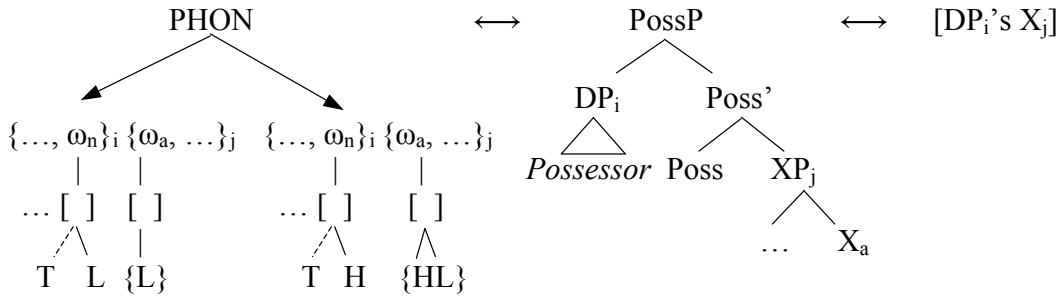
[5]An alternative analysis is discussed in Chapter 1 Fn.(16). Unfortunately, since the floating L allomorph of the 1sg is only used in possessive contexts, we cannot definitively tease apart the floating tone and the tonal overlay.

(11) nù^{L} ú bì-bàrú (Ben Tey)
person 2SG.PRO RED-help.IMPF.REF.AN.PL
'people who will help you'

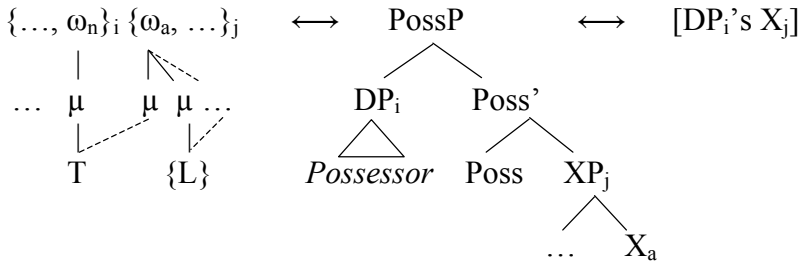
Further, it must be specific to possessive constructions with simple possessors, since no spreading is found when the possessor is complex; in that case, the overlay is always {HL}.

We have two choices when it comes to constructional schemas in "spreading-type" languages. Either the phonological branch contains subschemas for H-final and L-final possessors or the phonological branch specifies spreading from the final tone of the possessor (i.e. we have construction-specific spreading). The two possibilities and laid out in (12):

(12) a. Constructional schema for subcategorized overlays in Ben Tey



b. Constructional schema for spreading-type analysis in Ben Tey



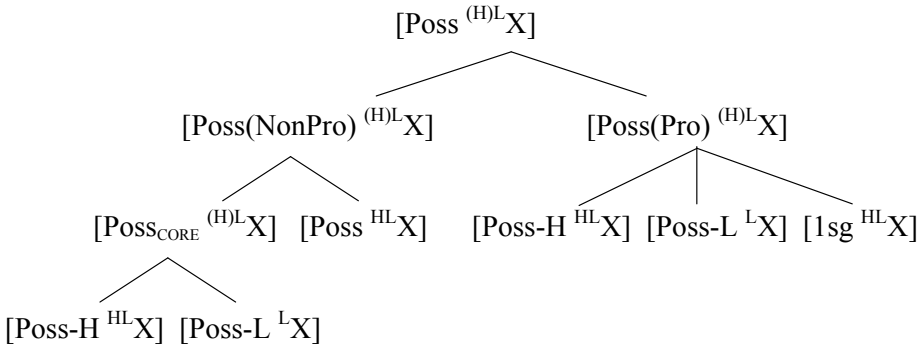
In (12a), the PHON branch of the schema splits into one where the final word of the possessor ends in a L tone, imposing {L} on the possessed noun, and one where the final word of the possessor end in a H tone, imposing {HL} on the possessed noun. The alternative hypothesis in (12b) requires only one phonological branch, in which the tone of the final mora of the possessor DP spreads onto the first mora of the possessed noun, with a {L} overlay filling in subsequent moras. In Nanga, where {HL} is realized as H(H...)L, the possessor's tone would spread onto all but the final mora of the first word, which takes the {L} overlay; see §3.3.4.

While (12b) seems simpler, requiring no subcategorization, it involves tone spreading, a phonological process not found anywhere else in Ben Tey. Overlays, on the other hand, are found in many different DP configurations and in verb conjugation. Therefore, I believe that the subcategorized version in (12a) simplifies the grammar, using all of the same tools and processes found across the grammar. Under either analysis, only the top level of the schema would be associated with a constraint.

See §3.3.5 for a discussion of the effects of syntactic structure on possessive constructions.

The following hierarchical structure shows simplified versions of the various subschemas of the main possessive constructional schema:

(13) Hierarchical structure of Ben Tey possessive constructions



The top of the hierarchical tree shows in broad terms that a possessor imposes either {HL} or {L} on c-commanded words (X). This splits into two subschemas, one for nonprominal possessors and one for pronominal possessors, both of which retain the underspecified overlay {(H)L}. The pronominal branch contains one more layer with three branches. The most specific is the rightmost subschema for the 1sg, which assigns {HL} without regard to phonological information. If the possessor is not 1sg and does not fit into this subschema, it will fall into one of the other two depending on phonological form: possessors ending in H impose {HL} and those ending in L impose {L}. The nonpronominal branch is more complicated. The first split is between possessors consisting of only a core NP and possessors more generally (the elsewhere condition); the latter always impose {HL}. The core NP possessors follow the pattern of the pronominal possessors, branching into H-final and L-final and imposing {HL} and {L}, respectively.

Despite these complexities, I maintain that only the top level of the hierarchical structure is encoded as a constraint, i.e. Poss $^{(H)L}$X. This assertion is once again due to the fact that more specific subschemas never interact differently with other constructions, nor do they interact with each other (since different realizations can be viewed as akin to allomorphs of a single possessive overlay, rather than different overlays). The constraint-based grammar is fairly straightforward. One interesting feature is that the possessive overlay always wins in the face of a non-possessive controller, even one that it is structurally higher, such as a demonstrative:

(14) a. PossANonP $^{(H)L}$N Dem (Ben Tey)
yǎ-m ^{HL}íŋjɛ̀ mùú
woman-SG dog this.AN.SG
'this dog of a woman' (/ìŋjɛ̌-m/)

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

'this dog'

In (14a), the possessor's {HL} overlay trumps the demonstrative's {L} overlay, shown in (14b).

This result is captured by a constraint-based grammar in which phase-based faithfulness is powerful (reducing the number of viable targets for the demonstrative by one) and the possessor's constraint carries a higher weight than that of the demonstrative, as illustrated in the following tableau of (14a):

(15)

/PossANonP N Dem/	*p* Obs	*p* Pred	*Score*	Id(T) 6.6	Id(T)/Ph 27.5	Id(T)/Ph-Lex 8.7	Poss $^{(H)L}$X 22.1	X^{L} Dem 12.9	*SelfCont 27.5	Locality 3.3
a. $Poss_1$ $^{(H)L1}$N Dem_2	1	∼1	32.4	1	0	0	0	2	0	0
b. $Poss_1$ $^{(H)L1}$N $Dem_2{}^{L2}$	0	∼0	40.7	2	0	0	0	0	1	0
c. $Poss_1$ N^{L2} Dem_2	0	∼0	41.6	1	0	0	1	1	0	0
d. $Poss_1$ N Dem_2	0	∼0	47.9	0	0	0	1	2	0	0
e. $\{Poss_1$ N$\}^{L2}$ Dem_2	0	∼0	49.4	2	1	1	0	0	0	0
f. $Poss_1$ $\{$N $Dem_2\}^{L2}$	0	∼0	62.8	2	0	0	1	0	1	0
g. $Poss_1{}^{L2}$ $^{(H)L1}$N Dem_2	0	∼0	81.5	2	1	1	0	1	0	1
h. $\{Poss_1$ N $Dem_2\}^{L2}$	0	∼0	83.5	3	1	1	0	0	1	0
i. $^{(H)L1}Poss_1$ N^{L2} Dem_2	0	∼0	89.8	2	1	1	0	1	1	0
j. $^{(H)L1}\{Poss_1$ N$\}$ Dem_2	0	∼0	102.7	2	1	1	0	2	1	0
k. $^{(H)L1}\{Poss_1$ N$\}$ $Dem_2{}^{L2}$	0	∼0	111	3	1	1	0	0	2	0
l. $^{(HL)1}Poss_1$ $\{$N $Dem_2\}^{L2}$	0	∼0	111	3	1	1	0	0	2	0

In this tableau, candidate (e), in which the demonstrative fully implements its {L} overlay, is ruled out due to violations of phase-based faithfulness; candidates (g-l) are also ruled out

in large part due to this same violation. In candidate (c), this {L} overlay applies only to the noun, but this incurs a violation of both Poss $^{(H)L}$X and X^{L} Dem. Because the demonstrative's constraint has a weight of 12.9 and the possessor's constraint has a weight of 22.1, it is better to maximally violate the demonstrative's constraint (as in candidate a) than to incur one violation of each (as in candidate c). The Nanga-like output in candidate (b), in which the possessor imposes {(H)L} on the noun and the demonstrative takes its own overlay, is ruled out by the large weight of *SelfControl (coupled with two violations of Ident-OO(T)); any other candidates that violate *SelfControl are likewise ruled out (candidates f, h-l). Fully faithful candidate (d) maximally violates both construction constraints for a total penalty score of 47.9, higher than that of the winning candidate.

This tableau also shows that Ident-OO(T)/Phase-Lex receives a non-negligible weight, meaning that we do find differences in faithfulness between pronominal and nonpronominal possessors. The one attested case of a possessor taking an overlay is in the configuration PossIP N Adj, where the output {PossIP N}^{L} Adj varies with PossIP $^{(H)L}$N Adj^{L} (self-control):

(16) a. {PossIP N}^{L} Adj (Ben Tey)
{ù lèsù}^{L} mɔ̀sû-m
2sg.pro uncle nasty-an.sg
'your nasty uncle' (/ú/, /lèsú//)

b. PossIP $^{(H)L}$N Adj^{L} (Ben Tey)
ú ^{HL}lésù mɔ̀sù-m^{L}
2sg.pro uncle nasty-an.sg
'=(a)'

In contrast, with nonpronominal possessors, only the equivalent of (16b) is possible:

(17) a. *{PossINonP N}^{L} Adj^{L} (Ben Tey)
{yà-m lèsù}^{L} mɔ̀sû-m
woman-AN.SG uncle nasty-AN.SG
'a woman's nasty uncle' (/yǎ-m/, /lèsú//)

b. PossINonP $^{(H)L}$N Adj (Ben Tey)
yǎ-m ^{HL}lésù mɔ̀sù-m^{L}
woman-AN.SG uncle nasty-AN.SG
'=(a)'

Here, I analyze the resistance of nonpronominal possessors to variation as the result of IDENT-OO(T)/PHASE-LEX: faithfulness to phases containing lexical, rather than functional or pronominal, material.[6]

Under the same lexical phase-based analysis used for the other Dogon languages, the variation in (16) can be modeled in the following way:

[6]Heath (2012) notes, however, that even bimoraic pronouns are more likely to resist overlays, suggesting that the faithfulness should be calculated based not on whether material in a phase is lexical or functional but on prosodic size. It is not immediately clear how to reconcile these facts with a spell-out approach, unless a phonological rule or constraint later "cleans up" the output of the morphology, by phrasing a monomoraic pronoun together with the following material and assimilating it phonologically.

(18)

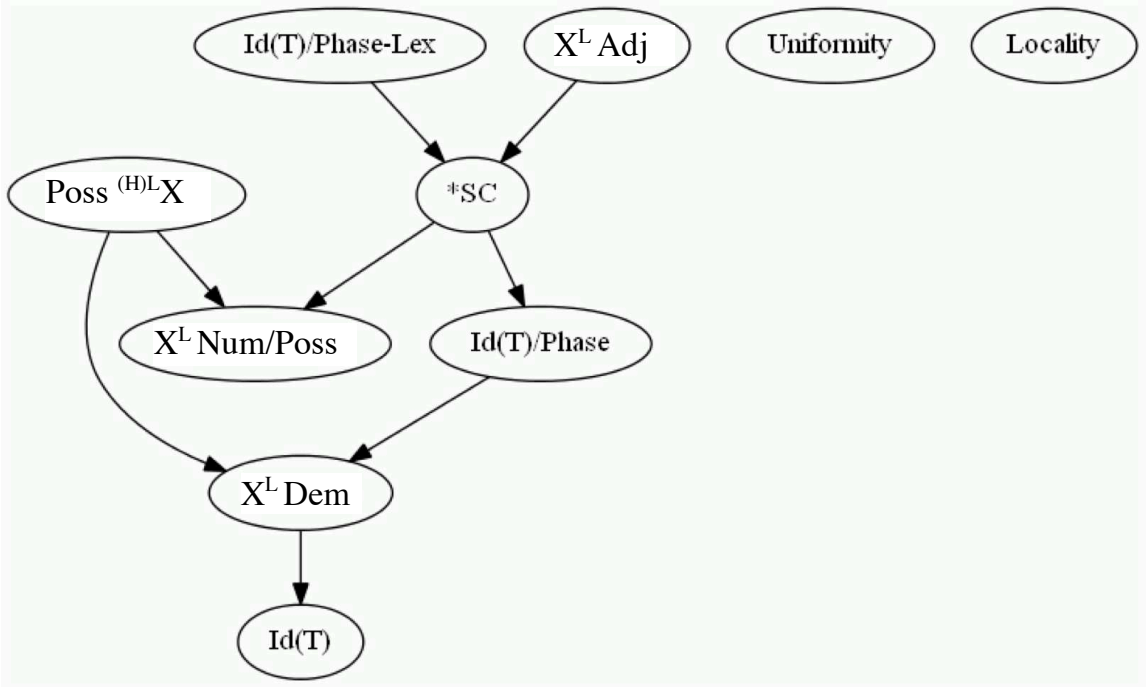
/PossIP N Adj/	*p* Obs	*p* Pred	*Score*	Id(T) 6.6	Id(T)/Ph 27.5	Poss $^{(H)L}$X 22.1	X^{L} Adj 22.7	*SelfCont 27.5	Uniformity 19.2	Locality 3.3
a. $Poss_1$ $^{(H)L1}$N $Adj_2{}^{L2}$	.5	∼.5	40.7	2	0	0	0	1	0	0
b. $\{Poss_1$ N$\}^{L2}$ Adj_2	.5	∼.5	40.7	2	1	0	0	0	0	0
c. $Poss_1$ N^{L2} Adj_2	0	∼0	51.4	1	0	1	1	0	0	0
d. $Poss_1$ $^{(H)L1}$N Adj_2	0	∼0	52	1	0	0	2	0	0	0
e. $Poss_1{}^{L2}$ $^{(H)L1}$N Adj_2	0	∼0	66.7	2	1	0	1	0	0	1
f. $Poss_1$ N Adj_2	0	∼0	67.5	0	0	1	2	0	0	0
g. $\{Poss_1$ N $Adj_2\}^{L2}$	0	∼0	74.8	3	1	0	0	1	0	0
h. $^{(H)L1}Poss_1$ N^{L2} Adj_2	0	∼0	90.9	2	1	0	1	1	0	0
i. $^{(H)L1}\{Poss_1$ $\{N\}^{L2}\}$ Adj_2	0	∼0	110.1	2	1	0	1	1	1	0
j. $^{(H)L1}\{Poss_1$ N$\}$ Adj_2	0	∼0	113.6	2	1	0	2	1	0	0

Both candidates (a) and (b) fully satisfy both active construction constraints. Candidate (a) does so by applying the possessor's overlay to the possessed noun while the adjective reabsorbs its own overlay. Candidate (b) does so by applying the adjective's {L} overlay to both c-commanded words, rendering the possessor's construction constraint moot. Because Ident-OO(T)/Phase and *SelfControl have the same weight, the penalty score for these two candidates is the same, and variation results. If the possessor were nonpronominal instead, the extra weight of Ident-OO(T)/Phase-Lex would rule out candidate (b). Candidate (c) does not incur a violation of phase-based faithfulness, but because the possessor retains lexical tone, its construction constraint remains active and incurs a violation for the possessed noun in addition to the violation of X^{L} Adj incurred by the possessor itself. The large weight of X^{L} Adj means that candidate (d), in which it retains lexical tone and does not apply its overlay to any targets, is worse than candidate (a), containing self-control. Candidates (e) and (h-j) are ruled out by the combined weights of phase-based faithfulness and X^{L} Adj. Fully faithful candidate (f) receives a large penalty score by maximally violat-

ing both construction constraints. Finally, candidate (g) violates both *SelfControl as well as phase-based faithfulness and is ruled out.

In Ben Tey, weighted constraints are required only to account for the single case of variation in (16). Constraint ranking can generate either output if the data are destochasticized. The Hasse diagram for the grammar choosing (16a) as winner is given in (19):

(19) Hasse diagram for Ben Tey



Summary of important points

- Possessive overlays are sensitive to syntactic structure and final tone of the possessor.
- Floating tones (tonal morphemes) differ from tonal overlays.
- Ident-OO(T)/Phase-Lex receives a larger weight than in other languages, leading to a difference in faithfulness between phases with lexical material and those without.

3.3.2 Jamsay

Jamsay has a number of interesting features that differentiate it from Tommo So. In this section, I will discuss the data and analysis of its lexical exceptions, L-toned possessive pronouns, unfaithful phases, and the interaction between possessive clitics and LOCALITY.

In §3.2.6 above, I discussed languages with lexical exceptions to regular possessive patterns. Jamsay is one such language. Segmental idiosyncrasies are found mostly in Jamsay where two kinship terms show a change to final [u] and four are suffixed in their possessed forms. An example of the former is given in (20a) and the latter in (20b):

(20) a. mì ^{HL}léjù (Jamsay)
1SG.PRO.L uncle
'my uncle' (/lèjé/)

b. mì ^{HL}tírɛ̀-n (Jamsay)
1SG.PRO.L grandparent-SG
'my grandparent' (/tìrɛ́/)

As stated above, these can be seen as subschemas of the general possessive schema. While the general schema has both the possessor and the possessed noun as a variable, in the subschema, the possessed noun is specified, along with its associated phonological changes in the phonological branch of the constructional schema. As with Ben Tey above, the construction constraint is calculated off the most general schema only (not specific subschemas), hence lexical exceptions are not represented specially in the constraint set below.

The examples above show that in Jamsay, inalienable pronominal possession is marked with a L-toned version of the independent pronoun immediately before the possessed noun. Compare the following series of pronouns:

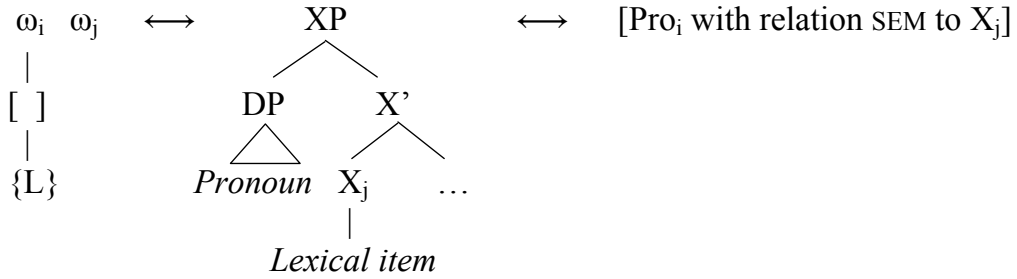
(21)

	Independent	Possessor
1sg	mí	mì
2sg	ú	ù
3sg	wó	wò
1pl	ɛ́mɛ́	èmɛ̀
2pl	é	è
3pl	bé	bè

The pronouns in the independent series (Heath 2008:149 "oblique") are used as direct objects, with postpositions, as focused pronominal subjects, and (with the exception of the 1sg and 2sg) as alienable possessors. The L-toned possessive form is also found as the subject of the verb in subordinated clauses (including relative clauses), where subject agreement suffixes are obligatorily absent.

How should L-toned possessive pronouns be encoded in the grammar? While we could posit two separate lexicalized series, with members of the L-toned series lexically inserted into possessive constructions and as the subject of subordinated verbs, I propose that the {L} overlay is, like tonosyntax, the result of a constructional schema. The following schema unifies the two contexts in which the pronoun undergoes lowering:

(22) Constructional schema for Jamsay L-toned pronouns



Inalienable possessors and regular (non-focused) subject pronouns share the same syntactic structure: they are both in the specifier of a lexical (not functional) XP. This schema states that when a pronoun is found in this syntactic position, it should be realized with {L} tone. I assume that focused subject pronouns do not fit this description, since they are moved to a functional focus projection. Alienable possessors likewise do not fit this description, since PossP is a functional projection, not a lexical projection like NP or VP. The constructional schema is specific to pronouns: nominal possessors/subjects do not take a {L} overlay in this context.

In this formulation, the tone of the possessive pronoun is dictated by a different construction from the one applying possessive overlays to possessed nouns. While it would be possible to combine the two (an inalienable possessive construction includes both a {HL} overlay on the noun and a {L} overlay on the pronoun), this would still require a separate construction to assign {L} to pronominal subjects in subordinate clauses, missing the generalization that the two have the same abstract syntactic structure. Given this analysis, a form like *mí* ^{HL}*léjù* 'my uncle' would fully satisfy the possessor's tonosyntactic constraint (the c-commanded noun takes {HL}) but violate the constraint on the form of the pronoun itself. Since there is (to my knowledge) no competing construction for the tone of the pronoun in these positions, it will always surface as {L}.

One force that could potentially block a {L} overlay on a pronoun would be phase-based faithfulness. These possessors and subjects are in DP phases. At the point when they are sent to spell-out, their broader syntactic context (where they are in a syntactic structure, i.e. in a lexical or functional projection) is not available, so they will simply be spelled out with lexical tone (H). Later, when merged with the rest of the structure in which they are a possessor or a subject and sent to spell-out, this H-toned form could be protected by phase-based faithfulness. As we will see, though, phase-based faithfulness is not active in Jamsay. Consider the configuration PossIP N Adj in Tommo So and Jamsay:

(23) a. PossIP N^{L} Adj (Tommo So)
ú bàbè^{L} mɔ̀ŋjú
2SG.PRO uncle ugly
'your ugly uncle'

b. {PossIP N}^{L} Adj (Jamsay)
{ù lèjù}^{L} mɔ̀ŋú
2SG.PRO uncle ugly
'your ugly uncle'

The adjective's {L} overlay is dominant in both languages, but in Jamsay, it is also applied to the possessor. This indicates a lower weight for phase-based faithfulness constraints in Jamsay than in Tommo So. Nonpronominal possessors are also subject to overlays, as shown in (24a); a possessor's usual effect, a {HL} overlay, is illustrated in (24b):

(24) a. {PossINonP N}^{L} Adj
{Sàydù lèjù}^{L} mɔ̀ŋú (Jamsay)
Seydou uncle ugly
'Seydou's ugly uncle'

b. PossINonP ^{HL}N
Sáydù ^{HL}léjù
Seydou uncle
'Seydou's uncle'

Thus, we know that the weights of both specific IDENT-OO(T)/PHASE and general IDENT-OO(T)/PHASE must be small, as the tableau in (25) shows for a schematic version of (24a):

(25)

/PossNonP N Adj/	*p* Obs	*p* Pred	*Score*	Id(T) 6.8	Id(T)/Ph 7.8	Poss ^{HL}X 17.9	X^{L} Adj 30.9	*SelfCont 24.2	Locality 35.7	Uniformity 9.9
a. {Poss$_1$ N}^{L2} Adj$_2$	1	∼1	21.4	2	1	0	0	0	0	0
b. Poss$_1$ ^{HL1}N Adj$_2$^{L2}	0	∼0	37.8	2	0	0	0	1	0	0
c. {Poss$_1$ N Adj$_2$}^{L2}	0	∼0	52.4	3	1	0	0	1	0	0
d. Poss$_1$ ^{HL1}N Adj$_2$	0	∼0	68.6	1	0	0	2	0	0	0
e. ^{HL1}Poss$_1$ N^{L2} Adj$_2$	0	∼0	76.5	2	1	0	1	1	0	0
f. Poss$_1$ N Adj$_2$	0	∼0	79.7	0	0	1	2	0	0	0
g. ^{HL1}{Poss$_1$ {N}^{L2}} Adj$_2$	0	∼0	86.4	2	1	0	1	1	0	1
h. Poss$_1$^{L2} ^{HL1}N Adj$_2$	0	∼0	88	2	1	0	1	0	1	0
i. ^{HL1}{Poss$_1$ N} Adj$_2$	0	∼0	107.4	2	1	0	2	1	0	0

Because phase-based faithfulness has such a small weight in Jamsay, the ideal candidate is (a), which satisfies both construction constraints without any violations of either *Self-Control, as in candidates (b,c,e), or Locality, as in candidate (g). Candidates (d), (f), and (h) derive most of their penalty score from X^{L} Adj, which is fully violated, due to the fact that the adjective retains its lexical tone yet does not impose its overlay on any c-commanded words.

The difference between Jamsay and Tommo So, then, can be seen in the weights of phase-based faithfulness compared to X^{L} Adj:

(26)

	Tommo So	Jamsay
Ident-OO(T)/Phase-Lex	2.2	7.8
Ident-OO(T)/Phase	42.9	7.8
X^{L} Adj	22.9	27.7

In Tommo So, IDENT-OO(T)/PHASE is much stronger than X^{L} ADJ, protecting possessors from an adjective's overlay; in Jamsay, the opposite is true. However, in both Jamsay and Tommo So, the weight of the lexically-specific faithfulness constraint is low (2.2 in Tommo So, 7.8 in Jamsay). This means that pronominal and nonpronominal possessors pattern together in both languages: In Tommo So, both are faithful, while in Jamsay, both can be controlled.

There is, however, a mystery in the lack of phase-based faithfulness. Only inalienable possessors can receive overlays, in the same way that they are the only possessors to **impose** overlays on the possessed noun. Alienable possessors do not participate tonosyntactically in any way. If we considered only nonpronominal possessors, we could explain this asymmetry through the constraint LOCALITY: the alienable possessor carries a possessive pronoun *mà*, which stands between the possessive DP and the possessed word string and could in principle block overlays from passing in either direction. This effect can be seen in the following:

(27) a. PossANonP POSS N (Jamsay)
Sáydù mà úró
Seydou POSS house
'Seydou's house'

b. PossANonP POSS N Dem (Jamsay)
Sáydù mà ùrò^{L} núŋò
Seydou POSS house this
'this house of Seydou's

The possessor *Sáydù* does not impose an overlay on the possessed noun in (27a). In (27b), the demonstrative's {L} overlay applies to the noun but does not apply to *Sáydù* despite the fact that it c-commands it.

If the possessor is plural, the plural particle *bé* is used, which blocks the use of the possessive particle *mà*; still, no overlay is applied:

(28) PossANonP PL N (Jamsay)
ìjú bé úró
dog PL house
'house of dogs'

In this case, we could claim that it is the plural particle blocking the application of overlays rather than the possessive particle.

However, this adjacency analysis begins to run into trouble: Jamsay alienable pronominal possessors are not followed by *mà*, yet they too cannot receive overlays from other controllers, nor do they impose overlays themselves. For example:

(29) a. PossAP N (Jamsay)
bé úró
3PL.PRO house
'their house'

b. PossAP N Dem (Jamsay)
bé ùrò^{L} núŋò
3PL.PRO house this
'this house of theirs'

No possessive particle intervenes between the possessor and the possessed noun, yet in (29a) no overlay applies.[7] Likewise, in (29b), we cannot say that the possessor is blocked from taking the demonstrative's overlay due the presence of *mà*. The 1sg alienable possessor *má* and the 2sg *á* 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 LOCALITY-based explanation. However, the other pronouns do not fit this description.

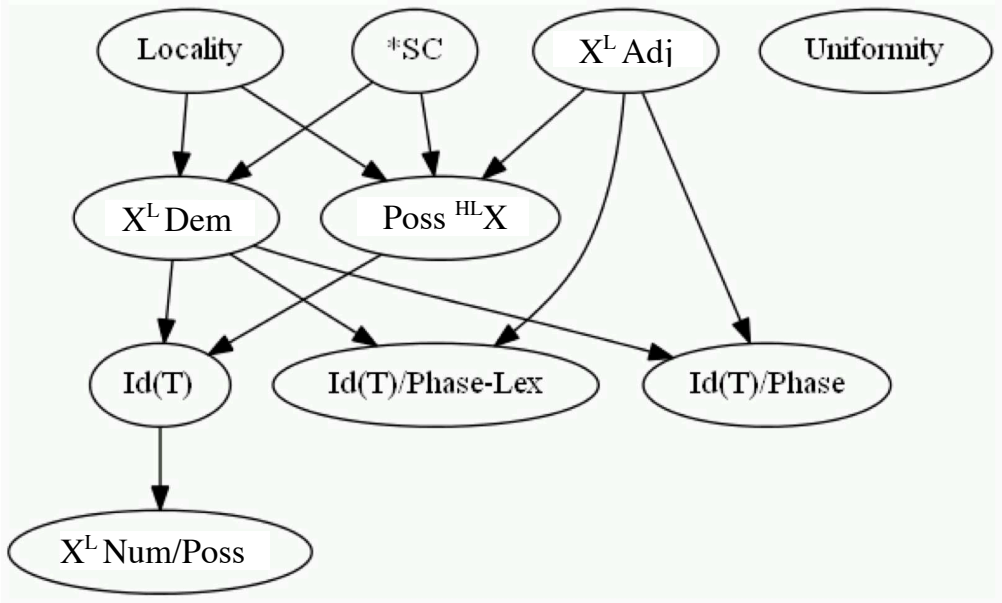
[7]It is almost certain that the plural particle *bé* and the 3pl pronoun *bé* are historically related; the question is whether they are synchronically linked such that the absence of *mà* following the plural particle follows directly from its absence with pronominal possessors.

It is likely that synchronically, there is simply no constructional schema for alienable possessors, pronominal or nonpronominal. The lexicalized constructional schema for Jamsay has in the syntactic branch only possessors occurring in the specifier of NP, i.e. inalienable possessors. This accounts for the lack of possessive overlays for alienable possessors.

A remaining issue is how to protect alienable possessors from taking overlays from other higher controllers. One possibility would be to find a reason why only DPs in the specifier of PossP project phases, though this seems unsupported by the literature on phases. If we were able to find such a reason, then phase-based faithfulness would need to be weighted very highly in Jamsay; inalienable possessors would take overlays because they are not spelled out as separate phases and hence are not subject to special faithfulness. Another possibility would be to posit abstract possessive morphemes even where they are not present that block the spread of overlays onto the possessor. In the absence of any evidence for abstract morphemes, I shy away from such an analysis here. I leave this mystery to be resolved in future work.

The Hasse diagram for Jamsay is given in (30):

(30) Hasse diagram for Jamsay



Summary of important points

- Lexical exceptions are attested with inalienable possession.
- Phase-based faithfulness is inactive.
- Possessive overlays can be blocked by a genitive morpheme; this effect is analyzed using LOCALITY.

3.3.3 Najamba

Najamba tonosyntax is among the most straightforward of any Dogon language. There are no variable outputs, no numeral-controlled overlays, and no self-control. If a controller is able, it imposes its overlay on c-commanded words; if it is blocked, it holds its peace.

We see this clearly in the context N PossAP Dem, the same context that shows variation in Tommo So. In Najamba, we find that this configuration surfaces with fully faithful tone; the demonstrative's overlay fails to apply:

(31)

N	PossAP		Dem
pɛ̀gɛ́	[ɔ́	yɛ̀]	ǒm
sheep	2SG.PRO	POSS.AN.SG	PROX.AN.SG

'this sheep of yours'

As in Tommo So, postnominal possessors are morphologically complex, consisting of a pronoun and a possessive classifier, which in Najamba agrees for animacy and number. The demonstrative, *ǒm*, would regularly control a {L} overlay (e.g. *pɛ̀gɛ̀*^{L} *ǒm* 'this sheep'), but it is unable to do so across the possessive construction. The following tableau illustrates why this fully faithful output is chosen, as opposed to one in which the demonstrative takes its own tone overlay, as in Tommo So:

(32)

/N PossAP Dem/	*p* Obs	*p* Pred	*Score*	Id(T) 8.4	Id(T)/Ph-Lex 2.5	Id(T)/Ph 22.9	X^L Dem 15.6	*SelfCont 30.3	Locality 15.3
a. N PossAP Dem	1	∼1	31.2	0	0	0	2	0	0
b. N PossAP Dem^L	0	∼0	38.7	1	0	0	0	1	0
c. N^L PossAP Dem	0	∼0	39.3	1	0	0	1	0	1
d. {N PossAP}^{L} Dem	0	∼0	42.2	2	1	1	0	0	0
e. N^L PossAP Dem^L	0	∼0	62.4	2	0	0	0	1	1
f. {N PossAP Dem}^{L}	0	∼0	80.9	3	1	1	0	1	0

Looking first at the difference between candidates (a) and (b), we see that candidate (a)'s two violations of X^L Dem actually outweigh candidate (b)'s single violation of *SelfControl. However, because candidate (b) does impose a tonal overlay, it incurs a violation of Ident-OO(T), adding 8.4 to its penalty score. As in Tommo So, candidates (b) and (c) are close in penalty score, since the combined weights of Locality and X^L Dem roughly equal a single violation of *SelfControl. Combined violations of phase-based faithfulness and either Locality or *SelfControl rule out candidates (d,f), while combined violations of *SelfControl and Locality rule out candidate (e).

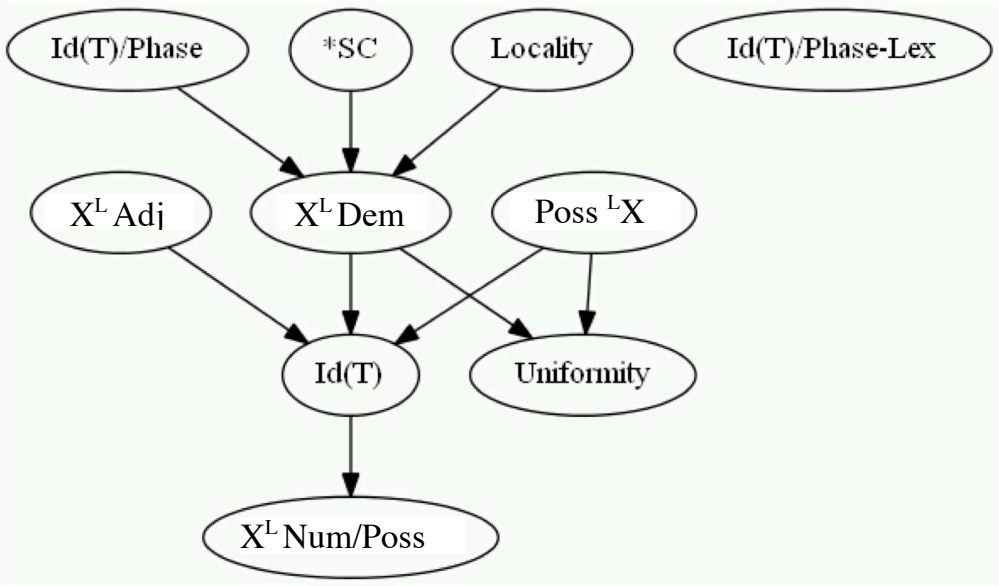
The tableau in (32) contains all of the same output candidates and constraints as the tableau for Tommo So. It is the relative weighting of these constraints that determines which tonosyntactic pattern is allowed to surface.

As this example shows, phase-based faithfulness is active in Najamba, but there is no distinction between pronominal and nonpronominal possessors. This is captured by the constraint weights for Ident-OO(T)/Phase and Ident-OO(T)/Phase-Lex: 22.9 and 2.5 respectively. In other words, the lexically-specific faithfulness constraint does not add

enough additional penalty to candidates in which nonpronominal possessors take a tonal overlay to differentiate them from pronominal possessors. This constraint could be removed from the grammar with no effect.

The Hasse diagram for Najamba constraints is given in (33):

(33) Hasse diagram for Najamba



3.3.4 Nanga

Nanga is one of the most tonosyntactically complex languages in the sample. Among other phenomena, it shows numeral-induced tone lowering (see §3.3.7 for more in-depth discussion), differing faithfulness to pronominal and nonpronominal possessors, and many cases of free variation, such as the following:

(34) a. PossIP ^{HL}N Adj (Nanga)
ú ^{HL}lésî mɔ̀sí
2SG.PRO uncle ugly
'your ugly uncle'

b. {ù lèsì}^{L} mɔ̀sí ({PossIP N}^{L} Adj, Nanga)

c. ú ^{HL}lésî mɔ̀sì^{L} (PossIP ^{HL}N Adj^{L}, Nanga)

In (34a), we see that the possessive overlay can trump that of the adjective. This is one of the cases of a syntactically higher controller overpowered by a lower controller, lending support to a constraint-based analysis rather than one based on syntactic hierarchy alone (as suggested by Green 2006 for cases of competition in Irish). The form in (34b) is the output seen in Jamsay, where the c-commanding adjective imposes {L} on both the noun and the possessor. The form in (34c) is more surprising. At first listen, it appears that the inalienable possessor has extended the domain of its {HL} overlay to include the adjective, despite the fact that it does not c-command it. However, this form is explained if we see the {L} on the adjective as being a case of self-control. The following tableau illustrates these three outputs:

(35)

/PossIP N Adj/	*p* Obs	*p* Pred	*Score*	Id(T) 7.1	Id(T)/Ph 20.6	Poss $^{(H)L}$X 21.0	X^{L} Adj 14.0	*SelfCont 20.0	Uniformity 11.7	Locality 12. 8
a. Poss$_1$ ^{HL1}N Adj$_2$^{L2}	.33	∼.53	33.3	2	0	0	0	1	0	0
b. {Poss$_1$ N}^{L2} Adj$_2$	.34	∼.28	34.2	2	1	0	0	0	0	0
c. Poss$_1$ ^{HL}N Adj$_2$	.33	∼.19	35.1	1	0	0	2	0	0	0
d. Poss$_1$ N Adj$_2$	0	∼0	49.0	0	0	1	2	0	0	0
e. Poss$_1$^{L2} ^{HL1}N Adj$_2$	0	∼0	61.6	2	1	0	1	0	0	1
f. {Poss$_1$ N Adj$_2$}^{L2}	0	∼0	61.9	3	1	0	0	1	0	0
g. ^{HL1}Poss$_1$ N^{L2} Adj$_2$	0	∼0	68.8	2	1	0	1	1	0	0
h. ^{HL1}{Poss$_1$ {N}^{L2}} Adj$_2$	0	∼0	80.5	2	1	0	1	1	1	0
i. ^{HL1}{Poss$_1$ N} Adj$_2$	0	∼0	82.8	2	1	0	2	1	0	0

It is worth noting in this tableau that the observed and predicted probabilities do not match as neatly as they have in previous tableaux. In reality, we do not have actual frequency data on the three surface variants, and so I assigned them equal probabilities of approximately one third. Given that these are randomly selected probabilities, I am not too concerned with the mismatch with predicted probabilities, though with a larger corpus of data with actual frequencies, it may turn out to be problematic.[8]

Candidates (a-c), the attested surface forms, have roughly equal penalty scores. We see that the weights of *SelfControl and Ident-OO(T)/Phase are almost the same, hence either method of satisfying the construction constraints (by self-control on the part of the adjective or by controlling the possessor, rendering its constraint moot) is equally viable. For candidate (c), X^{L} Adj is maximally violated. Two violations of this constraint would outweigh single violations of either phase-based faithfulness or self-control, but since candidate (c) has applied an overlay only to the noun, it incurs just a single violation of Ident-OO(T). Fully faithful candidate (d) violates both construction constraints, yielding

[8]Problematically, Heath (2013a) suggests that candidate (a) is the least frequent of the forms, despite having the highest predicted probability.

a total penalty of 49.0, while candidates (e-g) violate both *SelfControl and Ident-OO(T)/Phase, which makes them nearly twice as bad as candidates (a-b), which violate just one of the two.

As we can see, *SelfControl has a relatively smaller weight in Nanga than it does in other Dogon languages, making reabsorption of a tonal overlay a more likely outcome. However, we find an interesting interaction between phonological form and the probability of self-control. In Nanga, the phonological content of the possessive overlay depends on the final tone of the possessor: possessors ending in a H tone impose {HL} while L-final possessors impose {L} (spreading-type system, see §3.3.1 above for discussion of constructional analyses). In a context like PossNonP N Det (definite and demonstrative behaving the same way in Nanga), we find a single output option with H-final possessors (36a), but two output options for L-final possessors, (36b)-c:[9]

(36) a. PossANonP-H_1 ^{HL1}N Det$_2$^{L2}
yǎŋ$_1$ ^{HL1}ńdô ŋgù$_2$^{L2} (H-final possessor)
woman house INAN.DEF
'the house of a woman' (/ńdô/)

b. PossANonP-L_1 ^{L1}N Det$_2$^{L2}
Sùmǎylâ$_1$ ^{L1}ǹdò ŋgù$_2$^{L2} (L-final possessor)
Soumaila house INAN.DEF
'Soumaila's house'

c. PossANonP-L_1 ^{L1}N^{L2} Det$_2$
Sùmǎylâ$_1$ ^{L1}ǹdò^{L2} ŋgú$_2$ (L-final possessor)
Soumaila house INAN.DEF
'Soumaila's house'

[9]This is a case where lexical tone and grammatical tone are homophonous when the possessor's overlay is imposed.

In (36a), the only way for both the possessive overlay and the definite overlay to be realized is for the definite to take its own {L}. When the possessive overlay is {L}, however, we can either find self-control, as in (36b), or the two homophonous overlays can dock on the same word, as in (36c). This UNIFORMITY-violating output is not an option with H-final possessors, since the overlays are phonologically distinct. Variation between forms (b) and (c) arises from the interplay of UNIFORMITY, *SELFCONTROL, X^{L} DET, and general faithfulness. Form (b) violates *SELFCONTROL, with a weight of 20.0, and violates IDENT-OO(T) twice for each word with an overlay. This yields a total penalty score of 34.2. Form (c), on the other hand, violates UNIFORMITY (weight of 11.7) as well as X^{L} DET (weight of 15.4) once, since the determiner has lexical tone and yet does not impose an overlay on the possessor. These two constraints together outweigh *SELFCONTROL, but since IDENT-OO(T) is violated only once, the total penalty score comes to the identical 34.2.

The model does not fit the Nanga data perfectly. A few puzzles remain for future work. For example, the self-control output form of (34b) above is only reported in Heath (2013) for H-final possessors, yet the model predicts it for L-final possessors as well. Whether this is a gap in the data or a problem with the model is not clear. Additionally, a numeral's ability to control a {L} overlay in Nanga appears to only be triggered by pre-nominal possessors; in other words, in a context N Num PossAP, the output form is fully faithful, rather than a Yorno So-like N^{L} Num PossAP. It will take a deeper understanding of what drives a numeral to take on adjective-like qualities in certain contexts to explain the differences between possessive forms. I leave these puzzles for future work.

There is no possible Hasse diagram for Nanga. Even rendering the data nonstochastic, choosing every possible combination of single possible winners in cases of variation, the Constraint Demotion algorithm in OTSoft was unable to produce a ranking capable of accounting for the data. As with Tommo So, this is the result of ganging in determining the winning candidate. To take one example, consider the following inputs and outputs chosen for a non-stochastic grammar:

(37) a. PossIP-H_1 N Dem_2: PossIP-H_1 ^{HL1}N $Dem_2{}^{L2}$

b. PossIP-L_1 N Dem_2: PossIP-L_1 $^{L1}N^{L2}$ Dem_2

The output in (37b) violates X^L DEM once, because the possessor retains lexical tone. In order for this output to beat a candidate PossIP-L_1 ^{L1}N $Dem_2{}^{L2}$, *SELFCONTROL must outrank X^L DEM (since this competing candidate incurs no violations of X^L DEM). For (37a), an output mirroring that of (37b) is not available, since the two overlays are not homophonous and cannot be realized on the same word (in violation of UNIFORMITY). What we see is that in (37a), this output violating *SELFCONTROL beats an output PossIP-H_1 ^{HL1}N Dem_2 violating X^L DEM, opposite of the ranking determined for (37b).

Weighted constraints are able to model this situation by appealing to COUNTING-UP CUMULATIVITY: PossIP-H_1 ^{HL1}N Dem_2 violates X^L DEM twice, once for each c-commanded word. Though this constraint is weaker than *SELFCONTROL (i.e. it has a lower weight), two violations of it are enough to outweigh a single violation of *SELFCONTROL.

In every non-stochastic input I have attempted, OT fails, while maxent is able to construct a grammar. I suspect that in every case, this is due to ganging effects like those described here.

Summary of important points

- Numerals become controllers in the presence of possessors.
- A hierarchically lower controller can impose its overlay, while the higher controller undergoes self-control.
- UNIFORMITY plays a role in accounting for variation.

3.3.5 Toro Tegu

As mentioned in §3.2.5, and like Ben Tey (§3.3.1), Toro Tegu is a language in which the syntactic structure of the possessor (either simplex or complex) affects the choice of tonal overlays. In Toro Tegu, core NP possessors assign {L} to the possessed noun while complex NP possessors assign {HL}:

(38) a. ànú $^{\text{L}}$ìlò (Toro Tegu)
man house
'a man's house' (/íló/)

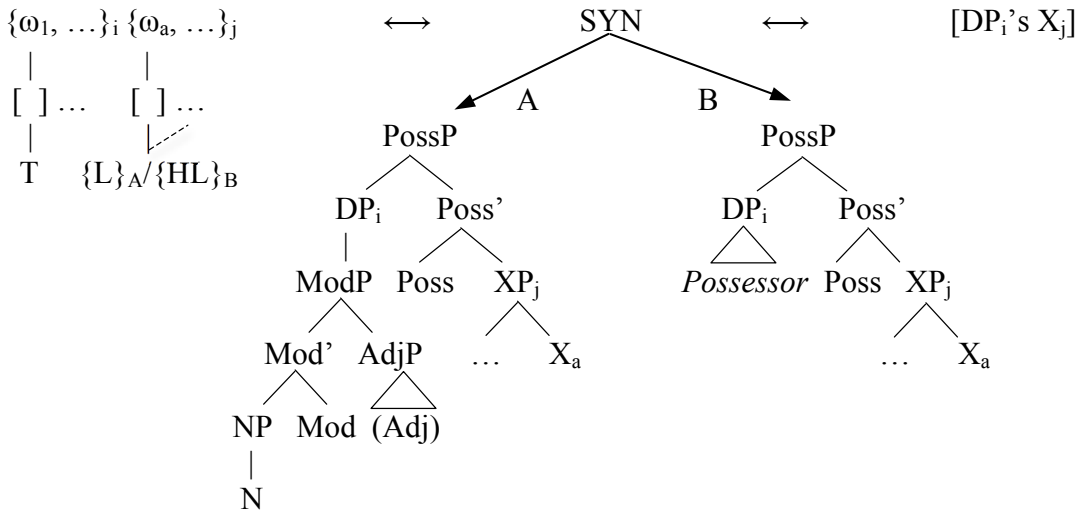
b. [ànù$^{\text{L}}$ ŋú] $^{\text{HL}}$ílò (Toro Tegu)
man this house
'this man's house'

As we can see, this choice between {L} and {HL} has nothing to do with the phonology of the syllable immediately preceding the possessed noun: both are H-toned *Nú*.

As argued in §3.3.1 on Ben Tey, I propose that this variation in syntactic structure be captured using subschemas, with the particular phonology ({L} overlay or {HL} overlay) coindexed with the appropriate syntactic branch:[10]

[10]This constructional schema represents alienable possessors in the specifier of PossP. I assume this in and of itself to be a subschema of a more general possessive construction encompassing both alienable and inalienable possessors, indicating only a DP c-commands material contained itself within a DP, corresponding to possessive semantics.

(39) Constructional schema for Toro Tegu non-pronominal possessors



The syntactic branch SYN bifurcates into two structures. Structure A is the more specific, where the possessor DP contains ModP and NP levels only (crucially nothing higher), with the adjective optional. Structure B is more general. As in other cases of schemas and subschemas, I assume a constraint only for the most general schema. Structures are evaluated based on the subschema they most closely fit. The phonological branch consists of the possessor's DP words, enclosed in $\{\ \}_i$, associated with regular segmental and tonal material.[11] The words c-commanded by the possessor, enclosed in $\{\ \}_j$, are associated with regular segmental material but either a {L} or {HL} overlay, depending on which syntactic subschema is used ({L} for A and {HL} for B). The semantic branch is the same, regardless of the syntactic structure involved.

Pronominal possessors in Toro Tegu pattern with complex possessors (and impose {HL}); in Ben Tey, they pattern with core NPs. As in the Ben Tey hierarchy of constructions in §3.3.1 above, I assume that the tonosyntactic behavior of the pronominal possessor is determined by

[11] This schema would have to be tweaked slightly to allow the possessor to contain its own tonal overlays. Specifically, it is not always the case that the first word of a possessor carries lexical tone T, as shown by (39b). It is simply the case that this constructional schema imposes no specific tonal requirements on the possessor itself.

its own constructional schema and is not due to any inherent connection between pronouns and syntactic complexity.

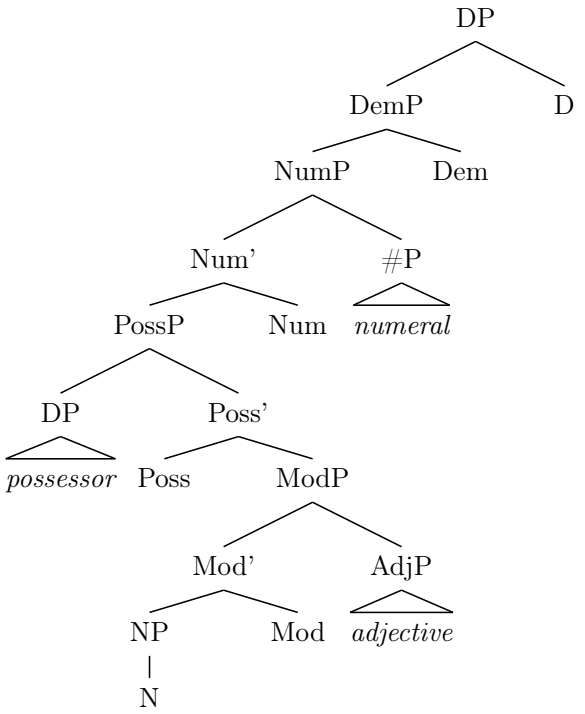
Toro Tegu has a constraint-based grammar that is very similar to that of Ben Tey: the possessive overlay always wins (no variation in Toro Tegu) and adjectives but not demonstratives self-control when not c-commanded by a higher controller.

The differences between the two languages arise in the syntactic structure of possessors. First, tonal and morphological evidence suggests that there is no difference between alienable and inalienable possession in Toro Tegu. Tonal evidence also suggests that NumP is syntactically higher than the possessor, an unusual outcome in the Dogon languages:

(40) PossAP $^{H(L)}$N Num (Toro Tegu)
m̀ ^{HL}árzàgà tààlí
1SG.PRO animal three
'my three animals'

If the numeral were below PossP in the syntactic structure, the possessor would c-command the numeral and include it in the {HL} overlay; as we can see in (40), though, the numeral retains lexical tone. The literature on the alienable vs. inalienable distinction in possessors sometimes shows PossP below NumP (e.g. Dobler 2008), and it may well be that this is a language-specific parameter in the Dogon languages. I assume the following syntactic structure for Toro Tegu, with constraint violations dependent on c-command assessed on this basis:

(41)



All possessors, regardless of alienability, are in the specifier of PossP.

A tableau illustrating (40) is given in (42), leaving out X^{L} NUM/POSS, which has a weight of 0 in Toro Tegu:

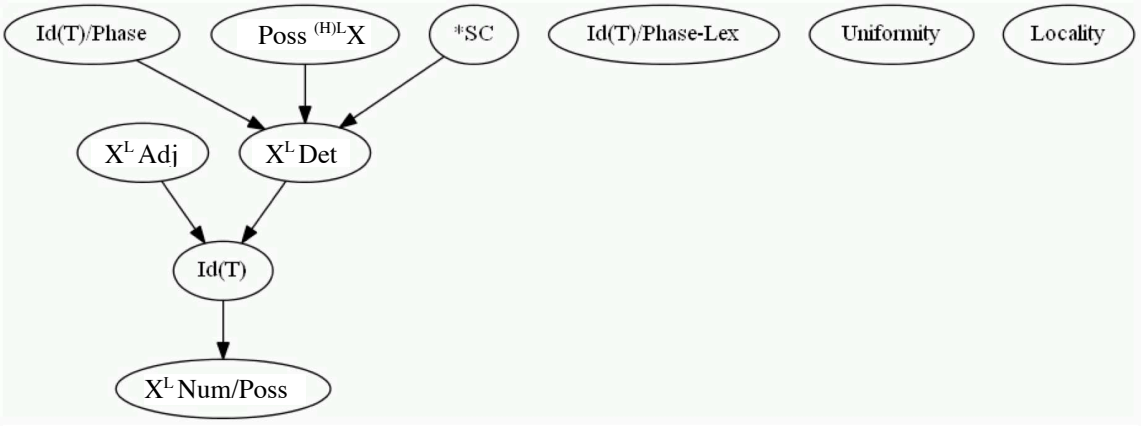
(42)

/PossAP N Num/	*p* Obs	*p* Pred	*Score*	ID(T) 7.4	ID(T)/PH 28.7	POSS $^{(H)L}$X 23	*SELFCONT 29.3	LOCALITY 3.2
a. Poss $^{(H)L}$N Num	1	∼1	7.4	1	0	0	0	0
b. Poss $^{(H)L}${N Num}	0	∼0	14.8	2	0	0	0	0
c. Poss N Num	0	∼0	23	0	0	1	0	0
d. Poss N $^{(H)L}$Num	0	∼0	33.6	1	0	1	0	1
e. $^{(H)L}$Poss N Num	0	∼0	65.4	1	1	0	1	0

Winning candidate (a) incurs only a violation of general IDENT-OO(T) for the possessed noun; the possessor's constraint is satisfied, since the noun is the only c-commanded word. In candidate (b), the domain of {(H)L} is superfluously extended to a non-c-commanded word, incurring another violation of IDENT-OO(T); this candidate is also conceptually problematic, based on the assumption in Chapter 2 that controllers only see c-commanded words. Fully faithful candidate (c) receives a penalty score of 23, the weight of one violation of the possessor's constraint. Candidate (d), like candidate (b), imposes the {(H)L} overlay on the numeral; not only is POSS $^{(H)L}$X not satisfied, but this candidate also incurs a violation of LOCALITY for skipping over the noun. Finally, candidate (e) satisfies POSS $^{(H)L}$X with the possessor taking its own overlay, incurring violations of the strong constraints IDENT-OO(T)/PHASE and *SELFCONTROL.

The Hasse diagram representing constraint rankings for Toro Tegu is given in (43):

(43) Hasse diagram for Toro Tegu



3.3.6 Yanda Dom

Yanda Dom displays two of the factors in §3.2.6 affecting the choice of possessive overlay: lexical exceptions and tonal melody of the possessor.

As mentioned in §3.2.6, Yanda Dom displays a special case of lexical exceptions to regular possessive patterns, where kinship terms fall into two arbitrary lexicalized classes regarding which overlay they take when possessed: a class that takes {LH} and a class that takes {H}. With the exception of monosyllabic CV: nouns, all of which belong to the {H} class, there is no a priori way to tell which overlay a noun will take. Examples of each class are given below:

(44)

a. *{LH} class*

LHlèzú	(/lèzù/)	'uncle'
LHdìmbú	(/dìmbú/)	'concubine'

b. *{H} class*

Hɔ́zɔ́	(/ɔ̀zɔ̀/)	'younger sibling (same sex)'
Hdéé-nɛ́	(/dèè-nɛ́/)	'father's younger brother'

The first example in each class is a lexically L-toned disyllabic noun. The second example is a lexically LH-tone disyllabic noun (though the example in the {H} class is morphologically complex, consisting of the word for 'father' and a suffix).

While an analysis like that given for Jamsay exceptions in §3.3.2, with subschemas for specific words, could account for the data, it misses the generalization that there are two tonal classes; that is, there is no default case from which the "exceptions" deviate. Instead, it may be the case that kinship terms are diacritically marked as belonging to one of two classes, corresponding to two phonological subschemas in the general constructional schema for possession. Regardless of whether subschemas are diacritically marked or lexically listed for particular lexical items, the possessive construction constraint Poss $^{(H)L}$X refers only to the top of the possessive hierarchy; thus, the constraint-based analysis is not affected by our analytical choice of subschemas.

The other factor affecting the choice of tonal overlay in Yanda Dom is the overall tonal form of the possessor, operative in the case of alienably possessed nouns. In particular, if the possessor contains a H tone anywhere, the possessive overlay is {L}; if it is lexically /L/ (which is possible in Yanda Dom), the overlay is {H(L)}. This is shown in (45) with the possessed noun *àŋǎy* 'manner':[12]

[12]Example (c) constructed based on analagous *Sǎydù* ^{L}*ʔàlò* 'Seydou's house' (cf. /ʔálɔ́/).

(45) a. pɛ̀ɛ̀ $^{H(L)}$áŋáy (Yanda Dom)
sheep manner
'a sheep's manner'

b. ʔə́né ^{L}àŋày (Yanda Dom)
goat manner
'a goat's manner'

c. Sădù ^{L}àŋày (Yanda Dom)
Seydou manner
'Seydou's manner'

In (45a), where the possessor is L-toned *pɛ̀ɛ̀* 'sheep', the possessed noun is overwritten with {H}; in (45b), which the possessor is H-toned, the possessed noun takes {L}. The overlay is written as {H(L)}, since if other modifiers fall in the c-command domain of the possessor, they receive {L} rather than {H}, suggesting a {HL} overlay with the tone break located at a word boundary:

(46) a. yɛ̀ ^{HL} {ʔə́ló pìlɛ̀} wò (Yanda Dom)
woman house white DEF.INAN.SG
'the white house of a woman' (/ʔə́ló/, /pílɛ́/)

The noun takes all {H} (regardless of syllable count), while the adjective receives {L}.

As Heath (2012c) points out, one is tempted to treat the {H} overlay on the possessed noun as phonological rather than tonosyntactic. After all, the language has an active process of Rhythmic Tone-Raising that causes the first syllable (or mora of a heavy syllable) of certain words and functional elements to raise to H after a L-toned constituent. In fact, the possessive particle *ŋ̀* is one such undergoer, being realized as H after an all L possessor (raising indicated with an up arrow)

(47) a. zɔ̀mɔ́ ŋ̀ ^{L}mɛ̀nɛ̀ (Yanda Dom)
hare POSS field
'hare's field' (/mɛ̀nɛ̀/)

b. Sǎydù ŋ̀ (Yanda Dom)
Seydou POSS
'Seydou's (thing)'

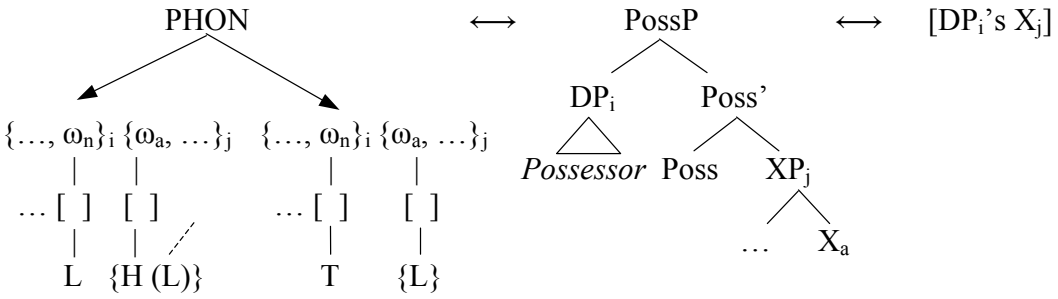
c. tàà ↑ŋ́ ^{L}mɛ̀nɛ̀ (Yanda Dom)
hyena POSS field
'hyena's field'

The example in (47b) is a headless possessive construction, but is included to illustrate that the L-toned realization of *ŋ̀* does not depend on the adjacency of a H tone. Heath argues that the {H(L)} overlay of possession is not the result of Rhythm Tone-Raising, since we find H tone across the whole word, rather than simply the initial syllable.

The examples in (47), however, bring up an interesting problem, first pointed out in §3.2.4. In both cases, the possessive overlay is {L}. In (47a), this is as expected, since the possessor contains a lexical H tone. In (47b), on the other hand, the H tone is ostensibly the result of a phonological process, which we would expect to be ordered after the morphological component responsible for assigning tonal overlays (assuming a division of these two components). This apparent ordering contradiction would be resolved if morphology and phonology were assessed concurrently by the grammar.

The constructional schema for Yanda Dom possessives, assuming the choice between {L} and {H(L)} is a tonosyntactic (i.e. morphological) one, would look like the following:

(48) Phonological subschemas for Yanda Dom possessive construction



The phonological branch bifurcates into a subschema for L-toned possessors (with a {H(L)} associated overlay, with the {L} portion associating only when there is a following word) and a more general subschema with a {L} overlay. Like other cases of tonosyntactic variation within a construction, I account for this with subschemas, leaving just a single possessive constraint for alienable possession Poss $^{(H)L}$X.

The constraint-based analysis of Yanda Dom presented in this subsection is preliminary, as we do not yet have a deep grasp of the tonosyntactic system and the factors that drive variation. Nevertheless, the language displays some other interesting features beyond those affecting possessive overlays that merit consideration here, with full analysis pending.

In most regards, Yanda tonosyntax resembles that of other languages: phase-based faithfulness is active, protecting possessors from demonstrative or adjectival overlays, non-possessive overlays from the demonstrative and adjective trump possessive overlays, etc. However, one unusual morphological aspect of the language leads to tonosyntactic consequences: the existence of prefixes on numerals, which variably resist taking tonal overlays (even when the numeral succumbs). Consider the following examples:

(49) a. {ʔənɛ̀ jèmɛ̀ à-kùlɛ̀}^{L} ɔ̀míy^{n}ɛ̀ (Yanda Dom)
goat black AN-six these
'these six black goats' (/ʔánɛ́/, /jèmɛ́/, /á-kúlé)

b. ʔənɛ̀^{L} jèmɛ́ [á-]kùlɛ̀^{L} ɔ̀mí́y^{n}ɛ̀ (Yanda Dom)
goat black AN-six these
=(a)

In (49a), the demonstrative imposes its {L} overlay across the board on all c-commanded words, including the numeral's animate prefix *á-*. In (49b), the prefix resists the overlay (shown in brackets [ ]), which acts as a barrier;[13] the demonstrative overlay applies only to the numeral stem but not to the adjective or noun.

It is unclear why prefixes resist overlays. I suspect there is a principled morphosyntactic reason for this resistance but leave this reasoning to future work. For the time being, as a stop-gap measure, I use IDENT-OO(T)/PREFIX as a stand-in for whatever a more adequate analysis would be. Under this view, we find that the variation in (49) arises from the interaction between this faithfulness constraint and LOCALITY, which requires tonosyntactic domains to be uninterrupted. The following tableau represents the simpler case of N Pre-Num Dem, without an adjective:

[13]Interestingly, the prefix can block the continued application of overlays even when it is itself L-toned, i.e. phonetically identical to the form with an overlay. For example: *ʔəlɔ̀^{L} jèmɛ́ ⌈yè-⌋kùlɛ̀^{L} ɛ̀ɛ́* 'these six black houses'.

(50)

/N Pre-Num Dem/	*p* Obs	*p* Pred	*Score*	Id(T) 6.9	Id(T)/Pre 13.7	X^L Dem 20.6	*SelfCont 35.4	Locality 20.8
a. {N Pre-Num}^{L} Dem	.5	∼.5	27.5	2	1	0	0	0
b. N [Pre]-Num^L Dem	.5	∼.5	27.5	1	0	1	0	0
c. N^L [Pre]-Num^L Dem	0	∼0	34.6	2	0	0	0	1
d. N Pre-Num Dem	0	∼0	41.2	0	0	2	0	0
e. N Pre-Num Dem^L	0	∼0	42.3	1	0	0	1	0
f. N^L Pre-Num Dem	0	∼0	48.3	1	0	1	0	1
g. N Pre-{Num Dem}^{L}	0	∼0	49.2	2	0	0	1	0
h. {N Pre-Num Dem}^{L}	0	∼0	69.8	3	1	0	1	0

In this tableau, prefixes do not incur independent violations of Ident-OO(T), nor do they incur separate violations of X^L Dem. This is an arbitrary analytical choice, and the system can also be modeled with the opposite assumptions. Candidates (a) and (b) are in free variation. Candidate (a) violates Ident-OO(T)/Prefix but candidate (b), which applies the overlay only to the numeral and not beyond, incurs one violation of X^L Dem. Locality rules out candidate (c), which fully satisfies the demonstrative's constraint while leaving Ident-OO(T)/Prefix unviolated; a similar situation holds in candidate (f), where only the noun takes a {L} overlay, skipping over the noun. Candidate (d), fully faithful, incurs two violations of X^L Dem. Candidates (e) and (g-h) are all ruled out by *SelfControl, the weight of which is greater than the penalty scores of winning candidates (a) and (b).

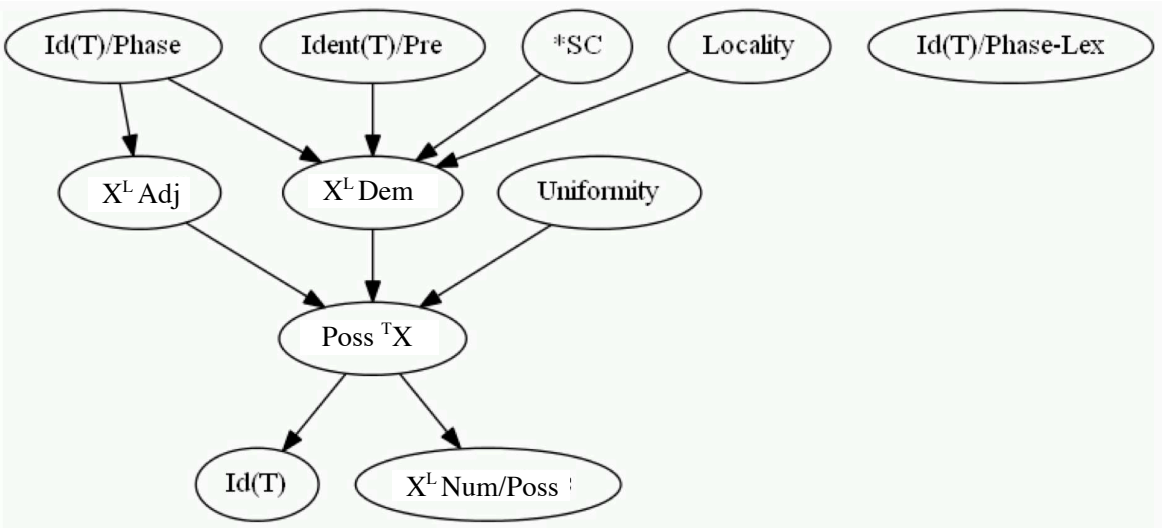
Certain data questions remain about Yanda Dom. For example, Heath (2012) reports that with animate plural nouns, suffixed with *-mù*, the numeral prefix is redundant and can be optionally omitted. This analysis would predict that in forms with the prefix omitted, the demonstrative would always be able to control both the numeral and the noun (since

there is no chance of a LOCALITY violation), but we do not have enough data to confirm this prediction. If overlays still do not apply, it may be further evidence for blocking by a null element, as suggested for Jamsay alienable pronominal possessors (see §3.3.2).

Future work will seek a principled explanation for the behavior of the prefix instead of the ad hoc analysis given here. I have included Yanda Dom in this study simply to show the effects of LOCALITY in another language, even though the reasons for the prefix's faithfulness are as of yet unclear.

In computing the Hasse diagram from Yanda Dom, I removed variation by specifying only the output N Pre-Num^{L} Dem as winner; in other words, the following Hasse diagram represents a grammar in which tone control never crosses over a numeral's prefix, visible in the undominated ranking of IDENT(T)/PRE(FIX) and LOCALITY and by the ranking of IDENT(T)/PRE over X^{L} DEM. However, it should be noted that both outputs were generable in an OT grammar:

(51) Hasse diagram for Yanda Dom



Summary of important points

- Inalienable nouns fall into two lexical classes, which differ in their tonal behavior under possession.
- The choice of possessive overlay (on alienable nouns) can depend on the broad tonal form of the possessor (not just the final tone).
- Prefixes resist tonal overlays and can block overlays from applying to lower words in the tree (due to LOCALITY).

3.3.7 Yorno So

Yorno So differs from Tommo So primarily in the fact that it displays contingent control with the numeral. As first described in §3.2.2, we find that numerals become controllers in the presence of a possessor. In simple combinations with nouns, numerals are non-controllers, as in all Dogon languages that we have worked on:

(52) N Num (Yorno So)
gɛ̀r^{n}ɛ́ kúlòy
house six
'six houses'

When a possessor is added, the numeral is able to impose a {L} overlay. This is shown in (53) with an inalienable pronominal possessor:

(53) a. PossIP ^{L}N (Yorno So)
mú ^{L}nàà
1SG.PRO mother
'my mother' (cf. /náá/)

b. {PossIP$_1$ N}^{L2} Num$_2$ Def (Yorno So)
{mù$_1$ nàà}^{L2} kúlòy$_2$ gɔ-m
1SG.PRO mother six DEF-PL
'my six mothers'

As shown in (53b), the {L} overlay encompasses both the noun and the inalienable pronominal possessor. The numeral also takes on tone control abilities when combined with an alienable pronominal possessor, which is not by itself a controller:

(54) a. N PossAP (Yorno So)
gɛ̀r^{n}ɛ́ wò-mɔ̀
house 3SG.PRO-POSS
'his house'

b. N^{L} Num PossAP (Yorno So)
gɛ̀r^{n}ɛ̀^{L} kúlòy wò-mɔ̀
house six 3SG.PRO-POSS
'his six houses'

Why should a non-controller like a numeral take on tone control properties in the presence of a possessor? It turns out that in many Dogon languages, numerals take on certain aspects of adjectives in the presence of reference restrictors, including possessors. For example, in Tommo So, as in many other Dogon languages, adjectives and numerals can be inverted when triggered by a definite determiner, demonstrative, possessor, or relative clause. The examples in (55) illustrate this using a definite determiner:

(55) a. N^{L} Adj Num (Tommo So)
gàmmà^{L} gɛ́m tààndú-go
cat black three-ADV
'three black cats'

b. *{N Num}^{L} Adj (Tommo So)
*{gàmmà tààndù-gò}^{L} gɛ́m
cat three-ADV black
(=a)

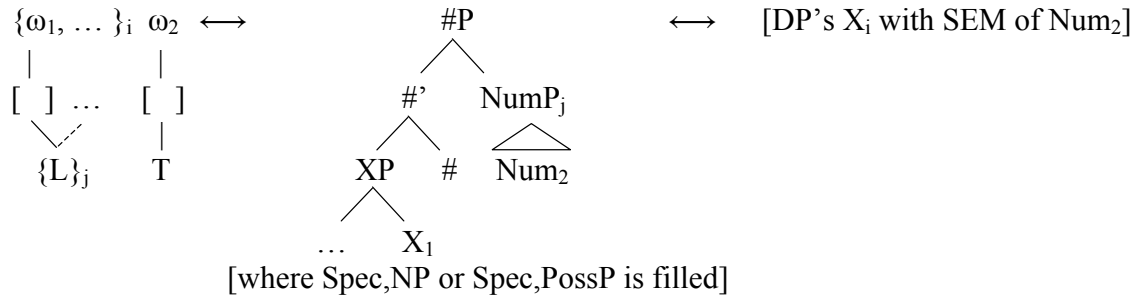
c. N^{L} Adj Num=Def=Pl (Tommo So)
gàmmà^{L} gɛ́m tààndú-go=gɛ=mbe
cat black three-ADV=DEF=PL
'the three black cats'

d. {N Num}^{L} Adj=Def=Pl (Tommo So)
{gàmmà tààndù-gò}^{L} gɛ́m=gɛ=mbe
cat three-ADV black=DEF=PL
(=c)

Example (55b) shows that Adj-Num inversion is ungrammatical in the absence of a determiner; the definite determiner in (55d) licenses this behavior. However, we do not want to go so far as to say that the numeral becomes syntactically an adjective, since morphological properties remain distinct between the two categories. This can be seen above in the presence of the suffix *-go* on the numeral, which never appears on adjectival modifiers.

The numeral's unusual tone control properties in the presence of a possessor may be related to the the phenomenon of adjective-numeral inversion. For the time being, I analyze this behavior as being the property of the specific constructional schema shown (56), encapsulated in the constraint X^{L} NUM/POSS.

(56) Constructional schema for possessor-induced numeral tone control



The syntactic branch states the condition that either the specifier of NP (inalienable possession) or the specifier of PossP (alienable possession) must be filled or the conditions of the constructional schema are not met. This schema says nothing about the possessor's tonal overlays, which are encapsulated in possessive schemas. This means that the numeral's overlay may be in conflict with the possessor's overlay, since each constructional schema corresponds to a constraint.

Example (53b) is exemplified in the tableau in (57) (leaving off the definite determiner in the schematization, since it has no tonal effect):

(57)

/PossIP N Num/	*p* Obs	*p* Pred	*Score*	Id(T) 8.4	Id(T)/Ph 7.3	PossIP ^{L}X 17.9	X^{L} Num/Poss 15.7	*SelfCont 23.1	Locality 2.4	Uniformity 7.9
a. {Poss$_1$ N}^{L2} Num$_2$	1	∼1	24.1	2	1	0	0	0	0	0
b. {Poss$_1$ ^{L1}N}^{L2} Num$_2$	0	∼0	32	2	1	0	0	0	0	1
c. Poss$_1$ ^{L1}N^{L2} Num$_2$	0	∼0	34.2	1	0	0	1	0	0	1
d. Poss$_1$ ^{L1}N Num$_2$	0	∼0	39.8	1	0	0	2	0	0	0
e. Poss$_1$ ^{L1}N Num$_2$^{L2}	0	∼0	39.9	2	0	0	0	1	0	0
f. Poss$_1$ N^{L2} Num$_2$	0	∼0	42.0	1	0	1	1	0	0	0
g. Poss$_1$^{L2} N^{L1} Num$_2$	0	∼0	42.2	2	1	0	1	0	1	0
h. Poss$_1$ N Num$_2$	0	∼0	49.3	0	0	1	2	0	0	0
i. {Poss$_1$ N Num$_2$}^{L2}	0	∼0	55.6	3	1	0	0	1	0	0
j. ^{L1}{Poss$_1$ N} Num$_2$	0	∼0	78.6	2	1	0	2	1	0	0
k. Poss$_1$^{L1} {N Num$_2$}^{L2}	0	∼0	78.7	3	1	0	0	2	0	0
l. ^{L1}{Poss$_1$ N} Num$_2$^{L2}	0	∼0	78.7	3	1	0	0	2	0	0
m. ^{L1}{Poss$_1$ {N} Num$_2$}^{L2}	0	∼0	86.6	3	1	0	0	2	0	1

Because Ident-OO(T)/Phase has a small weight, the winning candidate shows the numeral's {L} overlay on both the noun and the possessor. Candidate (b) is homophonous with candidate (a), but includes a Uniformity violation for the noun; note that this candidate is also conceptually problematic, since by virtue of taking the numeral's {L} overlay, the possessor would no longer have its own overlay to apply. Any candidate with SelfControl is ruled out (e, i-m), since violating *SelfControl entails a violation of Ident-OO(T), and this combined penalty score is larger than that of candidate (a). Candidates (d) and (f) are ruled out due to multiple violations of construction constraints (Poss ^{L}X and/or X^{L} Num/Poss).

Because X^{L} Num/Poss has a competitive weight, numerals are able to impose {L} overlays in the presence of a possessor in Yorno So, which they are unable to do in Tommo So

and Jamsay, where the constraint has a weight of 0.[14] Yorno So also gives us evidence for the distinction between IDENT-OO(T)/PHASE and IDENT-OO(T)/PHASE-LEX, as non-pronominal possessors do not take overlays:

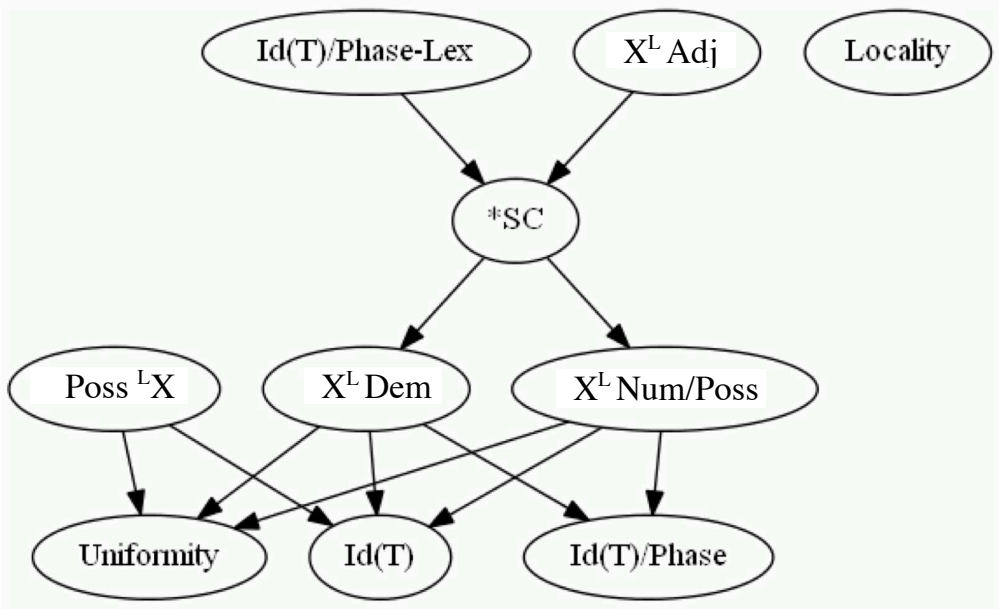
(58) PossINonP$_1$ ^{L1}N^{L2} Num$_2$ Def (Yorno So)
Sáydù ^{L}nàà^{L} kúlòy gɔ-m
Seydou mother six DEF-PL
'Seydou's six mothers'

In this language, general IDENT-OO(T)/PHASE has a small weight (7.3, less than general IDENT-OO(T)), allowing pronominal possessors to take overlays, but nonpronominal possessors are additionally penalized by IDENT-OO(T)/PHASE-LEX, which carries the large weight of 23.5.

In (59), I give the Hasse diagram for Yorno So constraints:

[14] In reality, I would argue that languages like Tommo So and Jamsay simply do not have the constraint X^{L} NUM/POSS in the grammar, since there is no evidence for it in the learning data. For the sake of consistency in the constraint set, though, I have included it in my modeling, where it receives a weight of 0. Indeed, any unmotivated constraint should receive a weight of zero or near-zero in a maxent grammar, and hence there is no harm in including them when modeling.

(59) Hasse diagram for Yorno So



3.3.8 Tiranige

The previous seven languages could be accounted for using more or less the same constraint-based grammar used for Tommo So. With Tiranige, however, we depart from the familiar patterns of Dogon tonosyntax, and this departure necessitates new theoretical tools. As first mentioned in §3.2.3, Tiranige motivates the addition of construction constraints based on **linear adjacency** rather than c-command. From a diachronic perspective, we can view linear effects as being just another way in which erstwhile phrasal phonology was restructured into a morphological system; some languages reinterpreted tonal changes as being sensitive to syntactic structure, while others (Tiranige, and to a certain extent Togo Kan) reinterpreted them as being sensitive to adjacent words.

Let us first consider a noun with a single modifying element. Unlike most Dogon languages, where the c-commanding modifier to the right imposes a tonal overlay on the noun to its left, the only right-to-left case we find in Tiranige is a noun modified by a single adjective. Other overlays apply to non-head material (to the right of the noun). Finally, the definite

may not be a case of tonosyntax at all, but rather simple phonological concatenation; see the discussion before (63). The basic patterns are summarized in the following table:

(60)

	Schema	Example	Lexical tones
Lefthand overlays:	N^{L} Adj	ìŋjɛ̀^{L} jɛ́mɛ́ 'black dog'	ííŋjɛ́ 'dog'
Righthand overlays:	N Num^{L}	ííŋjɛ́-gé tààndì^{L} 'three dogs'	táándí 'three'
	N Dem^{L}	ííŋjɛ́ mbò^{L} 'this dog'	mbó 'this'
	N 'all'^{L}	jíwá-gé cìmà^{L} 'all houses'	címà 'all'
Other:	$N^{+L/H}$ Def	ííŋjɛ̀$^{+L}$ rì 'the dog'	ííŋjɛ́ 'dog'

The only modifier that does not take a {L} tone following a noun is the adjective, which instead imposes {L} on the noun, looking just like any other Dogon language. Numerals (including 'one'), demonstratives, and 'all' take a {L} overlay following the noun. Definites are already L-toned, but it may be the case that this too is the result of an overlay; since the definite has no absolute form, used in the absence of a noun, we cannot test this. Note that the superscripted +L/H with the definite refers to the definite determiner's floating tone, exemplified in (63) below.

From these data, I propose the following two **linear** construction constraints:[15]

(61) a. N^{L} Adj (Lin): In a sequence N Adj, assess a violation when the N does not have {L} and the adjective does not have lexical tone.

b. X Mod^{L} (Lin): Assess a violation for every modifier following a word (X) in the DP that does not take {L}.

[15]In the analysis that follows, I mark linear constraints with Lin in all tableaux to clearly differentiate them from the c-command constraints of other languages.

The constraint in (61a) is fully specified (i.e. there are no variables); in (61b), the constraint contains a completely unspecified variable X and a variable Mod that stands in for any non N lexical head in the DP. Except in the case of X, which is fully variable, the desired tonal output is always specified in the constraint. That is, N^{L} Adj (Lin) does not mean a L-toned noun and an adjective with any tone, but rather a L-toned noun and an adjective with lexical tone. Any deviation in the output candidate results in a violation.

It should be noted that tonal overlays in Tiranige do not appear to adhere to the notion of "controller", as they do in other Dogon languages. That is, in the N^{L} Adj case, I do not consider the adjective to be the controller of {L}, since this overlay only appears on nouns in this precise configuration. Rather, overlays in Tiranige (represented neutrally as a superscript to the right) are very much an output property of the particular bigram construction, dependent both on the identity of the word taking the overlay and a neighboring word.

Let us examine a tableau for the input N Adj, which exemplifies the variation between the previous two constraints. As before, Ident-OO(T) is included to penalize deviations from isolation tone:

(62)

/N Adj/	*p* Obs	*p* Pred	*Score*	Id(T) 7	N^{L} Adj (Lin) 17.7	X Mod^{L} (Lin) 15.3
a. N^{L} Adj	1	∼1	22.3	1	0	1
b. N^{L} Adj^{L}	0	∼0	31.7	2	1	0
c. N Adj	0	∼0	33	0	1	1
d. N Adj^{L}	0	∼0	42.4	1	2	0

The winning candidate (a) violates IDENT-OO(T) once and X MOD^{L} (LIN) once, because the adjective retains lexical tone. However, this configuration fully satisfies N^{L} ADJ (LIN). Candidate (b) fully satisfies X MOD^{L} (LIN) because the adjective takes {L}, but it only half-satisfies N^{L} ADJ (LIN) because of it.[16] In fully faithful candidate (c), both construction constraints incur a violation (N^{L} ADJ (LIN) for the noun and X MOD^{L} (LIN) for the adjective), while candidate (d), which fully satisfies X MOD^{L} (LIN), incurs the highest penalty score because it reverses the desired tones of N^{L} ADJ (LIN). We will see below in (66) that only the adjective adjacent to the noun is required to have lexical tone; a second adjective can satisfy the requirements of X MOD^{L} (LIN).

Before turning to multiword sequences (a noun with multiple modifiers), let us briefly consider the form of the definite determiner. As I suggested above, a N Def sequence may contain no tonal overlays at all; the fact that the definite morpheme *rì* is L-toned may be due its own lexical tone. However, the definite does affect the tone of the preceding word due to the presence of a floating tone in its lexical representation (possibly ´ *rì*). In the table above, this was indicated with +L or +H superscripted after the noun, indicating that the floating tone has docked at the right edge of the noun. The choice between H and L appears to be driven by polarity, though other phonological constraints (e.g. *HLH, *Contour) can suppress the floating tone altogether. In other words, a simple N Def sequence may require no special constructional schema, being completely predictable based on the phonological concatenation of the noun and the definite.

The pattern we find in Tiranige is as follows: the floating tone is realized as L after a H-toned word and as H after a L-toned word (tone polarity); in each case, the floating tone docks to the right edge, replacing the tone of the final syllable. Some examples of tonal changes found with definite are as follows:

[16]Note that in this model, overlays are not considered to be triggered by a controller in the same way as in the other Dogon languages, but are rather a property of the construction. Thus, the adjective does not lose the ability to control {L} in candidate (b), because the {L} overlay is a property of the whole construction, not a part of a controller.

(63) a. náá-gè$^{+L}$ rì (Tiranige)
cow-PL DEF
'the cows' (/náá-gé/)

b. kɔ́ŋjɛ̀$^{+L}$ rì (Tiranige)
beer DEF
'the beer' (/kɔ́ŋjɛ́/)

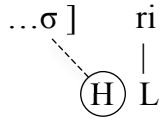
c. ìjó$^{+H}$ rì (Tiranige)
village DEF
'the village' (/ìjò/)

In these examples, the floating tone is indicated as a superscript with a +, contrasting with the replacive overlay notation which is a tone all on its own. Thus, *word*^{T} would be a word taking a {T} replacive overlay while *word*$^{+T}$ would be a word taking a floating T at its right edge (leaving other lexical tones intact). The closest parallel to the Tiranige definite system is once again found in Togo Kan, where the definite determiner is solely a tonal morpheme, a floating L that docks to the right edge of the preceding word; it is not affected by the lexical tone of the word it docks to.

Cases where the floating tone is not realized include monosyllabic H-toned nouns and bitonal words (/LH/, /HL/). The former could be due to the fact that falling tones are dispreferred in the language, so the expected L tone is blocked; the same could be said for /LH/ words, the only examples of which Heath gives have H only on the final syllable. The suppression of the floating tone after /HL/ could be due to a constraint against HLH sequences; while Heath reports a few cases of lexical /HLH/, they are vastly underrepresented in the lexicon.

The definite can be represented autosegmentally in Tiranige as follow:

(64) Tiranige floating tone docking in the definite



I represent the floating tone of the definite as a H tone underlyingly, assuming that it surfaces faithfully except when the preceding tone is H, in which case it is forced to surface as L to avoid violating the Obligatory Contour Principle (Goldsmith 1976); in other words, we have a case of tone polarity. I assume that the principles of floating tone realization belong squarely in the phonology proper and do not have a bearing on tonosyntax.

Multi-word sequences in Tiranige are, perhaps unsurprisingly, more complicated than single N Mod sequences. For example, we saw in the two-word sequences that an adjective imposes {L} on a preceding noun just like other Dogon languages. However, in the sequence N Adj Adj, we get the surface pattern N^{L} Adj Adj^{L}. Other multi-word sequences with adjectives behave the same way, with the element following the adjective taking {L} tone:

(65) a. jìwà^{L} báy pùlɛ̀^{L} (Tiranige, N Adj Adj)
house big white
'a big white house' (/jíwá/, /púlɛ́/)

b. jìwà^{L} wéní-gé tàándì^{L} (Tiranige, N Adj Num)
house small-PL three
'three small houses' (/jíwá/, /táándí/)

c. ìŋŋjɛ̀^{L} jɛ́mɛ́ mbò^{L} (Tiranige, N Adj Dem)
dog black this
'this black dog' (/íŋŋjɛ́/, /mbó/)

d. ìŋŋjɛ̀^{L} wéní-wè$^{+L}$ rì (Tiranige, N Adj Def)
dog small-DIM DEF
'the small dog' (/íŋŋjɛ́/, /wéní-wé/)

In (65) (a), we see that the second adjective in a two-adjective sequence takes {L}; numerals and demonstratives following an adjective take the same overlay. When a definite follows a N Adj sequence, the adjective realizes the definite's floating tone.

The output N^L Adj Adj^L is illustrated in the following tableau:

(66)

/N Adj Adj/	*p* Obs	*p* Pred	*Score*	Id(T) 7	N^L Adj (Lin) 17.7	X Mod^L (Lin) 15.3
a. N^L Adj Adj^L	1	∼1	29.3	2	0	1
b. N^L Adj Adj	0	∼0	37.6	1	0	2
c. N^L Adj^L Adj^L	0	∼0	38.7	3	1	0
d. N^L Adj^L Adj	0	∼0	47	2	1	1
e. N Adj Adj	0	∼0	48.3	0	1	2
f. N Adj^L Adj^L	0	∼0	49.4	2	2	0

The constraint X Mod^L motivates {L} overlays on all modifiers. The form that fully satisfies this constraint, candidate (c), is ruled out by a violation of N^L Adj, which states that an adjective after a noun should have lexical tone. If this constraint only specified the tone of the noun (as taking {L}) and did not care about the tone of the adjective, then candidate (c) would win. Because X is a variable in X Mod^L, the tone of this constituent is not specified.

Let us now turn to N Num sequences with following DP elements. In a N Num Dem sequence, we find a difference between the numeral 'one' and numerals 2+. With the numeral 'one', the demonstrative surfaces with lexical H tone:

(67) ííŋjɛ́ tòòmà$^{(L)}$ mbó (Tiranige)
dog one this
'this one dog'

Here, the {L} overlay on 'one' is in parentheses since it is lexically L-toned already. We can unify the numeral 'one' with other numerals by assuming a {L} overlay following a noun, but this is not empirically testable.

With higher numerals, the outcome is different. In this case, the numeral takes a {LH} overlay, with the H element surfacing on the plural suffix *-ŋge*, while the demonstrative surfaces with a {L} overlay:

(68) ííŋjɛ́-gé tààndì-ŋgé^{LH} mbò-gè^{L} (Tiranige)
dog-PL three-PL this-PL
'these three dogs' (/táándí-ŋgé/, /mbó-gé/)

This is similar to the Togo Kan output we will see in (88), only in Tiranige, the noun does not undergo tone lowering; this is consistent with the fact that nouns seldom take overlays in Tiranige, while they often do in Togo Kan. It is tempting to analyze this configuration as involving the regular numeral {L} overlay (found in the sequence N Num^{L}) coupled with a shifting of the demonstrative's H tone to the numeral suffix, but Heath reports that the demonstrative induces no tonal changes on any preceding words other than numerals. In other words, if a H-Tone Shift analysis were tenable (data are insufficient to prove or disprove), it would still need to be construction-specific, occurring only with a Num Dem sequence.

We also see an unusual tonal interaction between the numeral and the definite. In this combination, the numeral takes a {H} overlay with an additional floating L from the definite (due to tone polarity) that surfaces on the plural suffix:

(69) ííŋjɛ́ nííŋgá-ŋgè$^{H+L}$ rì (Tiranige)
dog two-PL DEF
'the two dogs' (/nììηgà/)

We saw above that when the numeral followed an adjective without a definite, it took a {L} overlay, but we find that the definite's {H+L} requirement trumps this overlay:

(70) ìŋjɛ̀^{L} bíní-gé nííŋgá-ŋgè$^{H+L}$ rì (Tiranige)
dog big-PL two-PL DEF
'the two big dogs' (/nììηgà/)

That is, the local tonal connection between the numeral and the definite is stronger than the local connection between the adjective and the numeral. Again, this {H} overlay is only characteristic of the Num Def sequence; definites following other syntactic categories, such as N, do not trigger an overlay (see (63)).

The facts with the numeral can be accounted for with two more bigram constraints, defined in (71):

(71) a. NUM^{LH} DEM^{L} (LIN): In a sequence Num Dem, assess a violation when Num does not have {LH} and Dem does not have {L}.

b. NUM^{H} DEF^{L} (LIN): In a sequence Num Def, assess a violation when Num does not have {H} and Def does not have {L}.

For consistency, I assess violations of NUM^{LH} DEM^{L} (LIN) and NUM^{H} DEF^{L} (LIN) in the same way as for N^{L} ADJ (LIN): violations are assigned either for a numeral without {(L)H} or for a determiner without {L}, though the data patterns are consistent with a model in

which only the numeral's tone is evaluated. In this case, the {L} on the demonstrative and definite is taken care of solely through X MOD^{L} (LIN), introduced above, but for a more consistent format of bigram constraints, I evaluate the tone of both constituents for these constraints as well.

It should be noted that as bigram constraints, linear adjacency is key. To illustrate, if the numeral is separated from the definite by a relative clause, the {H} overlay is no longer applied:

(72) jìwà^{L} wéní-gé nìŋgà^{L} dùmbɛ̀-sà-gé$^{+H}$ rì (Tiranige)
house small-PL two fall-RESULT-PL DEF
'the two small houses that fell'

The numeral surfaces not with a {H} overlay, as in the immediate juxtaposition of Num Def, but rather with the {L} overlay characteristic of the X MOD^{L} (LIN) schema.

The following tableau illustrates the form N Num^{LH} Dem^{L} (as in *ííɲjɛ́-gé tàándì-ŋgé*^{LH} *mbò-gè*^{L} 'these three dogs'):

(73)

/N Num Dem/	*p* Obs	*p* Pred	*Score*	ID(T) 7	NUM^{LH} DEM^{L} (LIN) 23	X MOD^{L} (Lin) 15.3
a. N Num^{LH} Dem^{L}	1	∼1	29.3	2	0	1
b. N Num^{L} Dem^{L}	0	∼0	37	2	1	0
c. N^{L} Num^{L} Dem^{L}	0	∼0	44	3	1	0
d. N Num Dem^{L}	0	∼0	45.3	1	1	1
e. N Num Dem	0	∼0	53.6	0	2	2
f. N Num^{LH} Dem	0	∼0	60.6	1	1	2
g. N Num^{L} Dem	0	∼0	68.3	1	2	1
h. N^{L} Num^{L} Dem	0	∼0	75.3	2	2	1
i. N^{L} Num Dem	0	∼0	83.6	1	2	2

Regardless of whether or not the tone of the demonstrative is evaluated by NUM^{LH} DEM^{L} (LIN), candidate (a) fully satisfies the constraint. In candidates (b-d) the demonstrative is {L}, and so the single violation in each case for the numeral would be the same no matter how we defined this constraint. Candidate (e) is fully faithful and incurs a violation of both NUM^{LH} DEM^{L} (LIN) and X MOD^{L} (LIN) for the demonstrative's lexical tone, but even if this violation were not incurred for NUM^{LH} DEM^{L} (LIN), it would still have a penalty score of 53.6, much higher than the winning candidate. Without the dual penalty of the demonstrative, candidate (f) would be closer to the winning candidate (with a penalty score of 37.3), but still sufficiently far away as to not be assigned any significant probability of being pronounced. The same can be said for candidates (g-i). Either way of the defining the constraint NUM^{LH} DEM^{L} (LIN) with respect to the demonstrative's tone, candidate (a) will always win.

Let us now turn to possessive data, where Tiranige more closely resembles the other Dogon languages. Nevertheless, this is also the domain where the most problematic data emerge and questions about data patterns put exact analysis on hold.

The possessive overlay is {LH} in Tiranige, which appears to be imposed on c-commanded words. This is encoded in the constraint Poss ^{LH}X, whose violations are assessed in the same way as in the other Dogon languages. As in these other languages, we find differences between alienable and inalienable possessive constructions, as in the following:

(74) a. Sàydú ^{LH}{jìwà-gè kùlèy^{n}-ŋgé} (Tiranige)
Seydou house-PL six-PL
'Seydou's six houses'

b. Sàydú ^{LH}sìjɔ-gé kùlèy$^{n(L)}$ (Tiranige)
Seydou uncle-PL six
'Seydou's six uncles'

With the alienable noun in (74a), the {LH} overlay is realized across both the noun and the numeral, and both take a plural suffix. When just the inalienable noun is c-commanded, as in (74b), only the noun takes the {LH} overlay. While the c-command facts are clear, it is unclear whether L on the numeral is the result of a modifier overlay or whether it is lexical ('six' is lexically L-toned); Heath (2012b) gives no data with non-L numerals, so this remains an open question.

However, things begin to look problematic for the typical Dogon syntactic structure (or a c-command analysis) when we turn to Poss N Adj sequences. In this case, unlike in other Dogon languages, there is no difference between alienable and inalienable possession in terms of scope:

(75) a. Sàydú ^{LH}{jìwà bày-gé} (Tiranige)
Seydou house big-PL
'Seydou's big houses'

b. Sàydú ^{LH}{sìjɔ̀ bày-gé} (Tiranige)
Seydou uncle big-PL
'Seydou's big uncles'

In both cases, the {LH} overlay encompasses both the noun and the adjective. There are at least two analytical approaches to this problem: First, we could assume that the syntactic structure of Tiranige possessives is such that both alienable and inalienable possessors c-command the adjective. This would be possible if, say, the adjective formed some sort of compound with the noun, and hence was c-commanded by both PossP and the specifier of NP. Second, we could reject the notion that possessive overlays are conditioned by c-command and simply posit a flat Poss N Adj construction specifying N Adj as the domain of {LH}.

The latter solution appears inelegant, as the differences with numerals, then, would become random as well, despite following the very regular Dogon pattern of c-command-based control. I am more inclined towards the former solution, since the lack of a plural suffix on the noun could indicate compounding; this morphological fact would need to be compared cross-linguistically before drawing any strong conclusions. I leave exact analysis for future work. In the model provided here, I simply included the alienable possessive construction with adjectives, where cross-linguistic comparison points to clear c-command. If the inalienable possessor also c-commands the adjective, then this form would add nothing new to the model and it could be reasonably omitted.

Another tricky case is found in the sequence Poss N Dem. Neither possessor should c-command the demonstrative, yet in both alienable and inalienable constructions, the demonstrative (but not its plural suffix) appears at first glance to fall inside the domain of the possessor's {LH}:

(76) a. Sàydú ^{LH}{jìwà-gè mbó}-gè (Tiranige)
Seydou house-PL this-PL
'these houses of Seydou's'

b. Sàydú ^{LH}{sìjɔ̀-gè mbó}-gè (Tiranige)
Seydou uncle-PL this-PL
'these uncles of Seydou's'

However, a look at the phonology of Tiranige reveals a H absorption rule, wherein LH → L before a H tone. The curious aspect of this construction, then, is not that the demonstrative is in the possessive domain, but that it retains lexical tone (/H/) rather than taking the usual modifier {L} overlay.

If the numeral in a Poss N Num configuration retains lexical tone as well, then a clear pattern emerges: modifiers retain lexical tone in the presence of a possessor. This analysis appears to be corroborated by data with postnominal possessors, where the numeral surfaces with lexical tone:

(77) nàà^{L} jɛ́mɛ́-gé táándí-ŋgé mɛ̀ɛ̀-gé (Tiranige)
cow black-PL three-PL 1SG.POSS-PL
'my three black cows'

In contrast to a regular N Num sequence (e.g. *nǎá-gé tàándì*^{L}), the numeral takes a plural suffix in this configuration, just as it would in the presence of a determiner. Thus, one possibility is that the lack of {L} overlay in this case and the presence of a plural suffix is the result of the possessor acting like a definite determiner. In fact, the latter consequence appears to be real; if the numeral is postposed after the possessor, it surfaces without its plural suffix:

(78) nàà^{L} jɛ́mɛ́-gé mɛ̀ɛ̀-gé táándí (Tiranige)
cow black-PL 1SG.POSS-PL three
'my three black cows'

Nevertheless, the numeral still retains lexical tone. It seems, then, that the mere syntactic or semantic presence of possession in a phrase triggers (or allows) lexical tone on modifiers.

How can we encode this in the grammar? I see two possibilities. First, we could leave the constraint X MOD^{L} (LIN) unchanged and add another constraint specifying that modifiers are **lexically-**toned in the presence of a possessor, e.g. MOD/POSS (modifier has lexical tone when possessed). Second, we could change the constraint X MOD^{L} (LIN) so that it only applies in the absence of a possessor. If it weren't for the data with postposed possessors, we could change the constraint so that it only applies when the head noun of the DP is aligned to the left edge, but obviously this cannot be the case, or we would get {L} on the numeral in (78). I believe it is easier to encode the presence of something (a positive condition) in a grammatical constraint rather than its absence, so I have tried the analytical route of adding a constraint MOD/POSS, and the grammar is able to match the data given to it with a high degree of accuracy. From a learning perspective, the presence of these conflicting constraints X MOD^{L} (LIN) and MOD/POSS seems plausible, as speakers would learn that modifiers are L-toned when not used absolutely, but would also have to learn that in the presence of possessors, this generalization is no longer true.

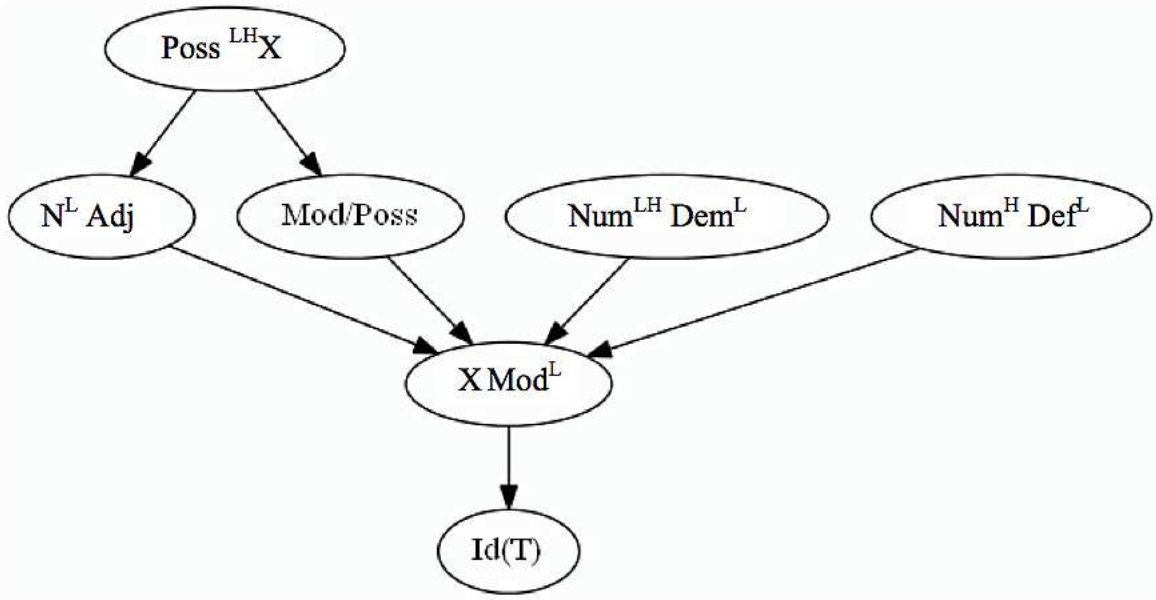
The maxent grammar of Tiranige, including MOD/POSS, is summarized in (79):

(79)

Constraint	*Weight*
IDENT-OO(T)	6.9
POSS ^{LH}X	30.6
N^{L} ADJ (LIN)	17.4
X MOD^{L} (LIN)	14.9
MOD/POSS	15.6
NUM^{LH} DEM^{L} (LIN)	22.6
NUM^{H} DEF^{L} (LIN)	22.6

The data can also be modeled by strict ranking in OT, represented by the following Hasse diagram:

(80) Hasse diagram for Tiranige



Summary of important points

- Tonal overlays can depend on linear adjacency rather than syntactic structure.

This raises the question: Can the other Dogon languages be analyzed using linear adjacency constraints, thus unifying the analysis of Tiranige and its relatives? The problem that arises is non-local control. For example, in Tommo So, a N Num sequence contains no tonal overlays, since neither the noun nor the the numeral is a controller. However, when an alienable possessor is added, we find the output Poss ^{L}{N Num}. In a bigram constraint model, containing only two adjacent words, we would need a constraint N^{L} NUM^{L}, indicating that a noun and numeral together are pronounced with all {L}, but this constraint crucially could not apply in the absence of a possessor. We could increase the linear constraints to three positions, allowing for constraints like $POSS\ ^{L}N\ ^{L}NUM$, but then we would need to specifically tag this constraint as applying only to alienable possessors (whose c-command domain, incidentally under this model, happens to correspond to the span of {L}), otherwise an inalienable sequence Poss N Num would incorrectly surface with a {L} numeral. As we can see, then, not only would such an analysis miss the generalization that overlays are applied to c-commanded words, but it would also require many more highly specific linear constraints that would make the tonosyntactic patterns look like accidents.

3.3.9 Togo Kan

Finally, we can return to Togo Kan, a language that is by-and-large a typical Dogon language but with traces of Tiranige-like patterns. I will first cover two phenomena related to Togo Kan possessives: the effects of mora count (as in Tommo So) and lexical exceptions, then discuss floating tones in the Togo Kan context, before turning to multi-word sequences and the analysis.

3.3.9.1 Possessive features

Like Tommo So, the choice of possessive overlay in Togo Kan is determined by the mora count of the possessed noun: words with one or two moras receive {H}, while words with

three or more moras receive {HL}. Unlike Tommo So, this pattern holds across all possessors, not only inalienable pronominal:

(81) a. Sèèdú $^{\text{H}}$kú$^{\text{n}}$ (Togo Kan, 1 mora)
Seydou head
'Seydou's head' (cf. /kú$^{\text{n}}$/)

b. Sèèdú $^{\text{H}}$gír$^{\text{n}}$í (Togo Kan, 2 moras)
Seydou house
'Seydou's house' (cf. /gìr$^{\text{n}}$í/)

c. Sèèdú $^{\text{HL}}$ínàà (Togo Kan, 3 moras)
Seydou mother
'Seydou's mother' (cf. /ìnàá/)

d. Sèèdú $^{\text{HL}}$báágà (Togo Kan, 3 moras)
Seydou stick
'Seydou's stick' (cf. /báágà/)

e. Sèèdú $^{\text{HL}}$kɛ́gɛ̀rɛ̀ (Togo Kan, 3 moras)
Seydou saddle
'Seydou's saddle' (cf. /kɛ́gɛ́rɛ́/)

As the example in (81d) shows, the mapping of {HL} in Togo Kan is sensitive to syllabic structure rather than moraic structure, with the change from H to L occurring after the first syllable (rather than the first mora, as in Tommo So).

In Tommo So, a compound noun is treated as a single stem tonosyntactically, so a kinship term like *nàà*^{L}*-díyɛ̀* 'aunt' (literally 'big mother') is possessed as ^{HL}*náà-dìyɛ̀*, despite the initial stem being prosodically light. This is not the case in Togo Kan. In Togo Kan, the initial stem is assigned {H} or {HL} according to the rules above, and the second stem takes {L}:

(82) a. Sèèdú ^{HL}gír^{n}í-dù (Togo Kan)
Seydou house-??
'Seydou's family (cf. /gìr^{n}ì-dú/)

b. Sèèdú ^{HL}ótèè-sùŋù (Togo Kan)
Seydou well-rope
'Seydou's well rope' (cf. /òtèè-sùŋú/)

In (82a), the two-mora initial stem takes {H}, while in (82b), the three-mora initial stem takes {HL}, with the location of the tone break from H to L located, as usual, after the initial mora.

It is tempting to seek a phonological explanation for these patterns. After all, shorter nouns receive the single-tone overlay, while longer nouns host an overlay with two tonal components. Maybe it is simply the case that shorter nouns do not have enough room to host a {HL} overlay.

This argument dissolves when we investigate the phonological realization of the two overlays. Crucially, when we look at examples (82c) and (82e), we find that the change from H to L in the {HL} overlay can occur after a single mora, meaning that technically a two mora word like *gìr^{n}í* 'house' has enough phonetic space to host a {HL} overlay.

We could look to tonotactics to shed light on whether HL sequences are banned on two-mora words. In fact, in Togo Kan, lexically Cv́Cv̀ nouns are rare (Heath and McPherson 2013 states that historically, HL and HH merged to HH on disyllabic nouns), but the HL melody is actually quite common on noun-like postpositions and words of other classes (verbs, adverbs, etc.). For example, we find *gírè* 'in front of' or *pórì* 'say'. Thus, we cannot claim that there is an active ban on HL sequences on disyllabic words in the language. The bifurcation into {H} and {HL} may have a diachronic explanation of this sort, but it cannot be explained wholly by the synchronic phonology.

Once again, what looks like a purely phonological effect belongs to the domain of tonosyntax. These different overlays can be accounted for using subschemas in the phonological branch, each subcategorized for words of different lengths.

The other phenomenon displayed by Togo Kan is lexical exceptions to the general pattern. There is a small number of words that behave in an unexpected way given their form. While words with one or two moras typically take {H} and words with three moras typically take {HL} according to the rules above, we find four exceptions to the pattern. First, two CVCV:^{n} words take a {H} overlay, despite having three moras:

(83) a. ^{H}súgɛ́ːⁿ 'younger sibling' (/sùgɛ̀ɛ́ⁿ/)

b. ^{H}ɛ́gɛ́ːⁿ 'husband' (/ɛ̀gɛ́/)

Notice that in (83b), the possessed form is also segmentally idiosyncratic, since the unpossessed form has a short oral vowel at the end (i.e. the citation form **does** have two moras). The other exceptions are two monosyllabic nouns that take an idiosyncratic {L} overlay rather than {H}:

(84) a. ^{L}ììⁿ 'child' (/ííⁿ/)

b. ^{L}ɲɛ̀ 'woman/wife' (/ɲɛ̌/)

With lexical exceptions such as these and the Jamsay examples given in §3.3.2, we can propose subschemas for individual lexical items. Because these are more specific than the general subschemas with a variable for the noun, nouns like 'child' or 'younger sibling' will follow their own patterns.

A final point to make about possessives in Togo Kan is that Heath reports no difference between alienable and inalienable possession. Very little explicit data is given involving inalienable nouns to test this point, but I follow this assumption in the analysis that follows, placing both alienable and inalienable possessors in a PossP level above the numeral.

3.3.9.2 Floating L definite

The existence of floating tones also sets Togo Kan apart from Tommo So and most other Dogon languages. As in Tiranige, Togo Kan floating tones are associated with the definite determiner, but in Togo Kan, they are the **only** phonological reflex. The Togo Kan floating definite is always L-toned.[17] When following a H-final word, the definite has an audible effect; this accounts for the vast majority of the lexicon, since like Tommo So, Togo Kan has primarily /H/ and /LH/ lexical melodies, as shown in (85) (where (L) stands for the floating L tone):

(85) a. báágá + (L) → [báágà$^{+L}$] (Togo Kan)
stick DEF
'the stick'

b. wòrú + (L) → [wòrû$^{+L}$] (Togo Kan)
field DEF
'the field' (cf. /wòrú/)

c. òtèé + (L) → [òtèê$^{+L}$] (Togo Kan)
well DEF
'the well' (cf. /òtèé/)

The +L superscript simply indicates the origins of L on the final syllable (i.e. its effect on pronunciation is already indicated in the square brackets). In (85a), the L-toned definite

[17]Both the floating L definite marker and the predomination of /H/ and /LH/ lexical melodies are reminiscent of Bambara (e.g. Creissels and Grégoire 1993).

affects the whole last syllable of an all /H/ word. In (85b) and (85c), contour tones are created (HL or LHL), since otherwise lexical tones would be lost.

In the case of a L-final word, the definite article is inaudible:

(86) àr^{n}áỳ^{n} + (L) → [àr^{n}áỳ$^{n+L}$] (Togo Kan)

For an interesting interaction between the definite floating L and the demonstrative, see §3.3.9.4.

3.3.9.3 Tiranige-like patterns

I now turn to the data patterns that resemble Tiranige. Let us first consider the sequence N Adj Dem. In Togo Kan, like most other Dogon languages, the demonstrative controls a right-to-left {L} overlay, so one possible outcome is {N Adj}^{L} Dem. However, we also see the outcome N^{L} Adj Dem^{L} in which the demonstrative takes its own overlay; this is never the case in the absence of another modifier:

(87) a. {gìr^{n}ì màr^{n}à}^{L} yɔ́ɔ́ (Togo Kan)
house big that
'that big house' (/gír^{n}í/, /már^{n}á/)

b. gìr^{n}ì^{L} már^{n}á yɔ̀ɔ̀^{L} (Togo Kan)
house big that
'=(a)'

In (87a), the demonstrative imposes {L} on both 'house' and 'big'. In (87b), the adjective imposes {L} on 'house' and the demonstrative takes a {L} overlay whose origins are unclear; see §3.3.9.4 below.

Similarly, in the sequence N Num Dem, we can see the typical Dogon pattern {N Num}^{L} Dem, but this can also surface as N^{L} Num^{LH} Dem^{L}, with the demonstrative tone lowered and the numeral taking {LH}:

(88) gìr^{n}ì^{L} kùréé^{LH} yɔ̀ɔ̀^{L} (Togo Kan)
house six that
'those six houses' (/gír^{n}í/, /kúréé/)

This outcome is interesting in that it is a combination of the Tiranige Num^{LH} Dem^{L} sequence and Yorno So contingent control of the numeral (§3.2.2, §3.3.7). However, unlike in Tiranige, this output is not tied solely to the demonstrative. Instead, data suggest that any following word in the DP (demonstratives, but also postnominal possessors and the universal quantifier 'all') trigger this contingent control:

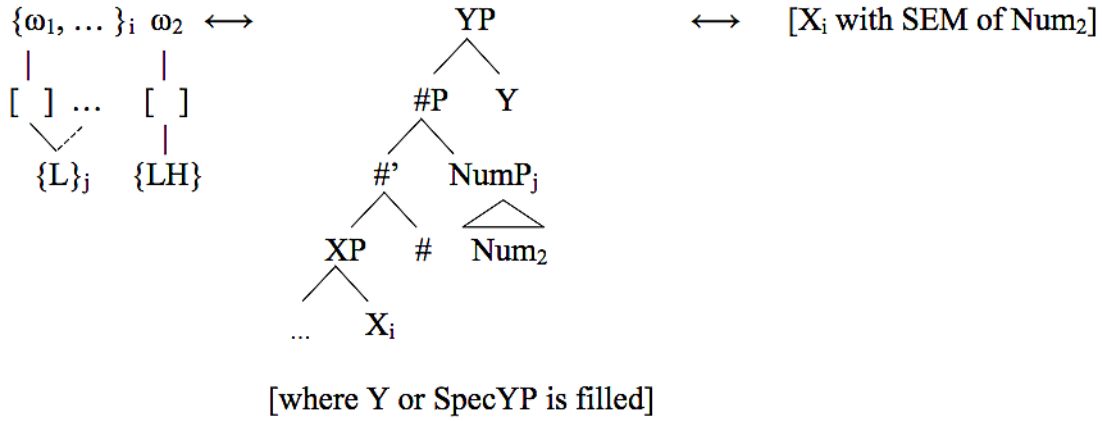
(89) a. {pèjù màr^{n}à}^{L} kùréé^{LH} mà (Togo Kan)
sheep big six 1SG.POSS
'my six big sheep' (cf. /péjú/, /már^{n}á/, /kúréé/)

b. pèjù^{L} kùréé^{LH} sáà^{n} (Togo Kan)
sheep six all
'all six sheep'

In (89a), the numeral's c-command domain also contains an adjective, showing that control of {L} is more than a local phenomenon for the numeral.

These effects require a rather complicated constructional schema, such as the following:

(90) Constructional schema for Togo Kan contingent control



In this schema, I have specified the effects as occurring whenever a syntactic projection above P is filled (either Y is a lexical head, or the projection is functional and the lexical material is contained in the specifier). This makes the prediction that anything higher, even possessors and relative clauses, should be able to display these effects. However, the tonal effects of possessors and relative clauses always take precedence, so we never see contingent control. These results are consistent with the constructional schema given above, but with the understanding that the corresponding construction constraint is weaker than the constraint for possession or relative clauses.

3.3.9.4 Analysis

Modeling Togo Kan has proven to be a challenge, and I have yet to achieve a satisfying result. This difficulty arises mainly from the existence of Tiranige-like L-toned demonstratives. These only surface in the presence of another modifier and never with a noun alone. We can summarize the pertinent patterns below:

(91)

N Dem	→	N^{L} Dem
N Adj Dem	→	$\{N\ Adj\}^{L}$ Dem ~ N^{L} Adj Dem^{L}
N Num Dem	→	$\{N\ Num\}^{L}$ Dem ~ N^{L} Num^{LH} Dem^{L}
Poss N Dem	→	Poss ^{HL}N Dem^{L}
N Def Dem	→	N^{+L} Dem^{L}

The form N^{L} Dem looks just like the majority of the Dogon languages and not like Tiranige (N Dem^{L}). With adjectives and numerals, Togo Kan varies between typical Dogon-like tonosyntax, with the demonstrative imposing {L} on c-commanded words, and Tiranige-like tonosyntax. N^{L} Adj Dem^{L} is exactly the pattern we found in Tiranige, derived using bigram constraints. With the numeral, the second output resembles Tiranige but is nonidentical, since in Tiranige, the numeral does not impose {L} on the noun (i.e. the output was N Num^{LH} Dem^{L}). The possessive outcome looks like Dogon languages such as Nanga, where the demonstrative self-controls. The case of the definite is strange in that the floating L of the definite precedes the demonstrative and blocks its tonal overlay. For example:

(92) báágà$^{+L}$ nɔ̀ɔ̀^{L} (Togo Kan)
stick.DEF this
'this stick' (cf. *bàà*g*à*^{L} *nɔ́ɔ́* 'this stick' (indef.))

The noun retains its lexical tone, concatenated with L of the definite, while the demonstrative surfaces with {L}. This outcome is, to my knowledge, not variable.

If we attempt to model Togo Kan with a normal Dogon constraint set (ignoring for now the issues that would arise with the numeral), we run into trouble with the outputs of N Adj Dem. Under the assumptions of the model, $\{N\ Adj_1\}^{L2}$ Dem_2 fully satisfies by X^{L} Adj and X^{L} DEM, the former because the adjective takes an overlay and loses its ability to control and the latter because all c-commanded words take {L}. The form N^{L1} Adj_1 $Dem_2{}^{L2}$ also

fully satisfies both constraints, but this time, it is the adjective's constraint that is fully satisfied and the demonstrative's rendered moot. This candidate, however, is harmonically bounded, since it incurs a violation of *SelfControl. What we need is a constraint that favors this latter candidate, motivating the variation that we see.

The constraint I use follows the format of the Tiranige bigram constraint X Mod^{L}, but it is more specific in Togo Kan, and structurally rather than linearly based:

(93) Mod Dem^{L}: Assess a violation when a demonstrative following a modifier does not take {L}.

I say that this constraint is structural rather than linear in that "following" indicates a modifier structurally lower than the demonstrative in the DP. This can be a linearly adjacent modifier like an adjective or a numeral or it can be a structurally lower modifier such as a possessor. Curiously, the floating definite also appears to be in this position, if we take linear order as an indication. This construction constraint licenses a candidate like N^{L1} Adj$_1$ Dem$_2$^{L3}, where the demonstrative takes a construction-specific {L} overlay that is not the result of self-control. This renders X^{L} Dem moot, while X^{L} Adj is satisfied by the imposition of {L1} on the noun.

However, in all of the grammars I have constructed, maxent assigns Mod Dem^{L} a weight of zero meaning that the constraint itself is basically meaningless as far as the grammar is concerned. The candidates instantiating the {L} of this constraint simply ensure that X^{L} Dem is not violated while at the same time incurring no violations of *SelfControl. When I added a candidate N^{L1} Adj$_1$ Dem$_2$^{H}, with a completely unmotivated {H} overlay on the demonstrative, it was assigned the same probability as winning N^{L1} Adj$_1$ Dem$_2$^{L3}; it violates Mod Dem^{L}, but since this constraint has a weight of zero, it makes no difference. In order to distinguish between these two candidates, I added a constraint Dep(overlay), which penalizes the insertion of an overlay not demanded by any construction constraints.

With the addition of this constraint to the constraint set, the model matches the attested probabilities. The full constraint set is given below:

(94)

Constraint	*Weight*
IDENT-OO(T)	0
IDENT-OO(T)/PHASE-LEX	0.3
IDENT-OO(T)/PHASE	12.4
POSS $^{H(L)}$X	17.4
X^{L} ADJ	8.6
X^{L} DEM	9.3
MOD DEM^{L}	0
X^{L} NUM^{LH} DET	9.8
*SELFCONTROL	13.2
UNIFORMITY	9
LOCALITY	1.6
DEP(OVERLAY)	9.8

Without DEP(OVERLAY), the model was unable to match N Num $\rightarrow$ N Num; it would predict small amounts of probability for N^{L} Num and N Num^{L}, even though no construction constraints demanded that {L} overlay, simply because the weight of Ident-OO(T) was so low (2.2 in a model without DEP). When DEP was added, the weight of IDENT-OO(T) dropped to zero, but all frequencies were matched perfectly.

It seems to me that this model is undesirable: Togo Kan, or any other Dogon language, does not simply change tones on words without any repercussions, as is implied by a weight of zero for IDENT-OO(T). Such tone changes must be motivated, but this, the only model I have been able to construct that matches the data, does not reflect this fact.

The L-toned demonstratives are not the only source of the problem. The variation in the outputs for N Num Dem also appears to contribute. {N Num}^{L} Dem is a regular Dogon-like

output, with the demonstrative imposing {L} on both c-commanded words. The output N^{L} Num^{LH} Dem^{L} is more problematic. I have accounted for this output form with the constraint X^{L} NUM^{LH} DET (with "det" rather than "dem" to capture the fact that the definite and the postnominal possessive pronoun also trigger these tonal changes). It is not obvious how to assess violations of this constraint. I first treated the constraint as a bigram constraint in Tiranige, assessing a violation for every N that is not {L} and every Num that is not {LH}; these violations were assessed individually, regardless of whether one or the other carried a {L2} from the demonstrative. However, I found that I got better results when Num was treated as the controller, only having the ability to impose {L} if it had not taken an overlay from a higher controller. Consider the following table showing the number of violations of X^{L} NUM^{LH} DET:

(95)

Candidate	*# of violations*
a. N Num_1 Dem_2	2
b. N^{L1} Num_1 Dem_2	1
c. N $Num_1{}^{LH}$ Dem_2	1
d. $\{N\ Num_1\}^{L2}$ Dem_2	0
e. N $Num_1{}^{L2}$ Dem_2	0

Candidate (a) incurs two violations, one for the noun and one for the numeral. Candidate (b) incurs one violation for the numeral, while candidate (c) incurs one violation for the noun. Candidates (d) and (e) have a {L2} overlay from the demonstrative on the numeral, stripping it of its tone control ability and rendering its construction constraint moot.

Under these assumptions, the model generates the correct results, but it seems ad hoc to say that a demonstrative's {L} overlay renders the numeral's constraint moot while the {LH} overlay specified in the construction (or the absence of that overlay) does not. While this model works, I find it unsatisfying and probably not on the right track.

I also put together a model closer to that used for Tiranige with the following constraint set:

(96)

Constraint	*Weight*
IDENT-OO(T)	6.4
POSS $^{H(L)}$X	27.2
X^{L} ADJ	13.9
X^{L} DEM	20.4
MOD DEM^{L}	27.9
X^{L} NUM^{LH} DET	20.4

Unlike the Tiranige model, all constraints with a variable X encode c-command (rather than linear pairwise combinations). Like the Tiranige model, however, a constraint X^{L} ADJ assigns a violation both for a c-commanded word without {L} and for an adjective without lexical tone; the same holds for all other construction constraints. This model does a pretty good job overall, but predicts unattested variation in the case of post-modifier demonstratives, as illustrated in the following tableau:

(97)

/N Adj Dem/	*p* Obs	*p* Pred	*Score*	Id(T) 6.4	X^L Adj 13.9	X^L Dem 20.4	Mod Dem^L 27.9
a. N^L Adj ^{L} Dem^L	0	∼.37	53.6	3	1	1	0
b. N^L Adj Dem^L	.5	∼.38	53.6	2	0	2	0
c. N^L Adj^L Dem	.5	∼.12	54.6	2	1	0	1
d. N^L Adj Dem	0	∼.12	54.7	1	0	1	1
e. N Adj^L Dem^L	0	∼0	81.4	2	2	2	0
f. N Adj Dem	0	∼0	82.6	0	1	2	1

The attested variation is between candidates (b) and (c), but the model is assigning the most probability to candidates (a) and (b) (and equal smaller probabilities to candidates c and d). In any of the Dogon languages studied to date, a form like candidate (a), in which a controller takes an overlay, never wins. Under the assumptions of the Tiranige-like model, there is no way to rule this out other than by brute force, adding a constraint like FreeController. When this constraint, which penalizes forms in which overlays are assigned by controllers that have themselves taken tonal overlays, is added, the model works perfectly.

However, we want these generalizations to emerge from the architecture of the grammar rather than by positing constraints like FreeController. It remains to be seen how we can develop a model of Togo Kan capable of elegantly capturing the data patterns.

Summary of important points

- Tonosyntactic grammars can combine c-command and linear order in defining constructions.

3.4 Factorial typology

I ran the factorial typology (the set of all possible strict rankings, i.e. classical OT) of the typical Dogon constraint set (i.e. the one used for Tommo So) using OTSoft, which yielded 732 distinct output patterns.[18] To understand what is being predicted without combing through thousands of data patterns, we can look at the t-order (Anttila and Andrus 2006) generated by OTSoft: the complete set of predicted implications holding between input-output pairs. We find examples like the following:[19]

(98) a. If the input N Adj has the output N^{L} Adj, then the input N Adj Adj has the output $\{N\ Adj_1\}^{L2}$ Adj_2.

b. If the input N Num Dem has the output $\{N\ Num\}^{L}$ Dem, then the input N Dem has the output N^{L} Dem.

In essence, the t-order helps us understand what the constraint set predicts regardless of how the constraints are ranked. If we find patterns that conflict with what the t-order predicts, then there is a problem with the constraint set; either a constraint is not formulated correctly or more constraints are needed.

The two implicational universals in (98) are fairly straightforward: a) If the adjective has the power to control a noun, it also has the power to control other c-commanded words. b) If the demonstrative is able to control both a noun and a numeral, then it can control a noun alone. Others require more reflection:

[18] At the time of writing, there is yet no algorithm to calculate the factorial typology of weighted constraints.
[19] For the full t-order, see Appendix B.

(99) If the input N Num Dem has the output N Num Dem^{L}, then the input N Dem has the output N^{L} Dem.

Upon first thought, it would seem that the second half of the implicational universal should yield the output N Dem^{L}. However, if a demonstrative is able to control itself, as in the first half of the implicational universal, it must have the ability to target c-commanded words. N Dem^{L} is harmonically bounded by N^{L} Dem (both satisfy X^{L} DEM while violating IDENT-OO(T), but the former additionally violates *SELFCONTROL). Therefore the output form N Num Dem^{L} is motivated by the fact that Dem would otherwise have to apply its overlay to two words, incurring two violations of IDENT-OO(T). Since N Dem offers just one c-commanded word, there is no motivation for self-control.

We find another interesting (and seemingly contradictory) implicational universal with this input-output pair:

(100) If the input N Num Dem has the output N Num Dem^{L}, then the input N Adj Dem has the output $\{\text{N Adj}_1\}^{\text{L2}}$ Dem_2.

The explanation of the last implicational universal had the demonstrative taking its own overlay rather than imposing it on two words, yet here we find that it obligatorily will impose it on two words when the modifier is an adjective. The reason for this output is as follows: The adjective is also a controller. A competing output would be N^{L1} Adj_1 $\text{Dem}_2{}^{\text{L2}}$, where the demonstrative undergoes self-control and the adjective imposes its {L} on the noun. In this case, X^{L} ADJ is satisfied and X^{L} DEM is rendered moot; there are two resulting violations of IDENT-OO(T) in addition to a violation of *SELFCONTROL. The actual implicated output also has two faithfulness violations, but no violation of *SELFCONTROL; X^{L} DEM is satisfied and X^{L} ADJ rendered moot.

All of the implicational universals depend on the assumptions of the model. Take the following:

(101) If the input PossANonP$_1$ N Adj$_2$ has the output PossANonP$_1$ N^{L2} Adj$_2$, then the input PossANonP$_1$ N has the output PossANonP$_1$ N.

In other words, if the adjective's overlay is imposed in the presence of a c-commanding alienable nonpronominal possessor, then that possessor must not impose an overlay at all. But is it not conceivable that the X^{L} ADJ simply outranks POSS ^{T}X (T standing in for any tonal overlay)?

Given the syntactic structure used in this study, POSS ^{T}X would have two targets (the noun and the adjective) while the X^{L} ADJ would have one. The output PossANonP$_1$ N^{L2} Adj$_2$ satisfies X^{L} ADJ but violates POSS ^{T}X twice (for both the noun and adjective). But there is another way to fully satisfy X^{L} ADJ, namely the form PossANonP$_1$ ^{L1}{N Adj$_2$}, which renders the adjective's constraint moot. Since this output is not chosen as winner, it means that POSS ^{T}X must be ranked below IDENT-OO(T); it is unable to impose an overlay.

This is the general case in the model: given two controllers, A and B, where A c-commands B, A will always impose its overlay unless B is protected by special faithfulness. If B takes A's overlay, B's overlay is lost. But if B remains faithful, then its overlay may remain active. In the case just considered of PossANonP N Adj, no special faithfulness protects the adjective. Thus, if it retains lexical tone, it can only be because the other controller (here, the possessor) does not have the power to impose an overlay.

For the complete t-order, see Appendix B.

CHAPTER 4

Relative clauses

4.1 Introduction

Relative clauses in the Dogon languages are a fascinating microcosm of tonosyntactic grammar, displaying aspects of DP tonal overlays, word-level verb overlays, and evidence for phases, all in addition to displaying a head internal nature, claimed to be rare in African languages (Creissels 2000, Kuteva and Comrie 2006).

Generally speaking, relative clauses have the same tonosyntactic effects as any other non-possessive modifier in the Dogon languages: modified words (i.e. the head) receive a {L} overlay. The analytical difficulty arises from the fact that the head is internal to the relative clause, surrounded by non-head constituents unaffected by the {L} overlay. The Tommo So example in (1) illustrates this phenomenon with an object relative clause. Here and elsewhere, I will underline the head of the relative clause to make it easier to parse:

(1) íí=gɛ mí=jì **<u>màŋgòrò</u>**$^{\mathbf{L}}$ ób-ì=gɛ kɛ́m (Tommo So)
child=DEF 1SG.PRO=OBJ mango give-PFV.REL=DEF all
(yé=jìy-ɛ̀-m.)
(EXIST=eat-PFV.L-1SG)
'(I ate) every mango that the child gave to me.' (/màŋgóró/)

The object head of the relative clause, *màŋgóró*, is marked with a {L} overlay, but it is left in situ, maintaining SOV word order. This **internally-headed** nature makes the c-command analysis used for other tonosyntactic controllers more complicated, but as I will

show in §4.4.2, relative clause tonal overlays can be understood with the same principle of c-command under the assumption that the syntactic structure contains two full copies of the head material, one internal to the relative clause and one external (Cinque 2010). Tonal overlays are assigned as usual to the **external** copy of the head (the same material on the spine of the DP that is targetted by possessors, adjectives, etc.). When the external copy and the internal copy match, the internal copy **inherits** the morphophonological properties of the external copy; the external copy is then deleted, leaving the head **internal** to the relative clause on the surface.

In this chapter, I focus mainly on data from Tommo So, including data from other languages only where it differs significantly and/or bears on questions of analysis. I begin in §4.2 by describing the basic structure of relative clauses: linear order, the form of the verb, and those few Dogon languages with overt relativizing morphemes. In §4.3, I lay out the patterns of tonal overlays on the head of the relative clause. Section 4.4 turns to syntax; §4.4.2 provides a syntactic analysis of Dogon relative clauses that unifies tonal overlays found in the DP while §4.5 incorporates these findings into the constraint-based analysis given in previous chapters. Finally, §4.6 describes some problematic data requiring further investigation.

4.2 Basic structure of relative clauses

4.2.1 Linear order

We can classify relative clauses as being either internally headed, with the head left in situ, or externally headed, with the head either before the relative clause (making the relative clause postnominal) or after the relative clause (making the relative clause prenominal). Dogon has internally-headed relative clauses. The data in (2) contrasts the internally-headed Dogon structure with examples of prenominal relative clauses and postnominal relative clauses, from Japanese and English, respectively; in each case, the head is in boldface and underlined:

(2) a. Sáná **<u>nàà</u>**^{L} sɛ́mɛ́-dɛ=gɛ (Tommo So; internally headed)
Sana cow slaughter-IMPF.REL=DEF
'the cow that Sana will slaughter'

b. Daisuke-ga tosatu suru **<u>usi</u>** (Japanese; prenominal)
Daisuke-NOM slaughter do cow
'the cow that Daisuke will slaughter'

c. the **<u>cow</u>** that John will slaughter (English)

In Tommo So, the basic SOV word order is not disrupted in the relative clause. In Japanese, the object head of the relative clause comes after the subject and verb. In English, the object head is placed before the subject and verb.

Because the head of the relative clause is left in situ, there is no fixed position of the head relative to the verb of the relative clause: subject heads may be clause-initial, object heads may immediately precede the verb, etc. The following examples illustrate subjects, objects, and PPs acting as head of the relative clause. The main clause equivalent is given first in (3a).

(3) a. Yàa-ná=gɛ jàndúlu=gɛ tàgá=le bɛ̀nd-ɛ̀.
female-HUM.SG=DEF donkey=DEF shoe=ASSOC hit-PFV.L
'The woman hit the donkey with a shoe.'

b. **yàà-nà^{L}** jàndúlu=gɛ tàgá=le bɛ́nd-ɛ̀=gɛ
female-HUM.SG donkey=DEF shoe=ASSOC hit-PFV.REL=DEF
'the woman who hit the donkey with a shoe'

c. yàa-ná=gɛ **jàndùlù^{L}** tàgá=le bɛ́nd-ɛ̀=gɛ
female-HUM.SG=DEF donkey shoe=ASSOC hit-PFV.REL=DEF
'the donkey that the woman hit with a shoe'

d. yàa-ná=gɛ jàndúlu=gɛ **tàgà^{L}** bɛ́nd-ɛ̀=gɛ
female-HUM.SG=DEF donkey=DEF shoe hit-PFV.REL=DEF
'the shoe that the woman hit the donkey with'

The word order is allowed to remain the same as that of the main clause. In every case, the noun functioning as the head takes a {L} overlay, while all other constituents retain their regular tones. Since most Dogon languages lack a lexical /L/ melody, this {L} overlay is always audibly distinct. Additionally, the definite determiner associated with the head of the relative clause appears after the relative verb, since definiteness scopes over the whole DP and not just the head noun. Thus, in (3b), *gɛ* is missing from 'woman', in (3c) it is missing from 'donkey', and in (3c), it is missing from 'shoe' (though the main clause equivalent was indefinite). Finally, postpositions like the associative *=le* are omitted when the object of the postposition acts as relative head.

Complicating matters a bit, we find that scrambling is allowed both in main clauses and in relative clauses in Tommo So, with no reported differences in meaning. An example of relative clause scrambling is given in (4):

(4) a. S Adv O V
Sáná yògó **nàà^{L}** sémé-dɛ=gɛ
Sana tomorrow cow slaughter-IMPF.REL=DEF
'the cow that Sana will slaughter tomorrow'

b. Adv S O V
yògó Sáná **nàà^{L}** sémé-dɛ=gɛ

c. S O Adv V
Sáná **nàà^{L}** yògó sémé-dɛ=gɛ

d. Adv O S V
yògó **nàà^{L}** Sáná sémé-dɛ=gɛ

e. O Adv S V
nàà^{L} yògó Sáná sémé-dɛ=gɛ

f. O S Adv V
nàà^{L} Sáná yògó sémé-dɛ=gɛ

All permutations of S, O, and Adv are acceptable before the verb. Tone marking on the object in each case picks out this constituent as the head. Note that the examples in (e-f) look like post-nominal relative clauses; some consultants offer this word order first, presumably due to the influence of French as the language of elicitation, though textual examples of relative clauses show no special inclination towards this order.

4.2.2 The verbal complex

The form of the verb in relative clauses differs from main clauses. Due to the lack of subject agreement on the verb and a reduced set of TAN (tense-aspect-negation)[1] specifications, I call the verb in a relative clause a **participle**, following Heath (2008). We can distinguish two main differences between main clause verbs and relative participles: (1) subject marking and (2) segmental and tonal form of the verb

[1]Mood does not play as large of a role as negation in Dogon inflection, and so I categorize it as TAN rather than TAM.

4.2.2.1 Subject marking

In main clauses, pronominal subjects are expressed on the verb through agreement suffixes, shown in (5) on the imperfective affirmative form of the verb *káná* 'do':

(5)

1sg	kánà-dɛ**-m**	1pl	kánà-dɛ**-y**
2sg	kánà-dɛ**-w**	2pl	kánà-dɛ**-y**
3sg	kánà-dɛ**-Ø**	3pl	kánà**-diŋ** (N)

As this table shows, 3sg marking is null. The first and second plural suffixes are homophonous (*-y*). The 3pl is more complicated, since it often blends with inflectional suffixes to create portmanteaus (in this case, *-diŋ*), but in every case, it donates a nasal component (indicated by the N in parentheses). The main TAN suffixes in isolation and 3pl form for the verb are given in (6):

(6)

Affirmative imperfective	kánà-dɛ	kánà-diŋ
Negative imperfective	kàn-éélè	kàn-énnè
Affirmative perfective	kàn-ì (/è/ɛ̀)	kàn-ìɛ̀^{n}
Negative perfective	kànà-lí	kànà-nní

For the affirmative perfective (/è/ɛ̀) is included after the verb form, since other verb stems take mid vowel suffixes (depending on a combination of lexical specification and vowel harmony; see McPherson 2013:§12.4). Other inflectional categories are formed with auxiliary verbs, which typically take the suffix -ɛ̀^{n} as 3pl agreement.

Relative participles, on the other hand, do not take agreement suffixes. Instead, pronominal subjects are expressed through independent pronouns (the same series as inalienable possessors) obligatorily placed immediately before the relative participle. If the subject is nonpronominal, third person pronouns are still optionally used.

The examples in (7)-(8) contrast subject marking in main and relative clauses:

(7) a. gámmá=gɛ ɛ́bɛ̀-dɛ-m (main clause)
cat=DEF buy-IMPF-1SG
'I will buy the cat'

b. **gàmmà^{L}** mí ɛ́bɛ́-dɛ=gɛ (relative clause)
cat 1SG.PRO buy-IMPF.REL=DEF
'the cat that I will buy'

(8) a. yògó Sáná nàá sɛ́mɛ̀-dɛ (main clause)
tomorrow Sana cow buy-IMPF
'Sana will buy a cow tomorrow'

b. yògó Sáná **nàà^{L}** (wó) sɛ́mɛ́-dɛ=gɛ
tomorrow Sana cow 3SG.PRO slaughter-IMPF.REL=DEF
'the cow that Sana will slaughter tomorrow'

In (7), the main clause contains the subject agreement suffix *-m* while the relative clause contains the independent pronoun *mí*. In (8), the verb in the main clause carries no agreement marking (null for 3sg), while the relative clause optionally contains the 3sg pronoun *wó*.[2]

4.2.2.2 Paradigmatic TAN forms

We also find differences in TAN marking between main clauses and relative clauses. Differences can be seen in both the segmental morphological form and the associated tonal overlays. The following table summarizes the different TAN forms in main and relative clauses using the verb *káná* 'do':

[2]If the subject were 3sg pronominal, *wó* would be obligatory.

(9)

	Main clause	Overlay	Relative clause	Overlay
Aff. Impf.	kánà-dɛ	{HL}	káná-dɛ	N/A
Neg. Impf.	kàn-éélè	{L}	kàn-éélè	{L}
Aff. Pfv. (no focus)	kán-aa=wɔ	N/A	kán-ì	{HL}
Aff. Pfv. (focused)	kán-ì	{HL}	kán-ì	{HL}
Aff. Pfv. (defocalized)	kàn-ì	{L}	kán-ì	{HL}
Neg. Pfv.	kànà-lí	{L}	kánà-lì	{HL}
Progressive	káná-gú=sɛ	N/A	káná-gú=sɛ	N/A

Note that overlays in this table apply only to the verb stem: the suffix may have its own lexical tone.[3] In the affirmative imperfective, the segmental form of the verb is the same, but the stem takes {HL} in main clauses and no overlay (allowing lexical /H/ to surface)[4] in relative clauses; the negative imperfective forms are identical. There are three different perfective forms in main clauses, depending on focus and tense (present perfective shown here), but these collapse to a single perfective form in relative clauses. The negative perfective is segmentally identical in main and relative clauses, but in main clauses, the stem takes {L} with a H-toned suffix *-lí* while in relative clauses, the stem takes {HL} with a L-toned suffix *-lì*. Progressive forms are the same in both kinds of clauses.

This is yet another case where the broader syntactic context of a word makes a difference for tonal overlays: the morphosyntactic features of TAN may be the same in the case of, for example, the negative perfective, but depending on whether the verb is in a main or subordinate clause, the associated tonal overlay differs.

[3]This parallels DP tonal overlays, where a trigger causes a tone overlay on a target but retains its own lexical tone.

[4]Recall that verbs in Tommo So are either lexically /H/ or /LH/. In the affirmative imperfective in main clauses, this distinction is neutralized (*kánà-dɛ* 'will do' vs. *jɔ́bɔ̀-dɛ* 'will run') but it is visible in relative clauses, where there is no overlay (*káná-dɛ* vs. *jɔ̀bɔ́-dɛ*).

4.2.3 Relative markers

In Tommo So, there is no explicit relativizing morpheme marking a relative clause; the combination of structure, verb inflection, tone marking on the head, and context makes it clear that a clause is relative. However, two languages, Toro Tegu and Ben Tey, do have specific relative markers.

Ben Tey is the simpler case. In Ben Tey, there is an optional relative pronoun *kàà*^{n}, which is placed immediately after the head NP:

(10) a. nàwáà^{n} **dògùrù^{L}** **kàà^{n}** gòó-rɛ̀-ẁ wôy (Ben Tey)
meat time REL go.out-PFV-PPL.INAN all
'any time that meat (=a game animal) comes out...' (/dógúrú/)

b. **{pɛ̀rɛ̀** **tàànù}^{L}** **kàà^{n}** î sɛ̀w^{n}ŭ-m kù (Ben Tey)
sheep three REL 1PL slaughter.IMPF-PPL.PL DEF
'the three sheep that we will slaughter'

In (10a), the relative pronoun immediately follows the head noun. In (10b), it follows the head NP, consisting of a noun and a numeral. It is unclear whether the {L} overlay on the head NP extends through the relative pronoun or if this marker is lexically L-toned already. According to Heath (2012a), relative pronouns are most likely to be found in formal speech registers.

Toro Tegu is more complicated in that it has two different relative markers, an unexpected configuration (de Vries 2001). One is a relative pronoun *kàà*, which, like its cognate in Ben Tey, immediately follows the head NP. The other relative marker is *ŋ́j*, which appears in clause-final position. Heath (2011c) notes that this marker is etymologically related to the demonstrative *ǹŋgú*, which can be pronounced as *ŋ́j* after a postnominal modifier.[5] The relative

[5]This development of a demonstrative into a relativizer is crosslinguistically quite common. See Heine and Kuteva (2002), Kuteva and Comrie (2006).

pronoun *kàà* is optional, but the *ŋ́* relativizer is not. The following examples illustrate the two relative morphemes:

(11) a. **nàw^{n}à^{L} kàà** ǹ zàlú-sà **ŋ́** (Toro Tegu)
meat REL 1SG.PRO cook-PFV.2 REL
'the meat that I cooked'

b. **nàŋà^{L} kàà** yè-lí́ **ŋ́** (Toro Tegu)
cow REL come-NEG.PFV REL
'the cow that didn't come'

These examples suggest another interesting fact about Toro Tegu relative clauses: unlike the other Dogon languages, in Toro Tegu, there is scant evidence for an internal head. Most often, relative clauses are head-initial (i.e. the relative clause is postnominal), typologically unusual for an SOV language. As in the other languages, the head NP is marked with a {L} overlay.

Section 4.4.4 discusses the syntactic analysis of the post-clausal relativizer and demonstrates an interesting tonal interaction between it and a higher controller.

4.3 The tonosyntax of relative clauses

By and large, the head NP of a relative clause takes a {L} overlay, regardless of whether it is a simple noun or a noun modified by an adjective and/or numeral. When a possessor is head, it takes {L} while the possessed noun is free of tonal overlays. When a possessed noun is head, it typically takes {L}; the possessor may also take the relative clause overlay, depending on the language.

4.3.0.1 Simple nouns

The following examples, repeated from (3), show that a simple noun as head of the relative clause takes {L}:

(12) a. **yàà-nà^{L}** jàndúlu=gɛ tàgá=le bɛ́nd-ɛ̀=gɛ
female-HUM.SG donkey=DEF shoe=ASSOC hit-PFV.REL=DEF
'the woman who hit the donkey with a shoe'

b. yàa-ná=gɛ **jàndùlù^{L}** tàgá=le bɛ́nd-ɛ̀=gɛ
female-HUM.SG=DEF donkey shoe=ASSOC hit-PFV.REL=DEF
'the donkey that the woman hit with a shoe'

c. yàa-ná=gɛ jàndúlu=gɛ **tàgà^{L}** bɛ́nd-ɛ̀=gɛ
female-HUM.SG=DEF donkey=DEF shoe hit-PFV.REL=DEF
'the shoe that the woman hit the donkey with'

Regardless of whether the head is a subject (a), object (b), or PP (c), it always takes a {L} overlay.

4.3.0.2 Nouns with non-possessive modifiers

A head noun is maximally followed by an adjective (or adjectives) and a numeral; definite and demonstrative determiners, along with the plural and higher quantifiers (like 'all') follow the relative clause. Only clause-internal modifiers (adjective and numeral) are included in the relative clause's {L} domain:

(13) yàa-ná=gɛ **{jàndùlù** **kòmmò** **nèè-gò}^{L}** tàgá=le
female-HUM.SG=DEF donkey skinny two-ADV shoe=ASSOC
bɛ́nd-ɛ̀=gɛ=mbe
hit-PFV.REL=DEF=PL
'the two skinny donkeys that the woman hit with a shoe'

Both *kómmó* 'skinny' and *néé-go* 'two' take {L}.

If the universal quantifier were added after the relative clause, it would remain free of tonal overlays:

(14) yàa-ná=gɛ **{jàndùlù** **kòmmò** **nèè-gò}^{L}** tàgá=le
female-HUM.SG=DEF donkey skinny two-ADV shoe=ASSOC
bɛ́nd-ɛ̀=gɛ=mbe kɛ́m
hit-PFV.REL=DEF=PL all
'both of the two skinny donkeys that the woman hit with a shoe'

4.3.0.3 Possessive constructions as head

Things become more complicated when possessive constructions are head. We can divide these into what I call "possessor-type relatives" and "possessed-type relatives" (McPherson 2013); in the former, the possessor is head, and in the latter, it is the possessed noun.

In Tommo So, when a possessor is head of a relative clause, it takes a {L} overlay. As with other modifiers that have taken an overlay, the possessor loses its ability to control the tone of the possessed noun; see §2.5.3. In the absence of possessive overlays, the relationship between the possessor and the possessed noun can be maintained in one of two ways: linear order (direct juxtaposition of possessor + possessed) or a resumptive possessive pronoun (obligatory when the linear order is disrupted):

(15) a. **yàà-nà^{L}** íí (wómɔ) jáŋgu jàŋgá-gú sɛ́=gɛ̀
female-HUM.SG child (3SG.POSS) studies study-PPL have.REL=DEF
'the woman whose child is studying'

b. íí wómɔ **yàà-nà^{L}** jáŋgu jàŋgá-gú sɛ́=gɛ̀
child 3SG.POSS female-HUM.SG studies study-PPL have.REL=DEF
(=a)

c. *íí **yàà-nà^{L}** jáŋgu jàŋgá-gú sɛ́=gɛ̀
child female-HUM.SG studies study-PPL have.REL=DEF
(ungrammatical)

The possessive construction 'the woman's child' would normally be *yàa-ná=gɛ* ^{L}*ìì*, where 'child' takes a {L} overlay. Instead, when 'woman' is head of the relative clause, it takes {L}, while 'child' retains its lexical tone. When the possessed noun is scrambled before the possessor, as in (15b), the possessive pronoun *wómɔ* is obligatory, as shown by the ungrammaticality of (15c), where it is absent.

Pronouns themselves cannot be the head of a relative clause in most Dogon languages. Instead, a light noun *ńdɛ́* 'person' serves as head and takes the {L} overlay. If the possessed noun is alienable, as in (16a), it retains lexical tone, and I do not have any cases in the data of a resumptive possessive pronoun. If it is inalienable, however, as in (16b), the pronoun may be repeated in front of the possessed noun, in which case it might apply its {H(L)} overlay. Nonetheless, the only examples of this form include lexically /H/ nouns, where the possessive {H} overlay is not audibly distinct:

(16) a. émmé **nɗɛ̀^{L}** úlûm yím-áá-dɛ̀=gɛ=mbe
1PL.PRO person children die-PFV-IMPF.REL=DEF=PL
'we whose children have died'

b. é **ǹdɛ̀^{L}** (é) $^{(H)}$náá jàŋgá-mɛ́-dɛ=gɛ=mbe
2PL.PRO person (2PL.PRO) mother study-CAUS-IMPF=DEF=PL
'you (pl) whose mothers are teachers'

In (16a), the alienable possessed noun *úlûm* 'children' retains lexical tone. In (16b), the inalienable possessed noun *náá* 'mother' is optionally preceded by a resumptive possessive pronoun; since the noun is already H-toned, it is unclear whether a {H} overlay is imposed by this resumptive possessor.

When the possessed noun (or rather, the entire possessive construction) is head of the relative clause, we find more varied outputs. If the possessor is nonpronominal, then the possessed noun and any modifiers take a {L} overlay; this overlay is ambiguous between the possessor's control and the relative clause's control for alienable possessors (since the possessor scopes over adjectives and numerals), but with an inalienable possessor, it is clearly the work of the relative clause:

(17) a. **Sáná ^{L}{jàndùlù pìlù nèè-gò}^{L}** mí bɛ́nd-ɛ̀=gɛ=mbe
Sana donkey white two-ADV 1SG.PRO hit-PFV.REL=DEF=PL
'Sana's two white donkeys that I hit'

b. **Sáná {^{L}bàbè kòmmò kùlòy-gò}^{L}** nɔ̀nú yɛ́l-ɛ̀=gɛ=mbe
Sana uncle skinny six-ADV here come-PFV.REL=DEF=PL
'Sana's six skinny uncles that came here'

In (17a), the whole {L} domain is ambiguously controlled by either the possessor or the relative clause, or both. In (17b), only the {L} on the possessed noun is ambiguous (shown

by placing the possessor's L superscript inside of the bracketed domain); the adjective and numeral must be controlled by the relative clause, since they are not c-commanded by the possessor and would regularly retain their lexical tones (*Sáná* ^{L}*bàbè*^{L} *kómmó kúlóy-go* 'Sana's six skinny uncles'). In both cases, though, the possessor escapes the relative clause overlay, which can be seen by the fact that the bracketed expanse of overlay is not co-extensive with the underlined head; see §4.5 for further discussion.

With an alienable possessive pronoun, we find variation in word order but none in tonal overlays: the possessed head NP takes {L} while the possessive pronoun retains lexical tone. Most often, it immediately follows the possessed noun (18a), but it can also be separated from the possessed noun, either internal to the relative clause (18b) or postposed (18c):

(18) a. **jàndùlù$^{\mathbf{L}}$** **ḿmɔ** wó bɛ́nd-ɛ̀=gɛ
donkey 1SG.POSS 3SG.PRO hit-PFV.REL=DEF
'my donkey that he hit'

b. **jàndùlù$^{\mathbf{L}}$** àn-ná=gɛ **ḿmɔ** (wó) bɛ́nd-ɛ̀=gɛ
'my donkey that the man hit'

c. **jàndùlù$^{\mathbf{L}}$** wó bɛ́nd-ɛ̀ **ḿmɔ**=gɛ
donkey 3SG.PRO hit-PFV.REL 1SG.POSS=DEF
'my donkey that he hit'

In (18b), the nonpronominal subject 'the man' can be optionally resumed by the pronoun *wó*.

Finally, the most complicated results are found with inalienable pronominal possessors. In this case, we find variation between three tonal outputs: one in which the relative clause imposes {L} on both the possessed noun and the possessor (19a), one in which it imposes {L} only on the possessed noun (19b), and one in which the possessor imposes its {H(L)} overlay, leaving the relative clause's {L} unrealized (19c):

(19) a. **{èmmè nìŋjù}^{L}** bàmàkó yá-è=gɛ
1PL.PRO uncle Bamako go-PFV.REL=DEF
'our uncle who went to Bamako'

b. **émmé nìŋjù^{L}** bàmàkó yá-è=gɛ
1PL.PRO uncle Bamako go-PFV.REL=DEF
(=a)

c. **mí ^{H}báá** nàmá tɛ́mɛ̀-lì=gɛ
1SG.PRO father meat eat-NEG.PFV.REL=DEF
'my father who doesn't eat meat'

As we will see in §4.5, variation between any two forms arises naturally from the interplay of X^{L} REL, POSS ^{T}X, and IDENT-OO(T)/PHASE, though it is not possible to construct a grammar with all three outcomes (see §4.5.3). It is also precisely these data that motivate the division of phase-based faithfulness in Tommo So into IDENT-OO(T)/PHASE and lexically-specific IDENT-OO(T)/PHASE-LEX, since nonpronominal possessors never succumb to relative clause tone control.

4.4 The syntax of Dogon relative clauses

For all other controllers (adjectives, demonstratives, possessors), there is a clear trigger imposing its overlay on c-commanded words. For relative clauses, the situation is more difficult in that there is not a single clear candidate for the controller: Is it the relative participle? The relative pronoun in a language like Ben Tey and Toro Tegu, null in other languages? Even if we can pinpoint the controller, how can it pick out only the words in the head NP and not any of the surrounding non-head constituents?

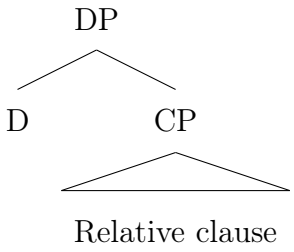
In this section, I will first cover previous proposals for the syntactic structure of head-internal relative clauses (§4.4.1), showing how these structures fail to provide the c-commanding

structure found in other cases of tonal overlay. In §4.4.2, I propose another analysis to account for the data, wherein the underlying structure crucially contains a full copy of the head NP both within the relative clause and on the spine of the DP, as argued by Cinque (2010). Unlike languages with overt external heads, in Dogon, when these two copies are "matched", the external copy deletes, leaving the head internal to the relative clause on the surface. The surprising and revealing aspect of Dogon internally headed relative clauses is that the internal copy inherits the morphophonological properties the external copy would have if it were pronounced.

4.4.1 Previous proposals

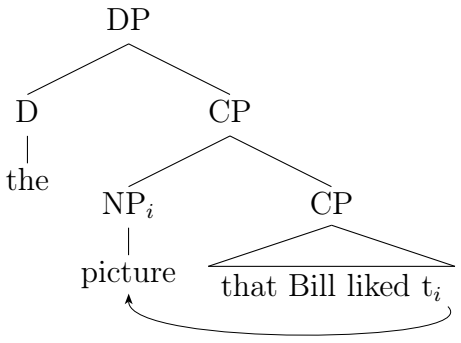
Arguably the most standard view of relative clause structure is one in which D selects a CP complement (e.g. Kayne 1994):

(20)



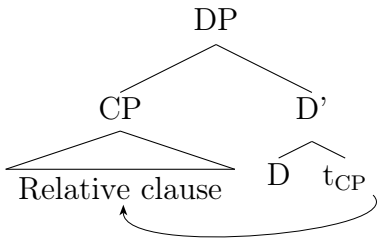
The head NP is embedded beneath CP, but raises in a head-initial language like English to the specifier of CP (Borsley 1997:631):

(21)



The same structure has been proposed for head-internal relative clauses as well (such as the head-internal relative clauses of the Gur languages, Hiraiwa 2009), but instead of NP movement to the specifier of CP, the whole CP moves to the specifier of DP (correctly predicting that the determiner will follow the relative clause). This is schematized in (22):

(22)

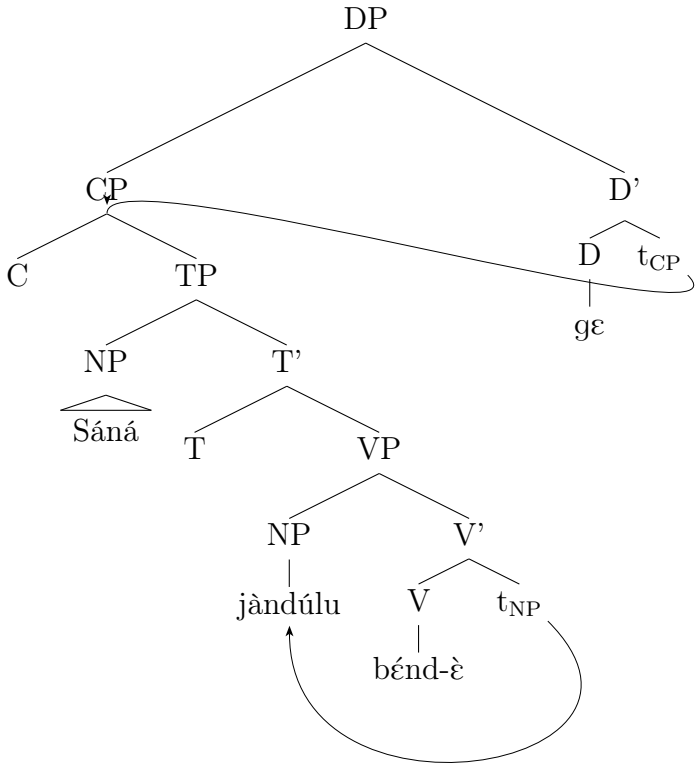


This structure would be able to account for the word order in Dogon relative clauses without problem. For example, consider the proposed tree structure in (23b) for the relative clause in (23a):[6]

(23) a. Sáná **jàndùlù^{L}** bɛ́nd-ɛ̀=gɛ (Tommo So)
Sana donkey hit-PFV.REL=DEF
'the donkey that Sana hit'

[6]I have simplified the clause structure in (b) to show the subject already in the specifier of TP, rather than originating in vP.

b.



The SOV word order of the clause is retained, the head NP remains nestled in this clause, and the whole thing surfaces before the definite determiner. However, this structure leaves the tonal overlays on the head noun unaccounted for. Every other tone controller in the language c-commands its targets, but here, the head noun is contained in the relative clause, meaning the clause cannot c-command it.[7]

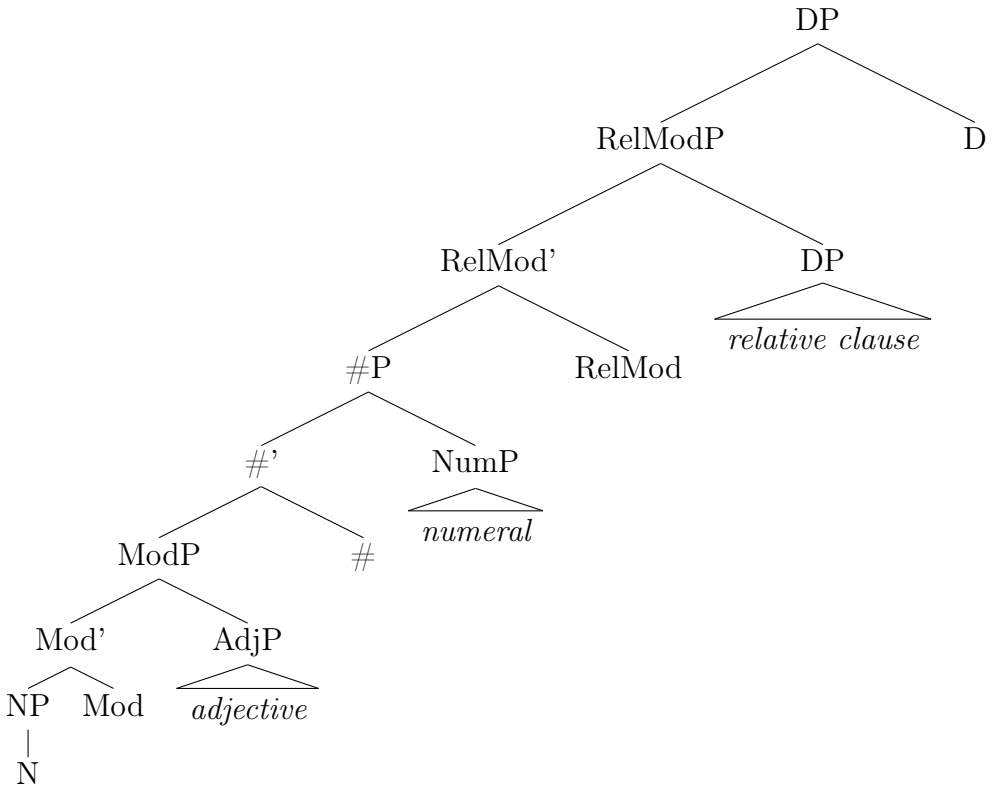
In the next subsection, I propose a different structure that provides a solution to this problem.

[7]One proposal that could be explored is that the Dogon languages have essentially prenominal relative clauses. This order is derived by first moving the head NP to the specifier of CP, followed by remnant movement of TP to the specifier of DP. This results in TP c-commanding the head NP. Crucially for Dogon, the head NP would have to be pronounced at the bottom of its movement chain, i.e. in its original position inside the relative clause. Such an analysis would still require inheritance of morphophonological properties between the trace and the moved copy, as in the analysis below.

4.4.2 Two copies of the head

I propose that the relative clause is a DP, rather than a CP,[8] contained in the specifier of a functional ModP projection (RelModP). In this way, the analysis resembles that of Culy (1990), who also places relative clauses under DP to reflect the fact that they are nominalized clauses. It is this DP (that is, the entire relative clause) that is the trigger of the relative {L} overlay, making the controlling structure of relative clauses parallel to that of alienable possessors: overlays are triggered by DPs in the specifier of a functional projection (PossP in the case of possessors, RelModP in the case of relative clauses). The tree structure I assume for relative clauses is given in (24):

(24)

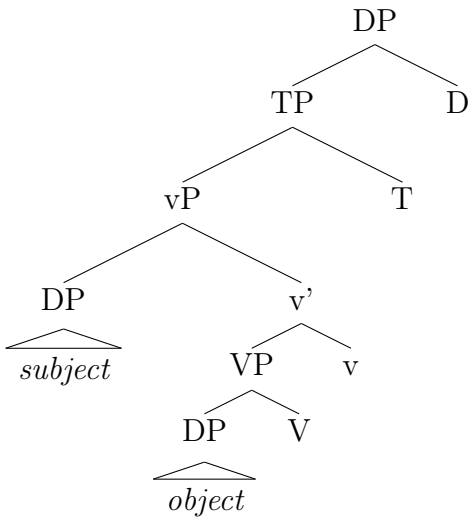


[8]As in Belikova (2009) for participial relatives. Dogon-specific arguments for DP rather than CP are given below, though nothing in the analysis hinges on this distinction. I continue to use the term "relative clause" here descriptively; technically speaking, DPs would be "phrases" while CPs are "clauses".

The relative clause c-commands the numeral, adjective, and noun, precisely those elements that appear internal to the relative clause with a {L} overlay. I will discuss this point further in the next subsection.

We can expand the structure of the relative clause itself as follows:

(25)



I argue that the relative clause is a DP rather than a CP for three reasons. First, the restricted set of TAN marking on the relative participle can be explained by restricting the left periphery of the clause. Second, the use of DP captures the generalization that relative clauses, and in particular the relative participle, are **nominal** in most Dogon languages rather than verbal. Finally, in Toro Tegu, the only language with a post-clausal relativizing morpheme, that morpheme appears to have developed from D, a structure which the clause may still retain.[9]

To illustrate, let us consider data from Jamsay, a language with more robust nominal morphology than Tommo So. In Jamsay, the participle agrees in animacy and number with the head noun (either subject or object) using the same agreement morphology found between nouns and adjectives:

[9]We could equally posit a CP with a reduced left periphery, or a CP carrying nominalizating features. There is, to my knowledge, no empirical way of distinguishing between these two analyses.

(26) a. pùlɔ-n^{L} nàŋá kù^{n} gúy^{n}ò-n (Jamsay)
Fulani-AN.SG cow DEF steal.PFV.REL-AN.SG
'the Fulani person who stole the cow'

b. pùlɔ-n^{L} dáɣá-n (Jamsay)
Fulani-AN.SG small-AN.SG
'a small Fulani person'

In both the relative clause and the N Adj phrase, the animate singular suffix *-n* on the noun is also present on the modifier (either the relative participle in (26a) or the adjective in (26b)). The same pattern is found with plural nouns:

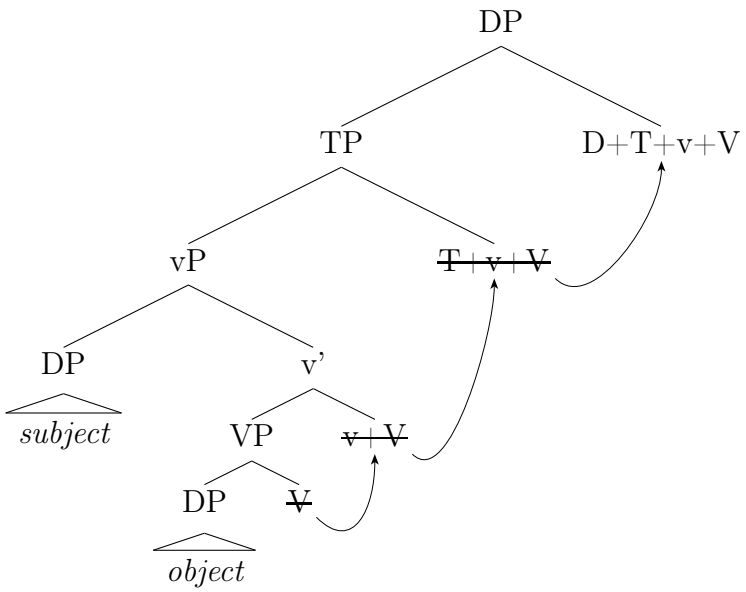
(27) a. **ìnè-m^{L}** dùŋdàŋá le jɛ́yɛ̀-m (Jamsay)
person-HUM.PL elephant with fight.PFV.REL-HUM.PL
'people who have fought with an elephant'

b. ìnè-m^{L} gùrú-m (Jamsay)
person-HUM.PL tall-HUM.PL
'tall people'

Recall from §4.2.2.1 that this nominal agreement pattern replaces the usual verbal subject agreement pattern, pointing to an analysis in which the verb is nominalized.

I argue that the verb becomes nominalized via head movement to D. For example:

(28)

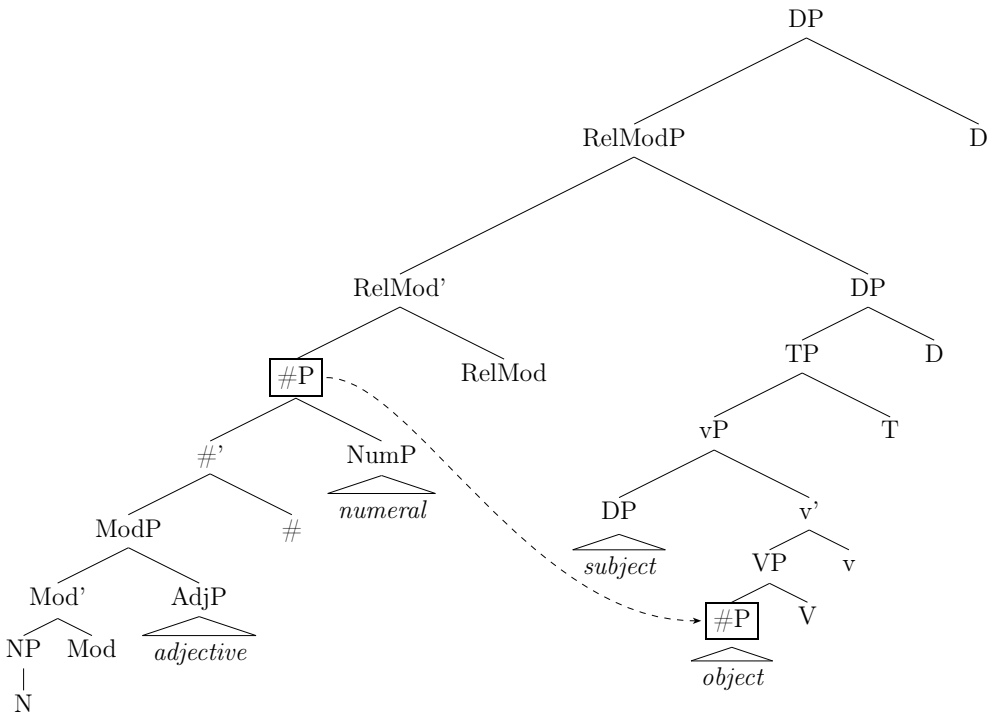


First, the verb moves from V and adjoins to v, then this v+V complex moves through T, becoming T+v+V, before finally moving to the head of DP, where it receives nominal agreement features. In Tommo So, the nominal nature of the relative participle can only be seen in the lack of verbal agreement, since the language lacks nominal agreement between the noun and modifiers. In §4.4.4, I will discuss independent evidence for verb movement in languages like Tommo So and Jamsay and the relationship between D and the relative particle in Toro Tegu.

4.4.3 Matching and morphophonological inheritance

If we combine the tree in (24) with the expanded view of the relative clause in (25), we see that there are two full copies of the head of the relative clause in the larger DP: one on the spine of DP (the external copy) and one within the relative clause itself (the internal copy):

(29)



The head of a relative clause (ignoring possessors for now) can be maximally #P, the same material found in the main DP beneath RelModP. These elements always take a {L} overlay inside the relative clause. Both of these properties are consistent with the external copy of the head. Nevertheless, the head is actually pronounced in the position of the internal copy, inside the relative clause. How can this contradiction be reconciled?

I propose a process of **morphophonological inheritance**, whereby when the two copies of the head are matched[10] in the Dogon languages, the internal copy inherits the morphophonological properties of the external copy before that copy deletes (represented in the the tree with the dashed arrow from the external #P to the internal copy). This is similar to an idea put forth in Selkirk (1996) and echoed in Ahn (2012, 2014), where postlexical features (particularly focus features) are shared across members of a movement chain. In this case, the chain is not related to movement but rather shared identity (i.e. the fact that they are identical copies).

[10]I am using the term "matched" here in an atheoretical way. We do not have sufficient data to determine whether Dogon relative clauses follow a pattern of matching or raising; see Cinque (2010) for discussion of syntactic tests.

Let us compare a main clause and a relative clause in Tommo So:

(30) a. Sáná jàndùlù^{L} gɛ́m=gɛ ɛ́b-aa=wɔ. (Tommo So)
Sana donkey black=DEF buy-PFV=be
'Sana has bought the black donkey.'

b. Sáná **{jàndùlù gɛ̀m}^{L}** ɛ́b-ɛ̀=gɛ
Sana donkey black buy-PFV.REL=DEF
'the black donkey that Sana bought.'

In the main clause in (30a), the adjective retains lexical tone and is followed by a definite determiner before the verb. In the relative clause in (30b), both the noun and the adjective take {L} and the definite determiner is absent, appearing instead after the relative clause.

I make two assumptions about the matching process in the Dogon languages: 1. The internal copy of the head of the relative clause contains only the material below the RelModP level (the level of the relative clause). 2. When the two copies are matched, the **external copy** deletes; as Cinque (2010) argues, which copy deletes is a language-specific parameter.

The process of matching for (30b) compares the internal head and the external head:

(31) Internal: jàndùlù^{L} gɛ́m
External: {jàndùlù gɛ̀m}^{L}

The external copy has {L} on both the noun and adjective, because both are c-commanded by the relative clause DP. The internal copy has lexical tone on the adjective (*jàndùlù^{L} gɛ́m*) since it is not c-commanded by a controller. They "match" because the syntactic structure of the two copies is identical. The external copy is then deleted, but not before its morphophonological features are transferred to the internal copy, giving both 'donkey' and 'black' the {L} overlay triggered by the relative clause.

Further evidence for morphophonological inheritance can be found in Ben Tey. In Ben Tey, nouns take inflectional suffixes for number and animacy, as they did in the Jamsay examples in (26). Unlike Jamsay, however, when an adjective modifies a noun in Ben Tey, the agreement suffix surfaces only on the adjective (i.e. it fails to appear on the noun):

(32) a. pɛ̀rɛ̌-m (Ben Tey)
sheep-AN.SG
'sheep'

b. pɛ̀rɛ̀^{L} dùgû-m (Ben Tey)
sheep big-AN.SG
'big sheep'

We find the same pattern with relative clauses. In a main clause, where an unmodified noun is an object, it carries the suffix *-m*, as in (33a), but when it is acts as head of the relative clause, this suffix surfaces instead on the relative participle, as in (33b):

(33) a. pɛ̀rɛ̌-m sɛ́w^{n}ú-ỳ (Ben Tey)
sheep-AN.SG slaughter.IMPF-1PL
'we will slaughter a sheep'

b. **pɛ̀rɛ̀^{L}** î sɛ̀w^{n}ǔ-m (Ben Tey)
sheep 1PL.PRO slaughter.IMPF.REL-AN.SG
'a sheep that we will slaughter'

This parallelism between relative clauses and other modifiers is once again explained if the internal head is pronounced with the morphophonological properties of the external head. The internal copy of the head has no modifier (it consists of only NP), but the external copy is c-commanded and modified by RelModP. The internal copy on its own would have the

form in (33a), but by morphophonological inheritance, it takes on the properties (both tonal and segmental) of the external copy, and is pronounced without the animate singular suffix.

4.4.4 Relative particles and phase boundaries

The syntactic structure proposed for relative clauses, with the verb moving to D, does more than just account for the nominal nature of the participle—it also helps explain the tonal behavior of relative clauses in the presence of a higher controller. The examples in (34a) and (34b) contrast a Tommo So relative clause carrying a definite determiner (a non-controller) and a demonstrative (a controller), respectively:

(34) a. Sáná **jàndùlù$^{\mathbf{L}}$** òlú=baa bɛ́nd-ɛ̀=gɛ
Sana donkey field=LOC hit-PFV.REL=DEF
'the donkey that Sana hit in the fields'

b. Sáná **jàndùlù$^{\mathbf{L}}$** òlú=baa **bɛ̀nd-ɛ̀$^{\mathbf{L}}$** nɔ́
Sana donkey field=LOC hit-PFV.REL this
'this donkey that Sana hit in the fields'

In (34a), we see a regular relative clause with tone lowering on the internal head, just as we have seen throughout this chapter. In (34b), where the definite determiner is replaced by a demonstrative, we see that the relative participle (in bold) also takes {L}, but no other clause-internal non-head constituents (the subject, the PP) do. At first glance, this resistance is surprising, given that the demonstrative c-commands the entire relative clause.

As first suggested in Chapter 2, I argue that these tonosyntactic facts are consistent with the phase-based analysis originally proposed for possessors. In the Dogon languages, DP is a phase.[11] When this phase boundary is reached, the complement to the phase head (in the relative clause, TP) is sent to spell-out, while the phase head itself spells out in the

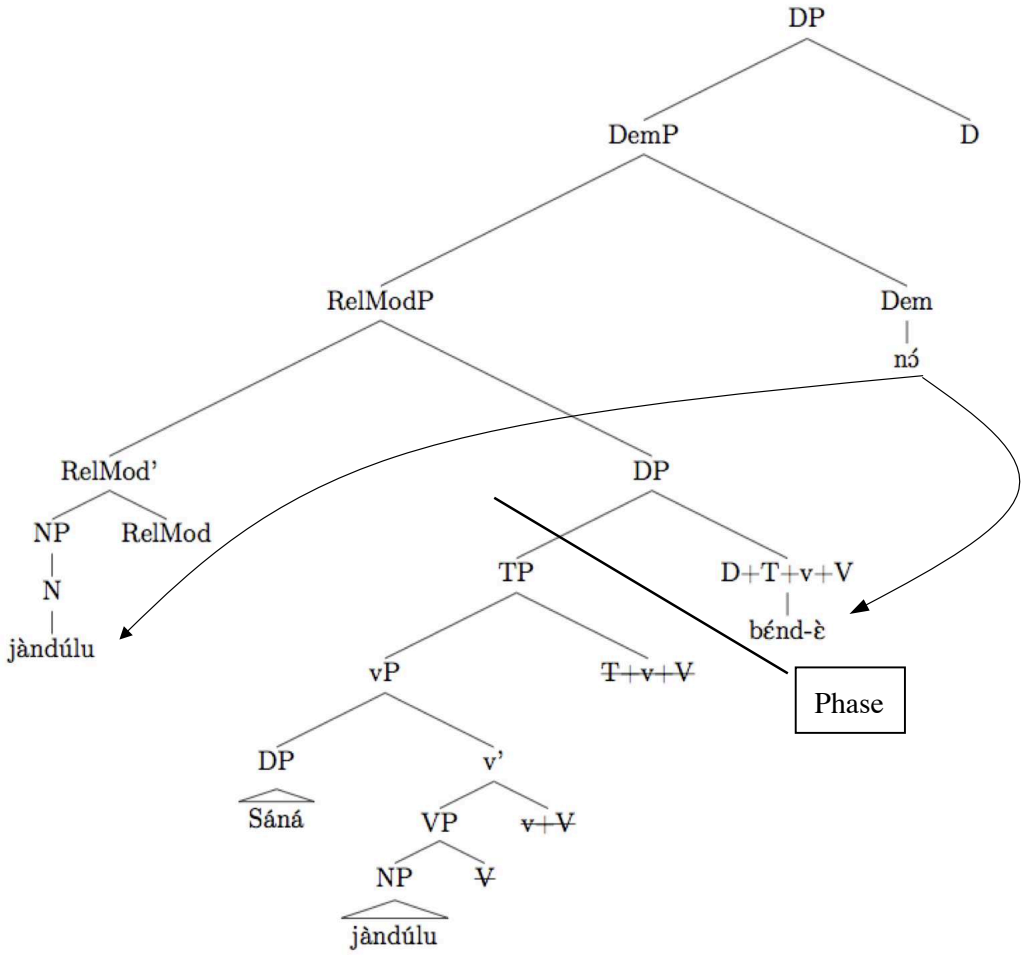
[11]Note that the same effects could be obtained in a CP analysis of relative clauses, since CPs are also phases.

next cycle. When TP is spelled out, its phonological output form is protected from further manipulation by IDENT-OO(T)/PHASE. In the following example, phases are delimited by square brackets:

(35) [Sáná **jàndùlù$^{\mathbf{L}}$** òlú=baa]$_{\text{TP}}$ [bɛ̀nd-ɛ̀$^{\text{L}}$ nɔ́]$_{\text{DemP}}$
Sana donkey field=LOC hit-PFV.REL this
'this donkey that Sana hit in the fields'

The consequence of this view is that when the verb moves to D, it "escapes" early spell-out. Thus, while the rest of the relative clause is protected from the demonstrative's tone control by phase-based faithfulness, the verb remains exposed, allowing it to take {L}. We can see these effects in the following tree structure:

(36) Phasal protection of relative clauses



A phase boundary separates TP from the controlling power the demonstrative. However, since the verb has raised to D, it is a viable target for the demonstrative's {L} overlay (which also targets the external copy of the head noun).

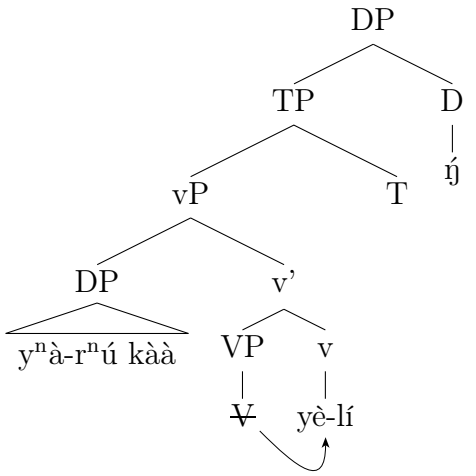
In Toro Tegu, the facts differ, but the underlying analysis remains the same. Recall that Toro Tegu is the only Dogon language with a post-clausal relative marker, *ŋ́j*. When a controller (either a definite or demonstrative in Toro Tegu) is added after a relative clause, only the relative marker takes {L}; the verb retains its regular tones:

(37) **y^{n}à-r^{n}ù^{L}** kàà yè-lí **ŋ́^{L}** kúnú (Toro Tegu)
woman-SG REL come-NEG.PFV REL DEF.SG
'the woman who didn't come'

The verb *yè-lí* retains L-H tone, but the relative particle *ŋ́* (in boldface) surfaces with {L}; the head noun, 'woman', also takes its usual {L} overlay from the relative clause itself.

I propose that in Toro Tegu, the verb is unable to move to D because D is already filled by the relative marker *ŋ́*, as shown below:

(38)



D is already filled, so the verb moves only as far as v (or possibly T). As a consequence, it is spelled out in the relative clause phase rather than with D and the higher phase. Thus, when the definite determiner or demonstrative seeks to impose its {L} overlay on c-commanded words, only the relative marker is affected; the verb and other relative clause constituents are protected by phase-based faithfulness.

Further evidence that the verb in Toro Tegu does not raise to D comes from the fact that the inflectional forms are tonally and segmentally identical to those found in main clauses (suggesting it has not been nominalized by head-adjunction with D); it is not clear from Heath (2011c) whether there is a reduced set of TAN categories or not. A prediction of the verb remaining low is that it has not been nominalized and will not display nominal agreement, but modifiers in Toro Tegu do not typically agree with the noun, so we cannot

test this question empirically. One piece of evidence that the verb could be nominal, going against the hypothesis that it does not move to D, is that it fails to take subject suffixes, just like in other Dogon languages where we posit movement. It is possible that the lack of subject agreement in relative clauses derives from some principle other than the verb being in D, allowing us to unify Toro Tegu and the other languages with more explicitly nominal relative participles.

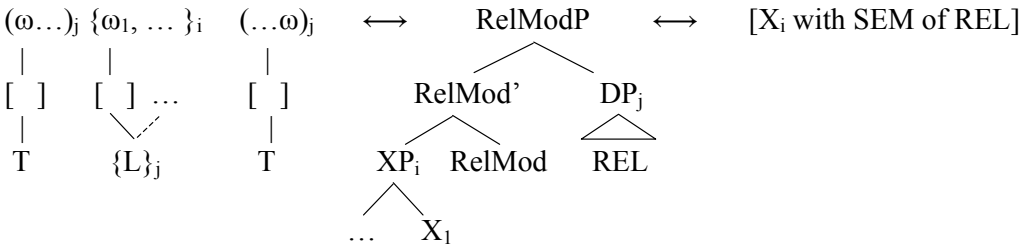
In the next section, we will see how tonosyntactic patterns involving relative clauses are accounted for in the constraint-based analysis.

4.5 X^L REL and its relation to other constraints

4.5.1 Relative clause schemas and X^L REL

Relative clause overlays are encoded in the grammar in the same way as those stemming from adjectives or demonstratives. I assume a constructional schema like the following:

(39) Constructional schema for Dogon relative clause



The syntactic branch shows the relative clause, REL, contained in a DP in the specifier of RelModP. Words c-commanded by this relative clause are XP (and below in the tree, represented by ...). The semantics of the construction are totally regular. The phonological branch is a little more complicated, due to the internally headed nature of Dogon relative clauses. The c-commanded words are represented in curly brackets, co-indexed with XP

in the syntactic branch. These words are associated to a {L} overlay, coindexed with the relative clause DP (the controller). The words of relative clause itself take their lexical tone (T), and potentially appear on either side of the c-commanded words (the head); I assume that exact word order is the responsibility of syntax.[12]

As with other controllers, this constructional schema is embodied in a construction constraint, shown in (40):

(40) X^{L} REL: Assess a violation for every word c-commanded by the relative clause DP that does not take a {L} overlay.

An example tableau illustrating the effect of X^{L} REL in Tommo So is given in (41b) for the object relative form in (41a):

(41) a. (Tommo So)

S	O^{L}	V.Rel=Def
Sáná	**jàndùlù^{L}**	bɛ́nd-ɛ̀=gɛ
Sana	donkey	hit-PFV.REL=DEF

'the donkey that Sana hit'

b.

Input: /Sáná jàndúlu bɛ́nd-ɛ̀=gɛ/		X^{L} REL	IDENT(T)
a.	☞ Sáná jàndùlù^{L} bɛ́nd-ɛ̀=gɛ		*
b.	Sáná jàndúlu bɛ́nd-ɛ̀=gɛ	*!	
c.	Sànà^{L} jàndùlù^{L} bɛ́nd-ɛ̀=gɛ		**!

[12] i.e. the difficulties in the PHON branch are a notational difficulty, not an analytical one.

Candidate (a), in which the head of the relative clause takes {L} tone, is selected as the winner since it satisfies X^L Rel. Candidate (c) likewise satisfies this constraint, but it includes an unmotivated {L} overlay on the non-head subject *Sáná*, resulting in an extra violation of Ident(T). Faithful candidate (b) is ruled out due to the violation of X^L Rel.

4.5.2 X^L Rel in the Tommo So constraint set

We can compare the constraint weights of the Tommo So constraint set before the incorporation of X^L Rel to those after its incorporation.[13] Forms containing relative clauses were added to the input file for the maxent grammar tool and the weights recalculated. The results are given in the rightmost column (42), compared to the original (pre-relative clause) weights in the middle column:

(42)

Constraint	*Old*	*New*
Ident-OO(T)	7.8	8.3
Ident-OO(T)/Phase-Lex	2.2	11.0
Ident-OO(T)/Phase	42.9	44.0
Poss ^{T}X	15.3	15.4
X^L Adj	22.9	23.1
X^L Dem	27.6	31.1
X^L Rel	–	36.8
*Self-Control	41.8	48.7
Uniformity	7.5	7.9
Locality	14.6	18.0

[13]More specifically, the weights in the lefthand column were calculated from a grammar containing only very basic cases of X^L Rel, while those in the righthand column contain all cases of X^L Rel in conflict with possessors, demonstratives, etc.

As we can see, most weights remain largely unchanged: 7.8 to 8.3 for IDENT-OO(T), 42.9 to 44.0 for Ident-OO(T)/Phase, etc. These small changes are tweaks that keep the grammar running in largely the same way, now that X^L REL has been introduced. The only significant change we see is in IDENT-OO(T)/PHASE-LEX, the faithfulness constraint that penalizes phases containing lexical material. In the last version of the grammar, this constraint had basically 0 weight; it could be removed from the constraint set to no effect.

With the addition of relative clauses, however, we find motivation for both general and lexical phase-based faithfulness. Specifically, we need the two versions of the constraint to capture the fact that relative clauses can impose their {L} overlay on pronominal possessors but never on non-pronominal possessors: a pronominal possessor with a {L} overlay violates only the general IDENT-OO(T)/PHASE constraint while a nonpronominal (lexical) possessor taking {L} violates both IDENT-OO(T)/PHASE and IDENT-OO(T)/PHASE-LEX.

Let us first examine the case of a nonpronominal possessor like the following:

(43) (Tommo So)

PossNonP$_1$	**^{L1}N^{L2}**	Rel$_2$	
Sáná$_1$	**^{L1}jàndùlù^{L2}**	[mí	bɛ́nd-ɛ̀=gɛ]
Sana	donkey	[1SG.PRO	hit-PFV.REL=DEF]

'Sana's donkey that I hit'

The domain of the relative tonal overlay ({L2}) is not coextensive with the material of the relative head; the possessor is protected by phase-based faithfulness, and any candidate in which the possessor takes the overlay is doubly penalized by both IDENT-OO(T)/PHASE and IDENT-OO(T)/PHASE-LEX. The following tableau illustrates the selection of this output form:

(44) *Tableau for PossNonP$_1$ ^{L1}N^{L2} Rel$_2$*

/PossNonP$_1$ N Rel$_2$/	*p* Obs	*p* Pred	*Score*	Id(T) 8.3	Id(T)/Ph-Lex 11.0	Id(T)/Ph 44.0	Poss ^{T}X 15.4	X^{L} Rel 36.8	*SelfCont 48.7	Uniformity 7.9	Locality 18.0
a. PossNonP$_1$ ^{L1}N^{L2} Rel$_2$	1	∼1	53	1	0	0	0	1	0	1	0
b. PossNonP$_1$ N^{L2} Rel$_2$	0	∼0	60.5	1	0	0	1	1	0	0	0
c. {PossNonP$_1$ N}^{L2} Rel$_2$	0	∼0	71.6	2	1	1	0	0	0	0	0
d. PossNonP$_1$ ^{L1}N Rel$_2$	0	∼0	81.9	1	0	0	0	2	0	0	0
e. PossNonP$_1$ N Rel$_2$	0	∼0	89.0	0	0	0	1	2	0	0	0
f. PossNonP$_1$^{L2} N Rel$_2$	0	∼0	118.1	1	1	1	0	1	0	0	1
g. PossNonP$_1$ ^{L1}N Rel$_2$^{L2}	0	∼0	120.3	2	1	1	0	0	1	0	0
h. ^{L1}PossNonP$_1$ N^{L2} Rel$_2$	0	∼0	157.1	2	1	1	0	1	1	0	0

Candidates (a) and (b) are close in weight, but candidate (b) receives a higher penalty score due to a violation of Poss ^{T}X as compared to candidate (a)'s violation of Uniformity. Crucially, this tableau illustrates that candidate (c) is ruled out from the combined weights of Ident(T)/Phase-Lex and Ident(T)/Phase. Candidates (d) and (e) receive high penalty scores due to the lack of the relative {L} overlay; both maximally violate X^{L} Rel. Finally, candidates (f)-(h) are ruled out due to phase-based faithfulness violations combined with either a violation of X^{L} Rel or *SelfControl. Note that candidate (g)'s violation of phase-based faithfulness is due to the {L} overlay on the relative clause, not on the possessor. I have painted this tableau in broad brush strokes, taking Rel to stand for all constituents in the relative clause (in the example above, the sequence *mí bɛ́nd-ɛ̀*), including those below the phase boundary. If this example were spelled out in more detail, we could find more fine-grained violations.[14]

[14]For example, a {L} overlay on the pronoun *mí* would result in a violation of phase-based faithfulness, since it is below the D level of the relative clause. A {L} overlay on the verb, however, would trigger no such violation. I will return to this point in the next subsection on the interaction of the demonstrative and the relative clause in a constraint-based grammar.

If the possessor is pronominal, we find a different outcome: Either the relative clause overlay is applied only to the noun, or the relative clause overlay can apply to both the noun and the possessor. Since the possessor is pronominal, this latter outcome results only in a violation of general IDENT-OO(T)/PHASE and not the lexically-specific version. The examples in question are repeated from (19):

(45) a. {**PossIP** **N**}^{L} Rel (Tommo So)
{**èmmè** **nìŋjù**}^{L} [bàmàkó yá-è=gɛ]
1PL.PRO uncle Bamako go-PFV.REL=DEF
'our uncle who went to Bamako'

b. **PossIP** **N**^{L} Rel (Tommo So)
émmé **nìŋjù**^{L} [bàmàkó yá-è=gɛ]
1PL.PRO uncle Bamako go-PFV.REL=DEF
(=a)

I will return to the third possible output form from (19c) (also candidate (c) in the following tableau) in §4.5.3 below. This form is attested once in my dataset, but poses analytical difficulties and may formally differ from the relative clauses in (45).

The tableau in (46) illustrates how candidates (a) and (b) are both assigned probability:

(46) *Tableau for PossIP$_1$ ^{L1}N^{L2} Rel$_2$*

/PossIP$_1$ N Rel$_2$/	*p* Obs	*p* Pred	*Score*	Id(T) 8.3	Id(T)/Ph-Lex 11.0	Id(T)/Ph 44.0	Poss ^{T}X 15.4	X^{L} Rel 36.8	*SelfCont 48.7	Uniformity 7.9	Locality 18.0
a. PossIP$_1$ N^{L2} Rel$_2$	.5	∼.5	60.5	1	0	0	1	1	0	0	0
b. {PossIP$_1$ N}^{L2} Rel$_2$	.5	∼.5	60.6	2	0	1	0	0	0	0	0
c. PossIP$_1$ $^{H(L)1}$N Rel$_2$	0	∼0	81.9	1	0	0	0	2	0	0	0
d. PossIP$_1$ N Rel$_2$	0	∼0	89	0	0	0	1	2	0	0	0
e. PossIP$_1$^{L2} $^{H(L)1}$N Rel$_2$	0	∼0	97.4	2	0	1	0	1	0	0	0
f. PossIP$_1$^{L2} N Rel$_2$	0	∼0	107.1	1	0	1	0	1	0	0	1
g. PossIP$_1$ $^{H(L)1}$N Rel$_2$^{L2}	0	∼0	120.3	2	1	1	0	0	1	0	0
h. $^{H(L)1}$PossIP$_1$ N^{L2} Rel$_2$	0	∼0	146.1	2	0	1	0	1	1	0	0

Candidates (a) and (b) tie for winner since their combined violations both equal roughly 60.5. If the possessor were nonpronominal, candidate (b) would receive an extra 11 in penalty score from Ident(T)/Phase-Lex. In this tableau, the only candidate to receive a violation of lexically-specific Ident(T)/Phase is candidate (g), for the {L} overlay on the relative clause. There are also no violations of Uniformity, since the competing overlays are non-homophonous ({H(L)} for the possessor, {L} for the relative clause), but I have left the constraint in the constraint set to maximize comparability with the tableau in (44).

Cases involving the interaction of X^{L} Rel and X^{L} Adj are straightforward and will not be illustrated with a tableau here. Since the relative clause c-commands the adjective, and since there is no special faithfulness protecting an adjective from taking an overlay, the optimal candidate is (schematically) {**N Adj**}^{L} Rel, where the relative overlay is realized on both the noun and adjective. By taking the relative clause's overlay, the adjective's construction constraint X^{L} Adj is rendered moot.

Turning back to the constraint set in (42), we see that X^{L} Rel has the largest weight of any construction constraint at 36.8. For comparison, X^{L} Adj has a weight of just 23.1.

The consequence of this lower weight is that an adjective will never have enough strength to overcome violations phase-based faithfulness in Tommo So and impose its overlay on a possessor. In light of the last tableau, a candidate like (a) would have a lower penalty score than candidate (b) if X^L REL were replaced with X^L ADJ; in other words, a violation of X^L ADJ is not as serious as a violation of phase-based faithfulness, and so no variation is seen with controllers other than the relative clause.

4.5.3 Revisiting variation

In (19), I showed that Tommo So varies between three output forms when the head of the relative clause is a possessive construction with an inalienable pronominal possessor. Those three forms can be schematized as in (47):

(47) a. {PossIP N}^{L} Rel

b. PossIP N^L Rel

c. PossIP $^{H(L)}$N Rel

In other words, the relative clause {L} overlay can apply to both the noun and the possessor, as in (a); the relative {L} overlay can apply to only the noun, as in (b); or the possessive {H(L)} overlay can outrank the relative {L} overlay, as in (c). The output form in (b) is the form we find in other cases of competition between an inalienable pronominal possessor and a nonpossessive modifier (cf. PossIP N^L Adj, PossIP N^L Dem). The output form in (a) shows a reversal in strength between nonpossessive control and phase-based faithfulness, as just described, while the form in (c) shows a reversal in strength between possessive and nonpossessive control.

The model is in fact not capable of generating the correct results when all three output forms are given non-zero probability. When they are, other cases of PossIP N Mod (either Adj or Dem) also show variation between the attested surface form (with a {L} overlay on the noun) and a form in which the possessive overlay wins. In diagnosing the problem, I ran models in which only two of the three attested output forms were given non-zero probability. A model with only (a) and (b) was successful, as was a model with only (b) and (c). The three-output model breaks down because of the incompatibility of outputs (a) and (c).

To understand this incompatibility, let us compare the following tableaux (omitting, for now, weights and winners):

(48) a.

Input: /PossIP N Rel/	IDENT-OO(T)/PHASE	POSS TX	X^L REL	IDENT-OO(T)
a. PossIP $^{H(L)}$N Rel			**	*
b. PossIP N^L Rel		*	*	*
c. {PossIP N}^{L} Rel	*			**

b.

Input: /PossIP N Adj/	IDENT-OO(T)/PHASE	POSS TX	X^L ADJ	IDENT-OO(T)
a. PossIP $^{H(L)}$N Adj			**	*
b. PossIP N^L Adj		*	*	*
c. {PossIP N}^{L} Adj	*			**

Here we have the same basic input form PossIP N Mod, where Mod = Rel in (48a) and Adj in (48b). The candidates are the same and the constraints the same, except for using X^L Rel in (48a) and X^L Adj in (48b). In (48a), we want candidates (a) and (c) to tie for winner, which happens in Harmonic Grammar when the two have equal penalty scores. This means the following, where w = weight:

(49) $2 * w(X^L \text{ Rel}) + w(\text{Ident(T)}) = w(\text{Ident(T)/Phase}) + 2 * w(\text{Ident(T)})$

Solving for $w(X^L \text{ Rel})$ in (49), we get the following:

(50) $w(X^L \text{ Rel}) = \frac{w(\text{Ident(T)/Phase})+w(\text{Ident(T)})}{2}$

The weight of Poss ^{T}X must be vastly higher than the weight of X^L Rel in order for candidate (b) to be ruled out. In other words, w(Poss ^{T}X) must be greater than $\frac{w(\text{Ident(T)/Phase})+w(\text{Ident(T)})}{2}$.

This ratio remains constant in the case of the adjective in (48b), since the constraints are the same. The only variable we can change in order to get a different output forms is the weight of X^L Adj. Candidate (c) does not involve any violations of this constraint, and so its penalty score will be the same as in the case of a relative clause (where that candidate is chosen as winner). The task is, then, to give X^L Adj a weight such that the penalty score of candidate (b) is less than that of candidates (a) or (c). The problem is the following: candidate (b) involves only a single violation of X^L Adj, while candidate (a) involves two. Getting the penalty score of candidate (b) below that of candidate (c) involves giving X^L Adj a lower weight, but doing results in an amplified reduction for candidate (a). In other words, candidate (b) with an adjective can never win with a constraint set that chooses candidates (a) and (c) as winners with a relative clause. The situation remains the same when the grammar chooses all three candidates as winners with a relative clause.

However, it is possible that the output form PossIP $^{H(L)}$N Rel does not have the same underlying syntactic or semantic structure as the other two, allowing us to avoid this modeling problem. The only case of this output form in my data is the example in (51):[15]

(51) **mí** ^{H}**báá** nàmá tɛ̀m-éélè=gɛ
1SG.PRO father meat eat-IMPF.NEG.REL=DEF
'my father who doesn't eat meat'

Though I have not found any systematic differences between restrictive and non-restrictive relative clauses in Tommo So, the semantics of this form are clearly non-restrictive: one presumably has but a single father, so the distinction of not eating meat only adds additional information, rather than restricting the reference on 'father'. The lack of relative {L} may be related to this fact (e.g. the structure of the relative clause may be appositive and hence not fit the structural description of the regular relative clause constructional schema). It will take further investigation and a larger corpus of data to determine how robust this output form is and under what conditions it appears. If it turns out to be a regular output form, used even in restrictive relative clauses, the constraint set will need to be altered to account for the data patterns.

4.5.4 The interaction between X^{L} REL and X^{L} DEM

The discussion of X^{L} REL thus far has included only to competitions between relative clauses and structurally lower controllers (possessors, adjectives). This section shows how the model accounts for the interactions between relative clauses and the demonstrative, the only structurally higher controller. To model the effects of demonstratives on relative clauses, we must split the relative clause portion of the schematic forms into (at minimum) Rel and V, where Rel represents all non-verbal constituents in the relative clause. This split must be made in

[15]Even if we assign this output form only very low probability in the model (e.g. 0.1) to reflect its less common status, the grammar still predicts unattested variation in other constructions.

order to account for the fact that demonstratives can impose {L} on the relative participle V, but no other constituents, which I argue to be spelled out in a separate phase (see §4.4.4).

Recall from §4.4.4 that a demonstrative after a relative clause will impose {L} on the verb of the relative clause, but nothing else:

(52)

N^{L2}	[Rel		V^{L2}]$_1$	Dem$_2$ (Tommo So)
jàndùlù^{L2}	[òlú=baa	mí	bɛ̀nd-ɛ̀^{L2}]	nɔ́
donkey	field=LOC	1SG.PRO	hit-PFV.REL	this

'this donkey that I hit in the field'

The relative participle *bɛ́nd-ɛ̀* takes the demonstrative's {L} overlay, while the subject and PP constituents of the relative clause retain lexical tone. The tableau selecting this schematic form is given in (53):

(53) *Tableau for N^{L2} [Rel V^{L2}]$_1$ Dem$_2$*

/N [Rel V]$_1$ Dem$_2$/	*p* Obs	*p* Pred	*Score*	ID(T) 8.3	ID(T)/PH-LEX 11.0	ID(T)/PH 44.0	X^L DEM 31.1	X^L REL 36.8	*SELFCONT 48.7	UNIFORMITY 7.9	LOCALITY 18.0
a. N^{L2} [Rel V^{L2}]$_1$ Dem$_2$	1	∼1	47.7	2	0	0	1	0	0	0	0
b. N^{L12} [Rel V^{L2}]$_1$ Dem$_2$	0	∼0	55.6	2	0	0	1	0	0	1	0
c. N^{L1} [Rel V]$_1$ Dem$_2$^{L2}	0	∼0	65.3	2	0	0	0	0	1	0	0
d. {N [Rel V]$_1$}^{L2} Dem$_2$	0	∼0	79.9	3	1	1	0	0	0	0	0
e. N^{L12} [Rel V]$_1$ Dem$_2$	0	∼0	96.4	1	0	0	2	0	0	1	1
f. N^{L1} [Rel V]$_1$ Dem$_2$	0	∼0	101.6	1	0	0	3	0	0	0	0
g. N^{L2} [Rel V]$_1$ Dem$_2$	0	∼0	125.3	1	0	0	2	1	0	0	1
h. N [Rel V]$_1$ Dem$_2$	0	∼0	130.7	0	0	0	3	1	0	0	0

In this tableau, the whole relative clause (barring the head) [Rel V] is marked as the controller, coindexed 1 with its {L} overlay. The demonstrative c-commands all words in the

relative clause, but as the tableau indicates, winning candidate (a) shows the demonstrative's {L2} on only the verb. If it were applied to the entire relative clause, as in candidate (d), this would incur a violation of the phase-based faithfulness constraints. This is because the Rel portion (all non-V constituents) is below the phase boundary associated with D of the relative clause DP. The verb, on the other hand, moves to D and is visible to the higher phase; see §4.4.3. Candidate (b) is harmonically bounded by winning candidate (a), since it incurs a violation of UNIFORMITY.[16] Candidate (c) is ruled out by a violation of *SELFCONTROL, whose weight is higher than the combined penalty score of the winning candidate. Candidates (e-h) have too many c-commanded words with lexical tone, resulting in two or more violations of X^{L} Dem.

In Toro Tegu, where the relative particle occupies D in place of the verb, this particle would take the demonstrative's {L} overlay; if the verb received the overlay this would result in a violation of phase-based faithfulness.

4.5.5 Phase-based faithfulness for relative clauses vs. possessors

In Tommo So, phase-based faithfulness is very powerful. Elements of the relative clause below a phase boundary are never altered, and possessors are only altered by relative clauses if they are pronominal. The constraint weights responsible for this grammar were given in (42) above.

But what about a language like Jamsay, where possessors readily take overlays from higher modifiers in violation of phase-based faithfulness but relative clauses follow the same pattern as Tommo So, with only verbs taking a {L} overlay? If phase-based faithfulness (or lack thereof) is responsible for both patterns, how do we reconcile these facts?

[16] As we have seen in other tableaux, though, this candidate is also conceptually problematic, since by virtue of taking the demonstrative's {L} overlay, the relative clause should lose the ability to control its own {L}. Note that I have made the modeling decision that *any* constituent in the relative clause taking {L} results in a loss of relative clause tone control. The alternative would be that the entire relative clause must be controlled in order to lose control. Under these assumptions, homophonous candidate (b) would be chosen as winner.

The key lies in the fact that when a controller takes an overlay, it loses its ability to control. For relative clauses, this is true even if the overlay is only on the verb: if the tone of the relative clause is altered, its own tone control is rendered moot. Compare the following output forms:

(54) a. {Poss N}^{L} Dem

b. N^{L} [Rel V^{L}] Dem

With the possessor in (54a), applying the demonstrative's {L} overlay violates phase-based faithfulness, but it means that the possessor's constraint is not violated (which it would be in a form Poss N^{L} Dem, since the possessor did not impose {HL}). With the relative clause in (54b), only the verb takes {L}, which does not violate phase-based faithfulness but still renders the relative clause's constraint moot. Thus, a form {N [Rel V]}^{L} Dem does nothing but violate phase-based faithfulness and alleviate one violation of X^{L} DEM; violations of X^{L} REL remain unchanged. A look at the relevant weights in Jamsay reveals the reason for this outcome:

(55)

IDENT(T)	6.8
IDENT(T)/PHASE-LEX	7.8
IDENT(T)/PHASE	7.8
POSS ^{HL}X	14.2
X^{L} DEM	15.2

The winning form for the possessor violates all faithfulness constraints, totaling 22.4 in penalty score (as considered here). The form Poss N^{L} Dem violates IDENT(T) once, POSS ^{HL}X once, and X^{L} DEM once, for a total of 36.2. Thus, it is better to fully satisfy the

demonstrative's construction constraint, at the expense of phase-based faithfulness. For relative clauses, on the other hand, the winning form (N^L [Rel V^L] Dem) violates IDENT(T) twice and X^L DEM once (for Rel), for a total of 28.8. If Rel also took {L}, this would reduce the penalty score by 15.2 (since X^L DEM would be fully satisfied), but it would gain an additional 22.4 from the combined weights of the faithfulness constraints. Thus, it is better for relative clauses to respect phase-based faithfulness.

4.6 Remaining issues

The analysis given in this chapter captures most of the relative clause data patterns in the Dogon languages. Nevertheless, a few interesting problems remain. I will lay out the data patterns here but leave analysis to future work.

4.6.1 Conjoined DP head

One problematic pattern is found when conjoined NPs function as head of the relative clause. Typically, this syntactic construction is avoided and the meaning is expressed periphrastically by repeating the relative clause after (or around) each head, illustrated in (56):

(56) **yàà-m$^{\mathbf{L}}$** ìsé tɛ́mɛ́-dɛ=gɛ=mbe **ànà-m$^{\mathbf{L}}$** ìsé
female-HUM.PL dog eat-IMPF.REL=DEF=PL male-HUM.PL dog
tɛ́mɛ́-dɛ=gɛ=mbe
eat-IMPF.REL=DEF=PL
'women and men who eat dog'

Some speakers do allow regular conjunction of relative heads, but in this case, the conjoined nouns do not take the relative clause {L} overlay:

(57) **yàá-m=le** **ànáá-m=le** ìsé (Tommo So)
female-HUM.PL=ASSOC male-HUM.PL=ASSOC dog
tɛ́mɛ́-dɛ=gɛ=mbe
eat-IMPF.REL=DEF=PL
'women and men who eat dog'

This same pattern is found in nearly all other Dogon languages, with the exception of three languages. First, Togo Kan and Yorno So fall at the opposite extreme: both coordinands in the conjoined head are subject to tone lowering, as shown by the following example from Yorno So:

(58) **{àr^{n}ù-m** **lè⇒** **yàà-m** **lè⇒}^{L}** tɔ́ɔ̀-m (Yorno So)
male-HUM.PL and female-HUM.PL and RECIP-HUM.PL
yɛ̀nɛ́-ŋ̀=b-ɛ́ɛ̀^{n} ŋɛ̀-m (Yorno So)
look.at-IMPF=PST.PPL-PL DEF-PL
'the men and women who were looking at each other'

The arrows on the conjunctions indicate prosodic lengthening. Like Tommo So, a strategy where the relative clause is repeated after each coordinand is preferred, except for cases like (58), where the reciprocal meaning requires both to be involved in the same action.

Falling in between these two poles, we find Jamsay, where the first coordinand retains its lexical tone but the second takes the relative clause's {L} overlay:

(59) **ŋɛ̌-n˰˰** **à-n^{L}˰˰** yɛ́rè-m kùn (Jamsay)
woman-SG man-SG come.PFV.REL-PPL.PL DEF
'the woman and the man who came' (/ă-n/)

The symbol ˰˰ indicates what Heath (2008) calls "dying quail intonation", a prolonged intonational fall used in conjunction, among other uses. Heath reports that in the case of

the second coordinand, which takes a {L} overlay, dying quail intonation is realized as a prolonged low level pitch.

It is not clear what is protecting conjoined DPs from overlays. One avenue to explore is the role of phases, since this has been responsible for all other tonosyntactic failures in the Dogon languages. Interestingly, in at least one example from Tommo So, it looks as though the conjoined DP is not syntactically the head at all, but rather a topicalized phrase that is resumed by a null head:

(60) ànáá-m=gɛ=le yàá-m=gɛ=le (bé) (Tommo So)
male-HUM.PL=DEF=ASSOC female-HUM.PL=DEF=ASSOC (3PL.PRO)
jáw-ìy-ì=gɛ
fight-MP-PFV.REL=DEF
'the men and the women who fought'

The presence of definite determiners on 'men' and 'women' suggests that they are not syntactically the same as regular relative heads, where these clitics are suppressed. Further, the participle does not carry a plural clitic, despite the semantic head (the men and the women) being plural.

Could it be the case that conjoined DP heads that resist tone lowering in general are not structurally the head? The data patterns suggest not. First, in almost every case, barring the one just given, the coordinands fail to carry definite determiners, which is expected of relative heads and not of regular conjoined DPs. Second, the structure appears to be identical to those languages in which one or both coordinands take the relative overlay. This intra-language variation suggests instead something like phase-based faithfulness, a constraint that varies in strength depending on the language. Future work will investigate whether phase theory may have an answer to the question of conjoined heads, and if not, where else we may be able to turn.

4.6.2 Jamsay repeated head

Another curious aspect of relative clauses in some Dogon languages is the presence of both an internal and external copy of the head. While this looks like additional evidence that the syntactic proposal given here is correct, it is not without its issues. To illustrate, let us consider data from Jamsay.

In Jamsay, the internal head may be repeated after the relative clause, preceded by the possessive particle *mà*. For example:

(61) a. **dògùrù^{L}** sâl kɔ̀ɔ̀-rɔ́-Ø kù^{n} mà **dógúrú** kù^{n} lè
time prayer be.INAN-NEG-PPL.INAN DEF POSS time DEF in
(Jamsay)

'(back) in the time when there was no praying (=before Islam)'

b. **wàkàtì^{L}** kì-káá ɲɔ́w^{n}ɔ̀ ɲúú lè tɛ́wɛ́
time RED-grasshopper damage millet in inflict
bɛ̀rɛ̀-gó-Ø mà **wákátì˙˙** fúú kɔ̀ɔ̀-rɔ́ (Jamsay)
be.able-IMPF.NEG-PPL.INAN POSS time all be.INAN-NEG
'There is no time when grasshoppers cannot inflict damage on the millet.'

The puzzle lies in the fact that the external copy of the head appears to be possessed by the relative clause. While both alienable possessors and relative clauses are in a DP in the specifier of a functional projection above NP, we expected PossP to carry the obligatory possessive particle *mà* and not RelModP. Further, if the internal copy inherits the morphophonological properties of the external copy, why is it that the internal copy does not look like a possessive construction, with either tonal overlays blocked by *mà* (the regular pattern of Jamsay alienable possessives) or with the characteristic {HL} overlay (since *mà* is not present in the relative clause)?

We can turn to other Dogon languages, where there is no possessive particle complicating matters. For example, Heath (2011a) reports rare cases of a repeated head in Najamba, such as the following:

(62) **kòŋgò^{L}** ó dùmă-ŋgà kà **^{L}kòŋgò** òndú-Ø kŏy (Najamba)
thing 2SG.PRO get-FUT.REL TOP thing be.NEG-3SG EMPH
'There is definitely nothing that you get.'

Once again, the repeated head noun looks possessed, this time with the possessive {L} overlay rather than with *mà*. In this case, the possessive and relative overlays are homophonous. The same pattern is found in Toro Tegu, though typically only with semantically "light" nouns, like 'thing' or 'day'.

One possibility is that these repeated heads started out as being exactly an external copy of the relative head, complete with the relative {L} overlay. At some point in Proto-Dogon, this {L} overlay was reinterpreted as possessive, and as the languages diverged in their possessive strategies, so too did this construction. While this is a possible diachronic path, it still leaves open the question of synchronic analysis: What is the structure of these repeated heads, and how can they be reconciled with the analysis proposed here? I leave this area for future work.

4.6.3 Further evidence for cyclic spell-out

The final point in this chapter is not so much a general issue as it is an additional piece of evidence for phases, though it may pose challenges in this arena as well. In this study, I have argued for cyclic spell-out at the level of phases but global evaluation of morphophonological form within a spell-out domain (rather than incremental building up of morphology, as in cophonology theory; see §1.3.3.3). Evidence for cyclic spell-out came from the extra faithfulness of phases (possessive and relative clause DPs). Jamsay data from Heath (2008) suggest a bit of additional evidence for this cyclicity.

When a demonstrative is added after a relative clause, it imposes its {L} overlay on the verb, as we saw earlier in this chapter. Quasi-verbs like *sà-* 'have' typically are monomoraic and L-toned in main clauses. As a relative participle, on the other hand, they take {HL} tone, which requires a lengthening of the vowel to realize (in a process Heath calls Contour Tone Mora Addition). Thus, *sà-* would surface as *sáà-*. Evidence for cyclicity comes from the fact that when the relative participle takes a {L} overlay from the demonstrative, it surfaces with a long vowel, suggesting it first was lengthened to accommodate {HL}:

(63) **èjù-nɔ̀wⁿɔ̀ᴸ** cíɾɛ́ sàà-∅ᴸ núŋò bé (Jamsay)
field-meat horn have.PFV-PPL.INAN DEM PL
'those (species of) animals who don't have horns'

If the form of the verb were assessed globally, taking into account that it is in a relative clause and that it is followed by a demonstrative, it could easily have taken {L} without adding a mora, resulting in *sà-∅ᴸ*.

The issue is that the verb must be above the relative clause's phase boundary in order to be visible to the demonstrative, yet it must have spelled out with its {HL} tone before the demonstrative imposed its {L}. This suggests an intermediate step between the spell-out of the relative clause TP and the spell-out of the larger DemP. A potential solution comes from the proposal that not only do specific phrase levels trigger spell-out (DP, CP, etc.), but also specifiers or adjuncts (i.e., any non-complements, Uriagereka 1999). The relative clause DP is in the specifier of RelModP, so it would also be spelled out as a phase before the rest of the matrix DP is constructed. This is schematized in (64), where square brackets represent spell-out domains:

(64) [[[Relative clause]$_1$ Verb]$_2$ Demonstrative]$_3$

The relative clause TP is spelled out first, then the whole relative clause DP is sent to spell-out again since it is a specifier. It is at this stage that the verb is assigned {HL} tone of the relative clause. Next, the whole matrix DemP (complement to the phase head D) is sent to spell-out once more. For this account to work, we would have to say that the material within the most deeply embedded spell-out domain would be protected by two violations of IDENT-OO(T)/PHASE, while the demonstrative is able to target the verb, since only a single phase boundary is crossed. If this analysis holds, it would provide further evidence for counting up cumulativity in Dogon tonosyntactic grammar.

CHAPTER 5

Predictions of the framework

5.1 Introduction

In the preceding chapters, I have developed a framework capable of accounting for the rather uncommon system of grammatical tone found in the Dogon languages. If the analysis is to have worth beyond this particular phenomenon, we must examine the predictions that it makes and how these predictions are upheld by crosslinguistic data.

The constructional framework proposed here is designed to account for **restructured phrasal phonology**. Its aim is to show what kind of grammar speakers develop to account for inter-word phonological changes that have become divorced from purely phonological environments. I argue that the framework makes the following predictions:

1. Triggers of phrasal morphophonological alternations are lexical or syntactic.
2. The domain of phrasal morphophonological alternations is determined either by linear adjacency or by c-command.
3. Competitions between constructions are resolved by constraint ranking/weighting.
4. Phrasal morphophonological alternations across phase boundaries are rare, due to phase-based faithfulness constraints, but not unattested.

The following sections address each of these predictions, showing that every one is supported by phenomena in other languages, both tonal and segmental. Space does not permit

full analyses of any of the languages discussed in this chapter; I leave this as an area of future research.

Before concluding the chapter, I briefly address the questions of phonological implementation in §5.6, since many of the languages involve less unified phonological changes than what we find in Dogon tonosyntax.

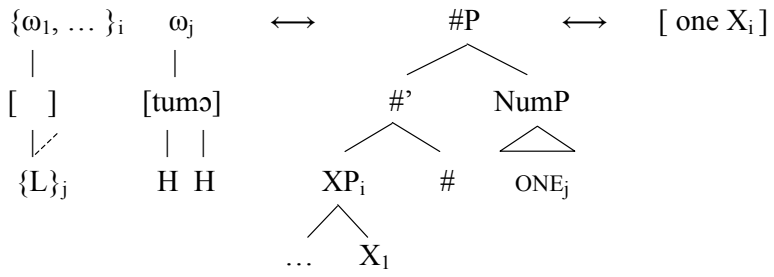
5.2 Triggers are lexical or syntactic

5.2.1 Lexical triggers

In the Dogon languages, nearly all tonosyntactic controllers can be defined by syntactic category and position alone: Adjective, Demonstrative, DP (Spec,NP), DP (Spec,PossP), DP (Spec,RelModP), etc. The one case in which a controller might need to be defined in terms of lexical identity is the numeral 'one', since the syntactic category Numeral is otherwise a non-controller. However, at least in Tommo So, it appears that 'one' is syntactically an adjective, so the appeal to lexical identity may not be required at all (see §2.7.1).

Nevertheless, the construction-based framework predicts the possibility of lexical triggers, by having a specified lexical item in place of a syntactic category in the constructional schema. This is essentially the mirror image of lexical exceptions to a process, with the trigger rather than the target specified in the construction. Such a constructional schema for the numeral 'one' in Tommo So would look like the following:

(1) Constructional schema for X^L 'one' in Tommo So



Here, the numeral position is filled specifically by ONE, which has the phonological form *túmɔ́*. Other numerals will not trigger a {L} overlay, since they do not fit this constructional schema.

The idea that constructions can have a range of specificity is not new. Booij (2010) supports this idea for Construction Morphology with Dutch constructional idioms like that in (2a), illustrated with data in (2b) and (2c) (Booij 2010:12):

(2) a. $[[X]_{Ni}\ [[\ van\ ]_P[[\ een\ ]_{Det}\ [X]_{Nj}]_{NP}]_{PP}]_{N'\ k} \leftrightarrow [SEM_j$ with SEM_i-like property$]_k$

b. een schat van een kind 'lit. a sweetheart of a child, a sweet child'

c. een kast van een huis 'lit. a cupboard of a house, a big house'

In this constructional schema, the lexical items *een* and *van* are specified. The other positions are variables. In discussing French liaison, Bybee (2005) proposes a similar idea, stating: "On one end of a continuum involving constructions are fixed phrases, such as *I don't know* and *c'est à dire* 'that is to say', nearer the middle are constructions with some grammatical material and a slot that is more open, e.g. the preposition *dans* with its NP object, and on the most general end, a construction such as [NOUN + PLURAL + ADJECTIVE], with

two slots which take open class items" (Bybee 2005:7-8). If this is the case, then, we predict the existence of languages in which phrasal phonology has been restructured such that the alternations are triggered by particular lexical items. In fact, this prediction is borne out with both segmental and tonal alternations.

An example of lexically-triggered segmental alternations comes from Celtic consonant mutations, in which the initial consonant of a word undergoes a number of feature changes after some trigger (for syntactic triggers, see §5.2.2). Mutations are far from a unified phenomenon. For Welsh, the most commonly discussed system of mutations, see Lieber (1983), Zwicky (1986), Boyce et al. (1987), Harlow (1989), Hannahs (1996, 2013), Ball and Ḿuller (2002), Mittendorf and Sadler (2006), Thomas and Gathercole (2007), Tallerman (2009), etc. Other Celtic languages whose mutation systems have been described include Irish (e.g. Ni Chiosáin 1991), Breton (e.g. Stump 1988), and Scots Gaelic (e.g. Stewart 2004).

In many Celtic languages, there is more than one type of mutation. For example, in Welsh, three mutation processes are distinguished: **soft mutation**, **nasal mutation**, and **aspirate mutation**. The effects of each mutation process on the consonants of Welsh are shown in (3) (Green 2006:1951), with orthography given in parentheses after each sound:

(3)

Radical	Soft Mutation	Nasal Mutation	Aspirate Mutation
p (p)	b (b)	m̥ (mh)	f (ph)
t (t)	d (d)	n̥ (nh)	θ (th)
k (c)	g (g)	ŋ̊ (ngh)	x (ch)
b (b)	v (f)	m (m)	–
d (d)	ð (dd)	n (n)	–
g (g)	Ø	ŋ (ng)	–
f (ff)	–	–	–
s (s)	–	–	–
x (ch)	–	–	–
h (h)	–	–	–
m (m)	v	–	–
n (n)	–	–	–
ɬ (ll)	l (l)	–	–
r̥ (rh)	r (r)	–	–
j (i)	–	–	–

Soft mutation is the most extensive mutation process in the language both in terms of targets and environments; it voices voiceless stops and fricatives, spirantizes /b/ and /d/, deletes /g/, and leaves all other consonants unchanged. Nasal mutation turns all oral stops into nasals, retaining the voicing and place of articulation of the original consonant. Aspirate mutation affects only voiceless stops, turning them into fricatives.

Historically, these changes were the result of regular phonology: intervocalic lenition, nasalization, etc. Due to sound change, the environments for these phonological changes were lost, but the alternations persisted, forcing learners to find alternative explanations for their application. In the majority of cases, the alternation became an idiosyncratic property of individual lexical items, though in certain cases, they were also tied to syntactic triggers

(see §5.2.2).[1] The lexical nature of certain triggers is clear when we compare them to words of the same syntactic category. For example, in Welsh, pronominal possessors have differing effects on the possessed noun depending on their person/number specification. The following examples illustrate the generality of these process using two nouns, *tad* 'father' and *pen* 'head' (Hannahs 2013:2):

(4) a. tad 'father' (Welsh, radical form)
pen 'head'

b. dy dad 'your father' (Welsh, soft mutation)
dy ben 'your head'

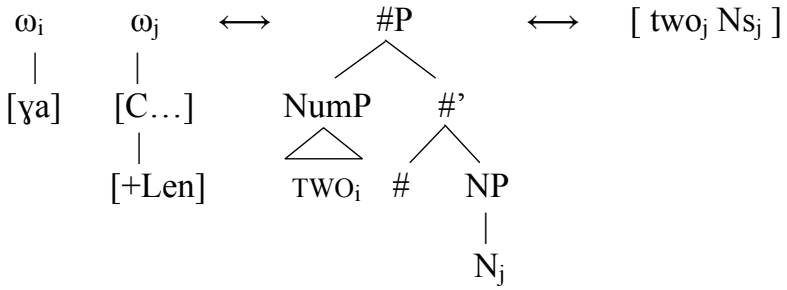
c. ei thad 'her father' (Welsh, aspirate mutation)
ei fen 'her head'

d. fy nhad 'my father' (Welsh, nasal mutation)
fy mhen 'my head'

All three consonant mutation processes—soft, aspirate, and nasal—are attested with different members of the pronominal paradigm. Likewise, Green (2006) reports that in Irish, the numerals two through six trigger Lenition (akin to Welsh aspirate mutation), while numerals seven through ten trigger Eclipsis (akin to nasal or soft mutation). Clearly, then, a constructional schema like those used for Dogon indicating only the syntactic category Numeral or DP (pronoun) would be unable to account for the facts. However, since the constructional analysis allows for lexically specified triggers, systems like Celtic mutations can be accounted for. A possible schematization of the Irish 'two N' construction is given in (5):

[1]See Hamp (1951) for a discussion of diachrony.

(5) Irish 'two N' construction with Lenition



The numeral is lexically specified as 'two', with the phonological form [ɣa]. For the time being, I represent the phonological changes of Lenition as a feature [+Len] on the initial consonant of the noun. I will return to the question of phonological realization in §5.6. Similar Lenition schemas would be posited for numerals three through six, while numerals seven through ten would be found in schemas with an Eclipsis feature on the noun.

A nearly identical situation is found in a tonal case. Kalabari Ijo (Harry and Hyman 2014) has tonal alternations that closely resemble Dogon tonosyntax, with tonal melodies triggered by words of a particular syntactic category. Most numerals in the language trigger a {L} melody on the target (6b), but the numeral 'three' is exceptional, triggering either a {HL} melody (6c) or no melody at all (6d):

(6) a. fénî 'bird' (lexical tone)

b. níná ^{L}fènì 'eight birds' ({L} melody)

c. tírá ^{HL}fénì 'three birds' ({HL} melody)

d. tírá fénî 'three birds' (no melody)

Like the hypothetical case of Tommo So given above, in which the numeral 'one' is treated as a lexical trigger (rather than as an adjective), Kalabari would have a general constructional schema for the syntactic trigger Numeral alongside a more specific constructional schema for the lexical trigger 'three'. One analytical difficulty is that 'three' also fails at times to trigger any melody. If this is the result of faithfulness (IDENT-OO(T)) beating the construction constraint, then THREE $^{\text{HL}}$X would have to be weaker than the general construction constraint NUM $^{\text{L}}$X, which never fails to apply. If this were the case, however, then it seems that 'three' should at least variably fall into the general numeral pattern. Cases like these suggest the need to allow constructional schemas with no idiosyncratic phonology, precisely in those cases where the lack of an alternation is in and of itself idiosyncratic.

A more general case of lexical tonal triggers is found in Urarina, a language isolate of Peru (Olawsky 2006, described in Harry and Hyman 2014). In this language, most nouns surface in isolation as all L with a single final H. In an OV construction, on the other hand, nouns fall into four unpredictable classes based on their effect on the verb (Harry and Hyman 2014: example (69)):

(7)

A	raaná	'peccary sp.'	→	raana rɨ́akaa	'he has carried a peccary'
B	obaná	'peccary sp.'	→	obana rʉakáá	'he has carried a peccary'
C	reemaé	'dog'	→	reemae rʉakaá	'he has carried a dog'
D	makusajarí	'pepper'	→	makusajarí rʉakaa	'he has carried a pepper'

Class A nouns assign H to the initial syllable of the following word; Class B assigns H to the second or third syllable, depending on syllable weight; Class C assigns H to the final syllable (or as Harry and Hyman point out, probably the final mora); finally Class D retains the H tone, and the following word surfaces as L.

If we think of these different tonal patterns as similar to different consonant mutation processes in Celtic (e.g. four classes of idiosyncratic phonology in Urarina, three in Welsh),

then we have another case where constructional schemas need to be lexically specific in order to account for the varied behavior of lexical items.

5.2.2 Syntactic triggers

The original formulation of this framework for the Dogon languages included exclusively syntactic triggers. If this represents a natural diachronic path for restructuring, then syntactic triggers should be found in other languages. I will give examples of two segmental cases, French liaison and Welsh soft mutation, then two tonal cases, Kalabari Ijo and Northern Mao.

Countless articles (Fouché 1959, Agren 1973, Selkirk 1974, Klausenburger 1974, Malecot 1975, Churma 1977, Rotenberg 1978, Morin and Kaye 1982, Selkirk 1986, Tranel 1995, 1996, Steriade 1999, Bybee 2001, 2002, Tseng 2003, Bonami et al. 2004, Nguyen et al. 2007, Durand and Lyche 2008, Chevrot et al. 2009 etc.) have been written about the phenomenon of French liaison, in which an ostensibly word-final consonant is pronounced before a vowel-initial word and not before a consonant-initial one. For example, we find cases like the following:

(8) a. les enfants → [lezɑ̃fɑ̃] 'the children'

b. les femmes → [lefam] 'the women'

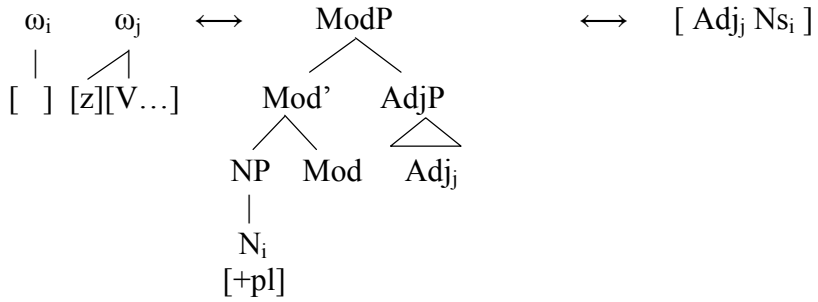
When the definite plural article *les* occurs before the vowel-initial noun *enfants* 'children', it is pronounced with a final [z]; when it occurs before the consonant-initial noun *femmes* 'women', no [z] is pronounced. In what follows, I will indicate the liaison consonant in square brackets between W1 and W2 when it is pronounced; if no liaison occurs, nothing is indicated (*les [z] enfants* vs. *les femmes*).

Though French liaison does show hints of lexical triggers in explaining frequency of occurrence (Bybee 2005), the general patterns of liaison can be captured with syntactic triggers. For example, the pattern of liaison found in (8) is general to all plural determiners (*les, des, ces*, etc.). Similarly, we find that liaison is likely to occur between a plural noun and a following vowel-initial adjective. Bybee (2005), who takes her own constructional approach, proposes the following construction:

(9) [*les/des/ces* NOUN -z- [Vowel-]ADJECTIVE]$_{\text{Plural}}$

We could translate this into the constructional format used in this study as follows:

(10) Constructional schema for French N[pl] Adj



Though many studies propose that the liaison consonant [z] is part of the lexical representation of the noun (Selkirk 1974, Steriade 1999, Tranel 1995, 1996, etc.), I follow Bybee (2002, 2005) in treating the liaison consonant as an idiosyncratic property of the construction in which it appears—it is not tied to the noun at all. As this constructional schema indicates, the [z] links to a vowel-initial adjective,[2] accounting for cases like the following, in which the

[2]The fact that these constructions are subcategorized for vowel-initial words is indicative of the phrasal phonological origins of French liaison: final consonants failed to delete in those cases where it would create vowel hiatus. Trying to derive this phonologically in the current language relies either on a deletion analysis (treating the liaison consonant as part of the word, problematic for reasons like the next example) and a constraint against vowel hiatus or an insertion analysis and a constraint against complex onsets. This latter

[z] surfaces not after the plural noun (the expected location if the consonant were part of the noun) but instead before the adjective, after the modified NP (Bybee 2005):

(11) chemins de fer [z] anglais

Such a result falls out naturally from the constructional schema in (10): the NP (here, it would have more complex structure) is headed by a plural noun and it is followed by a vowel-initial adjective. It thus surfaces with a [z] on the adjective.

Returning to consonant mutations, one phenomenon that has received much attention in the literature is so-called "syntactic soft mutation" in Welsh (Borsley 1999, Borsley and Tallerman 1998, Hannahs 1996, Harlow 1989, Tallerman 2009, etc.).[3] Unlike the cases discussed in the last subsection, many cases of soft mutation in Welsh lack a lexical trigger. Instead, they appear to be unified by syntactic structure: the target of mutation is also immediately preceded by a c-commanding XP (the XP Trigger Hypothesis, Borsley and Tallerman 1998). Some examples of the data are given in (12), with the mutated word in bold:

analysis is problematic in that plenty of complex onsets are attested in French, including onsets that could be created by "faulty liaison insertion" (as in **petit [t]rat* 'little rat'.

[3]Hannahs (1996) proposes a prosodic phonology account, where consonant mutation is a domain juncture rule. See §5.5 below.

(12) a. Mae [in [yr ardd]$_{NP}$]$_{PP}$ **afr**. (gafr) (Hannahs 1996:47)
is in the garden goat
'There is a goat in the garden.'

b. Dechreuodd [Emrys]$_{NP}$ **ddarllen** y llyfr. (darllen) (Borsley 1999:271)
began Emrys read the book
'Emrys began to read the book.'

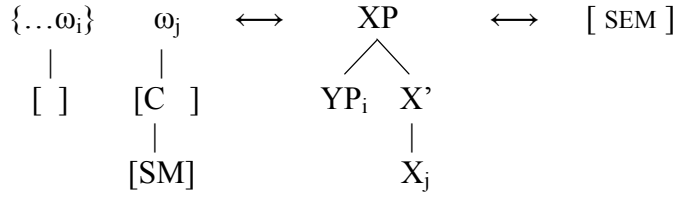
c. Gwelais i [yn sydyn]$_{AdvP}$ **blismyn** yn y stryd. (plismyn) (Borsley 1999:274)
saw-1SG I in sudden policemen in the street

'I suddenly saw Policemen in the street.'

In the examples above, there is no lexical trigger: *ardd*, *Emrys*, and *sydyn* do not trigger mutations on their own.

The syntactic trigger in the case of Soft Mutation is much more general than the syntactic triggers of tonosyntax or French liaison, which were by and large specific syntactic categories. For Welsh, the trigger is any phrase that c-commands and immediate precedes the target, as shown in (13):

(13) Constructional schema for Welsh syntactic SM



Here, YP c-commands X and triggers soft mutation, as shown by the [SM] label on the first consonant of the word corresponding to X; the semantics are regular. This idiosyncratic pairing of phonological form and syntactic structure is precisely the motivation for the con-

structional framework of this study. The existence of these lexicalized schemas captures the fact that speakers need to learn and codify the connection, separate from regular phonology or syntax once the original phrasal phonological system has been restructured.

As the discussion of Kalabari in §5.2.1 indicated, most tonal melodies in the language are triggered by syntactic categories, just as they are in the Dogon languages. Harry and Hyman (2014) describe how different syntactic categories of modifiers in Kalabari impose different tonal melodies on the modified noun. For example, consider the noun *ɓúrúmá* 'indigo' with different modifiers:

(14)

	Construction	*Phrasal Tones*	*Example*	*Gloss*
a.	N + N	{HL}	tʊ̀ɓɔ̀ ^{HL}ɓurúmà	'child's indigo'
b.	PRO_{Poss} + N	{HLH} [H$^{↓}$H]	mà ^{HLH}ɓurú$^{↓}$má	'their indigo'
c.	Det + N	{LH}	tɔ̀ ^{LH}ɓùrumá	'which indigo'
d.	Quant + N	{L}	jà ^{L}ɓùruma	'some indigo'

In these examples, L tone is indicated both by a grave accent and by the absence of an accent; those marked with a grave accent are specified lexically (or grammatically) as L, while unmarked syllables have acquired tone by spreading from the left.

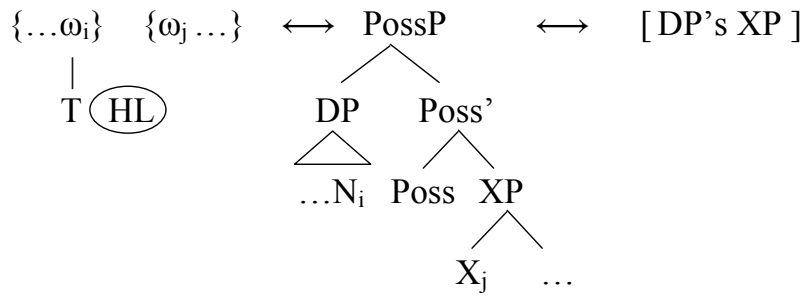
If we focus on one construction, such as N+N, we see that all nouns impose {HL} on the following word (here, *námá* 'meat'), regardless of its lexical identity:

(15)

a.	fénî	'bird'	H-H	→	fénî ^{HL}námà	'the bird's meat'
b.	tʊ̀ɓɔ̀	'child'	L-L	→	tʊ̀ɓɔ̀ ^{HL}námà	'the child's meat'
c.	èkpé	'he-goat'	L-H	→	èkpé ^{HL}námà	'the he-goat's meat'
d.	é$^{↓}$bé	'insect sp.'	H-$^{↓}$H	→	é$^{↓}$bé ^{HL}námà	'the insect's meat'

Thus, the most concise grammar a speaker could posit for these restructured alternations is to tie them to the syntactic category DP, as shown in the following constructional schema:

(16) Construction schema for Kalabari N+N construction



The possessor retains its lexical tone, as shown by the association of T to ω_i, while words in XP **do not carry tone**; this captures Harry and Hyman's (2014) analysis of tone reduction in these environments. The construction introduces the tone sequence HL, enclosed in a circle to represent that the tones are floating. The phonology of Kalabari tone melodies will be discussed in greater detail in §5.6.

The same contrast between category-specific syntactic triggers (French liaison) and category-neutral syntactic triggers (Welsh soft mutation) can be found in tonal cases. Kalabari presented a Dogon-like case, where the syntactic trigger of tonal melodies is category-specific (DP imposes {HL}, Quantifier imposes {L}, etc.). In the Omotic language Northern Mao (Ahland 2012), nouns take special tonal forms when modified by **any** element in the DP. The following table summarizes the tonal changes from unmodified form to modified form (Ahland 2012:145):

(17)

Unmodified tone	Example	Gloss	modified tone	Example
H1	kúsé	'hand'	MM	kūsē
M, L, HL1, MH, ML	kāsē	'hoe'	ML	kāsè
H2, HL2, LH	kàwé	'arm'	LL	kàwè

The only clear pattern that emerges is that H tones are absent in the modified form. The author suggests that this may be the result of historical downstep, but I will make no attempts at a phonological analysis here; for detailed discussion, see Ahland (2012).

Importantly, all modifiers trigger the same tonal forms (data from Michael Ahland, p.c.):

(18)

Construct melody:	MM	ML	LL
N+N	tí kūsē	tí kāsè	tí kàwè
	'my hand'	'my hoe'	'my arm'
Genitive	tí-ŋ ˡkūsē	tí-ŋ ˡkāsè	tí-ŋ ˡkàwè
	'my hand'	'my hoe'	'my arm'
Numeral	hīʃkì kūsē	hīʃkì kāsè	hīʃkì kàwè
	'one hand'	'one hoe'	'one arm'
Definite	íʃ kūsē	íʃ kāsè	íʃ kàwè
	'the hand'	'the hoe'	'the arm'
Demonstrative	nà kūsē	nà kāsè	nà kàwè
	'this hand'	'this hoe'	'this arm'
Relative clause	bī-t kūsē	bī-t kāsè	bī-t kàwè
	'the hand that was there'	'the hoe that was there'	'the arm that was there'

With the exception of a downstep in the genitive construction (introduced, presumably, by a floating L associated with the genitive suffix), the tonal outputs are identical regardless of which modifier precedes the noun. Schematically, we can propose a constructional schema

[XP N[+Mod]]$_{DP}$ $\leftrightarrow$ [N with SEM of Mod], where [+Mod] indicates the construct tone phonology on the noun in the presence of a c-commanding modifier of any category (XP) in the DP.

5.2.3 Local summary

In this section, we have seen that the constructional framework allows a spectrum of triggering elements, from specific lexical items to general syntactic projections, with no lexical or category specification. Triggers from each step along this spectrum are attested crosslinguistically, lending support to the framework developed in this study.

5.3 Linear adjacency and c-command

In the Dogon languages, we saw that tonal domains were mostly defined by syntactic structure: a trigger (controller) can only impose overlays on words that it c-commands. However, Tiranige required the introduction of linear adjacency into the model in order to account for the tonal alternations. If both of these relationships hold between trigger and target in the Dogon languages, we expect to find them both crosslinguistically as well.

Once again, this prediction is upheld. In this section, I show the need for linear adjacency in French liaison and most cases of Celtic consonant mutation. I then present cases of c-command, including Welsh syntactic mutation (which also requires linear adjacency) and Kalabari Ijo.

5.3.1 Linear adjacency

French liaison requires the linear adjacency of the trigger and target for liaison to occur. Recall the N Adj constuction from §5.2.2, in which a vowel-initial adjective after a plural NP has [z] appended to its beginning. If we insert something, such as an adverb, between that plural NP and the vowel-initial adjective, liaison fails to apply. Contrast (19a) and (19b):

(19) a. les [z]enfants [z]intelligents 'the intelligent children'

b. les [z]enfants trop intelligents 'the too intelligent'

In (19b), it would be ungrammatical for *intelligents* to begin with [z], since it is not adjacent to the plural NP. Similarly, a plural article will not trigger liaison on a vowel-initial noun if another word intervenes, as in *les vingt ([t]) enfants* 'the twenty children'.

Celtic consonant mutation also appears to require linear adjacency in most cases. Even when the trigger is not a lexical item, as in Welsh syntactic mutation, Borsley and Tallerman (1998) formulate the trigger as being an **immediately preceding** and c-commanding XP. We see this in a form like (Borsley 1999:271):[4]

(20) Gwelodd [$_{DP}$ y dyn] [ddafd]. (Welsh)
saw the man sheep
'The man saw a sheep.'

Soft mutation occurs on sheep (lexically *dafad*) because it is c-commanded and immediately preceded by the subject DP *y dyn*. If the object 'sheep' is preceded by a verbal noun in a periphrastic construction, where this verbal noun is presumably not an XP under their analysis, no mutation occurs, despite the fact that the subject DP still c-commands the noun (Borsley 1999:271):

(21) Mae [$_{DP}$ 'r dyn] wedi gweld [dafad]. (Welsh)
is the man after see sheep
'The man has seen a sheep.'

[4]I have changed NP to DP on the subject to match the syntactic assumptions of this study.

For a non-local case of Celtic mutation, see §5.3.2.

I am not aware of any explicit discussion of local cases of tonal alternations outside of the Dogon languages, though perhaps a case like Urarina (Olawsky 2006) might require this condition. Regardless, the existence of linear adjacency restrictions in Tiranige predicts that such cases should be attested elsewhere; for discussion of Tiranige, see §3.3.8.

5.3.2 C-command

In many cases of phrasal morphophonological alternations, the trigger must c-command the target. This was the case for Welsh syntactic mutation above (which also required linear adjacency) as well as for nine out of the ten Dogon languages surveyed in Chapter 3.[5] Other crosslinguistic evidence can be found in Irish and Kalabari.

First, while most consonant mutations require adjacency of trigger and target, there are at least two cases in the literature where a word triggers mutation on a nonadjacent target. One example comes from Irish. A 1pl possessive pronoun a possessive pronoun *ár* 'our' triggers the Eclipsis on the noun, while the numeral *dhá* 'two' triggers Lenition. In the sequence Poss Num N, Eclipsis is applied to the noun, skipping over the numeral, while Lenition goes unrealized:

(22) a. ár gcuid (cuid)
our part

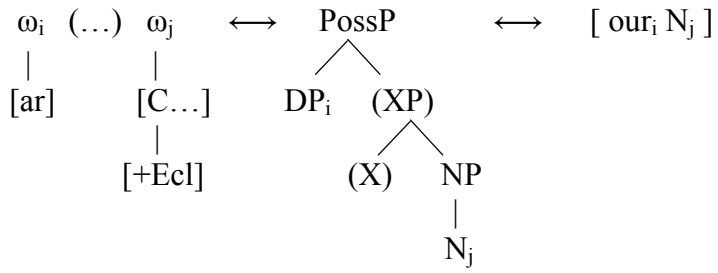
b. dhá chuid
two parts

c. ár dhá gcuid
our two parts

[5]Note that the effects of adjacency are felt even in these Dogon languages through the constraint Locality. This constraint penalizes outputs in which the c-commanded target domain of a tonal overlay is not immediately adjacent to the trigger. It may be that adjacency demands like those in Welsh could be accounted for simply by assigning a large weight or high ranking to Locality.

The competition aspect of this example will be taken up again §5.4. For now, it is clear that linear adjacency cannot account for the form in (22c). Instead, the relationship between the trigger and the target in the following constructional schema must be understood as one of c-command rather than linear adjacency of the two words. This is represented informally by (...) between $_i$ and $_j$ in the phonological branch and by optional XP intervening between PossP and NP in the syntactic branch:

(23) Constructional schema for Irish 'our N'



In the Dogon languages, these optional intermediate XPs are not required in constructional schemas of c-command, since the entire c-command domain is the target, rather than a single word (here, N) c-commanded by the trigger further down in the structure.

On the tonal side, Kalabari is like Dogon in that tonal melodies are imposed on all words in the trigger's c-command domain. For example, the {LH} melody imposed by determiners can cover a span of four words c-commanded by the demonstrative:

(24) má sɔ̀na iɓi mɪŋjɪ kukú (Kalabari)
L (H)
'these five good water pots'

The tonal tier beneath the Kalabari words indicates the automatic mapping of the melody: L on the first syllable of the first word, H on the final syllable, with rightward spreading

in between (discussed in more detail in §5.6).[6] This constructional schema would mirror that of (16), only PossP (and the DP in its specifier) would be replaced with DemP and the tonal melody in the phonological branch would be {LH} rather than {HL}. As in the Dogon languages, the target forms in the phonological branch correspond to anything c-commanded by the trigger (X and anything beneath it).

In some cases, the data are ambiguous as to whether the target must be c-commanded by or linearly adjacent to the trigger. Northern Mao (Ahland 2012) is one such case. Since all modifiers in the DP trigger "construct tone" on the noun, even in a longer DP such as 'these two houses', one modifier will be linearly adjacent; both will c-command.

5.3.3 Other possibilities

As this section illustrated, both linear adjacency and c-command are attested necessary conditions holding between the trigger and the target. Could there be other conditions not attested in any of these languages? To answer this question, we must consider the origins of these phrasal morphophonological alternations: regular phrasal phonology. Most phrasal or multi-word phonological alternations will occur either between words (e.g. lenition processes), at phrase edges (e.g. strengthening or lengthening), or across phrases (e.g. de-accenting). If these processes break down and become associated lexical or syntactic triggers, these are likely to be adjacent in the case of between-word alternations or triggered by something syntactic, in the case of phrasal alternations. It will take a better understanding of the typology of restructured phrasal phonology to know whether other systems are possible.

5.4 Competitions

If constructions are implemented as constraints, as this framework proposes, then when a phrase meets the structural description of two or more constraints at the time, the conflict

[6] In fact, this output is variable, with the H sometimes failing to surface. See Harry and Hyman (2014) for data and interpretation.

will be resolved through constraint interaction (ranking or weighting). Understandably, competitions are more likely to arise in cases where the trigger c-commands the target, since a target may be c-commanded by multiple triggers, whereas it can be adjacent maximally to two (and usually only one, since c-command still tends to hold between adjacent triggers and targets). The only case I have found where linear adjacency competitions arise is in Tiranige, where the conception of "trigger" and "target" is not applicable and instead the two-word construction indicates the desired output tones of **both** words. In a case like N Adj Adj, competitions between construction constraints like X MOD^{L} and N^{L} ADJ can arise, since N^{L} ADJ demands citation tones on the adjective while X MOD^{L} demands {L}. See §3.3.8 for analysis.

Other cases of c-command competition I have found in the literature include Irish consonant mutations and Kalabari tonal melodies. The Irish case was first presented in the last subsection, where the 1pl possessive pronoun *ár* can trigger Eclipsis on a noun non-locally. The other important aspect of the examples in (22) is that non-local possessive Eclipsis beats out local numeral-induced Lenition. If we assume that the constructional schemas for both triggers (1pl and the numeral 'two') define the target N by c-command rather than by adjacency, then a sequence 'our two Ns' will activate both constructions, demanding conflicting mutations on the noun. A ranking of construction constraints 1PL-ECL ≫ TWO-LEN predicts the correct results:

(25)

Input: /ár dhá cuid/	1PL-ECL	TWO-LEN	IDENT-OO(cont)	IDENT-OO(voice)
a. ☞ ár dhá gcuid		*		*
b. ár dhá chuid	*!		*	
c. ár dhá cuid	*!	*		

It is better to satisfy the demands of the possessor's construction than that of the numeral 'two'; both construction constraints dominate IDENT-OO constraints on the relevant phonological features. This analysis is more powerful than that of Green (2006), where all mutations are controlled by a single constraint MUTAGREE (which could never be fully satisfied in the case above, since only one mutation can apply to the noun). In the case of competitions, Green simply suggests that they might always be resolved in favor of the structurally higher modifier.[7]

In Kalabari, competitions are widespread, as they are in the Dogon languages, since all domains appear to be describable in terms of c-command and targets consist of multiple words. We typically find one of two outcomes of the competition: either the first word in the phrase (the outermost controller) imposes its melody, or a default {HL} melody is applied. Interestingly, this {HL} alternative does not appear to be sensitive to syntactic structure. Consider the examples in (26), variable outputs of the sequence /òpù námá wá↓rí/ 'a big animal's house', with the bracketing [[òpù námá] wá↓rí]:

(26) a. [òpù námá] ^{HL}wárì
big animal house
'a big animal's house'

b. [òpù ^{HL}{namá] warì}
big animal house
=(a)

The example in (26a) can be seen as the application of the constraint POSS ^{HL}N (corresponding to the constructional schema in (16)), where a possessor imposes {HL} on c-commanded words (only the possessed noun 'house'). In (26b), the "default" {HL} melody is applied to a sequence of words that does not match the syntactic structure. The construction constraint

[7]Note that if all consonant mutation environments were defined by c-command of the target, then most cases would actually be resolved in favor of the innermost trigger.

for this melody, then, must refer to linear order rather than syntactic structure. I propose X $^{\text{HL}}${Y...N where X is a modifier and precedes a multi-word sequence ending in N; crucially, this sequence must be contained in a DP, so as not to apply between a subject and object in an SOV sequence (i.e. it is structurally constrained even though not structurally defined). This constructional schema would be in competition with the more specific constructional schemas for the patterns in (6).

Depending on the relative weightings of each construction constraint, the specific and general overlays would be applied in some proportion. Though we do not have frequency data on which outcome is more likely in variable cases, Harry and Hyman (2014) report that the default {HL} is never an option with a demonstrative. Preliminary modeling of this language yields a large gap between the weightings of DET $^{\text{LH}}$X and X $^{\text{HL}}${Y...N}, such that the application of the former is always better than the application of the latter. The weights of the other construction constraints are roughly equivalent to that of X $^{\text{HL}}${Y...N}, which allows for the 50/50 variation we find in contexts where both may apply.

Bybee (2005) essentially proposes the idea of competitions for French liaison, but between constructions with the liaison consonant and ones without. I have argued in this study that phrasal morphological constructions are only lexicalized in cases of idiosyncrasy, ruling out constructions with totally regular phonology (those constructions without the liaison consonant).[8] Differing rates of frequency are instead resolved by the relative strength of the construction constraint and the faithfulness constraint, which I propose could be DEP(C) in French. To illustrate the effectiveness of this approach, I put the constraints N[z]ADJ and DET$_{pl}$[z] into a toy grammar with constructions involving *être* 'to be' conjugated in different forms, each shown by Bybee (2005) to have different rates of liaison application. The forms and frequencies are shown in the table in (27):

[8]Unless the lack of an alternation is idiosyncratic in and of itself, as with Kalabari 'three' (§5.2.1), Dogon N PossAP (§2.8.2.3), etc.

(27)

Input	Output	Frequency
les enfants	les enfants	0
	les [z] enfants	1
les femmes	les femmes	1
	les [z] femmes	0
enfants intelligents	enfants intelligents	.5
	enfants [z] intelligents	.5
enfants spéciaux	enfants spéciaux	1
	enfants [z] speciaux	0
est un homme	est un homme	.03
	est [t] un homme	.97
est l'homme	est l'homme	1
	est [t] l'homme	0
sont un groupe	sont un groupe	.14
	sont [t] un groupe	.86
sont les autres	sont les autres	1
	sont [t] les autres	0
était un homme	était un homme	.25
	était [t] un homme	.75
était l'homme	était l'homme	1
	était [t] l'homme	0
c'est à dire	c'est à dire	0
	c'est [t] Ãă dire	1

A construction constraint was included for each type of input (Det N, N Adj, *est*, *sont*, *était*, and the fixed phrase *c'est à dire*); each construction constraint was assumed to apply only to vowel-initial words. The faithfulness constraint DEP(C) was also included. The maxent algorithm fitted these constraints with weights, and the resulting fit to the data was perfect:

(28)

Constraint	*Weight*
DEP(C)	8.1
DET_{pl}[z]	16.1
N[z]ADJ	8.1
EST[t]V	11.5
SONT[t]V	9.9
ETAIT[t]V	9.2
C'EST[t]ADIRE	16.1

While a model with one constraint for every construction may not be the most impressive, it contains half the constructions assumed by Bybee, where one "liaison construction" and one "regular construction" is posited for each sequence. The differences in application rate of liaison in my model arise from the weight assigned to the liaison construction constraint relative to the faithfulness constraint DEP(C). In my view, this is a simpler grammar, one in which only the idiosyncratic sequences need to be learned and lexicalized.[9]

5.5 The role of phases

Data from Dogon tonosyntax support the view that syntax spells out cyclically in phases. However, as I have shown in previous chapters, the spelled out phonological material may be altered by morphophonological demands in later cycles, though doing so violates phase-based faithfulness (IDENT-OO/PHASE). The existence of this (possibly universal) constraint predicts that altering spelled out phonological material will be a marked option, and as a result, will be rarer than treating spelled out phonological material as inalterable.

In the langauges I have surveyed, I have found one clear case of what looks like a phasal effect. The effect is found in Welsh syntactic soft mutation, described in §5.2.2 and §5.3.1. A

[9]Though my constructional analysis contains a full syntactic component, while in Bybee's, everything is constructions.

seemingly problematic aspect of this system is the fact that the initial word of a CP fails to undergo mutation in a mutation environment. Syntactic approaches tend to simply stipulate this fact: CPs do not undergo mutation (Borsley and Tallerman 1998, Borsley 1999). Part of the motivation of Hannahs' (1996) prosodic phonology account is to find a principled explanation for this fact. The general phonological proposal for the environment of syntactic Soft Mutation is that Soft Mutation occurs at the juncture of two phonological phrases, appearing on the initial consonant of the second phonological phrase. However, Hannahs proposes that no stipulation regarding CPs is required if we reformulate the environment for mutation as follows:

(29) $[[...]_{\phi}\ [__...]_{\phi}]_{I}$

In other words, mutation occurs at the juncture of two phonological phrases contained within the same intonational phrase. This explains the lack of mutation in examples like the following:

(30) [[Gwn i]$_{\phi}$]$_{I}$ [[pwy]$_{\phi}$ [a ddaeth yn-ôl]$_{\phi}$]$_{I}$ (Hannahs 1996:56)
know I who PART came back
'I know who came back.'

The wh-word *pwy* is immediately preceded and c-commanded by a NP (*i*), the mutation environment for the syntactic account, yet it is the first word in a CP, so it fails to undergo mutation. In the phonological account, *pwy* is a phonological phrase preceded by another phonological phrase (*gwn i*), but an intonational phrase boundary intervenes, blocking the application of mutation. While this proposal can account for the data, Green (2006) rightly points out that there is no corroborating evidence of the phrasal constituents from other sandhi rules or stress/intonation. This is particularly problematic in the case of coordinated NPs, where Hannahs proposes a separate intonational phrase for each coordinand.

I suggest that the syntactic analysis of Soft Mutation can be maintained in a constructional framework without the need to stipulate the CP's failure to undergo mutation. If CP is a phase, then it is sent to spell out before it is c-commanded by another XP, meaning it lacks the trigger for SM when it is sent to the morphophonology. Though the trigger may be present later when spelled out chunks are concatenated, the radical form of the initial word is protected by high ranking IDENT-OO/PHASE.

5.6 Phonology and phonological subcategorization

The final topic I will consider here is the relationship between the phonological branch of a constructional schema and the regular phonology of the language. In the analysis of the Dogon languages, I have treated overlays as being fully specified tonally in the phonological branch of the schema, rather than as being mapped to syllables by the phonological grammar. This is a viable analysis in the Dogon languages because realizations of overlays are consistent, regardless of the number of words in a target domain. For example, in Nanga, a noun after a H-final possessor will always be {HL}; any words after that noun will be {L} (an extension of the {HL} overlay). Things are not so simple in Kalabari. We saw in (6) above that a pronoun assigns {HLH} to the target. Generally speaking, L tones target the initial syllable of a word while H tones target the final syllable. When multiple words are present, tones distribute themselves across the words in a way that respects these patterns of association:

(31) í sɔ́ná námá → í $^{\text{HLH}}$[sɔná fèní] (Kalabari)
1SG bird meat
'my five birds'

Both H tones find final syllables to dock to, while L docks to the initial syllable of the second word, respecting the linear order H-L-H.

Thus, unlike Dogon, the replacive melody does not appear consistently in all cases (such as {LH} on the first word and H subsequently); a word may surface differently following a possessor depending on how many other words it appears with. Instead, "replacive overlays" in Kalabari are more akin to independent tonal morphemes mapping to words whose lexical tones have been suppressed (indicated in constructional schemas like (16) by the absence of tone on the targeted words and the introduction of a tonal melody).

The mapping of the tonal melody is not clearly statable in output-oriented terms. Instead, the mapping seems to be the result of a phonological grammar, including the following constraints:

(32) a. ALIGN-R(H,ω): Align the right edge of a H tone to the right edge of a phonological word.

b. ALIGN-L(L,ω): Align the left edge of a L tone to the left edge of a phonological word.

In addition, the constraint LINEARITY penalizes differences in linear order between elements in the input and those same elements in the output, while *FLOAT(H) penalizes floating H tones.[10]

For ease of exposition, let us assume the morphological component applies first, in which the specific construction is chosen over the faithful concatenation of words due to ranking of the construction constraint over IDENT-OO(T). For the sequence *mà + ɓúrúmá* 'their indigo', we then have *mà* $\boxed{HLH}$ *ɓuruma* as the input to the phonology. With the correct ranking of the phonological constraints above, we arrive at the correct form.

[10]The grammar most likely contains the corresponding constraint *FLOAT(L), but it is lowly ranked, allowing L tones to be left floating in order to trigger downstep but not H tones.

(33)

Input: /mà [HLH] ɓuruma/	Linearity	*Float(H)	Max(T)	Align-R(H,ω)	Align-L(L,ω)
a. ☞ mà ɓurú [L]↓má				*	*
b. mà ɓúrùmá				**!	*
c. mà ɓùrumá			*!		
d. mà ɓurúmá			*!	*	
e. mà [H] ɓùrumá		*!		**	
f. mà ɓùrúmá	*!			*	

The winning candidate is candidate (a), in which the L is left floating and the H tones align as far right as possible, incurring only a single violation of Align-R(H,ω) for the initial H tone and a violation of Align-L(L, ω) for the floating L tone. If all three tones link, as in candidate (b), Align-R is violated twice for the two syllable distance between the first H and the right edge of the word, and the Align-L is violated once for the one syllable distance between the L and the left edge of the word. Violations of Align-L can be alleviated by left-aligning the L tone and deleting the H tone (candidate c), leaving it floating (candidate e), or changing the order of the floating tones (candidate f), but these three candidates are ruled out by violations of Max(T), *Float(H), and Linearity, respectively. Alternatively, the L can be deleted (candidate d), but this also violates Max(T).

Could such an analysis also work for the Dogon languages? It seems possible, though not straightforward. Consider, for example, the case of PossIP N Adj in Tommo So in a phrase like *mí bàbè^{L} kómmó* 'my skinny uncle'. Instead of proposing that, for example, the adjectival schema demands that the c-commanded words take {L}, the schema would demand the loss of tone on c-commanded words and the appearance of a {L} tonal morpheme. This would compete with the possessor's schema, where c-commanded words lose their tone and a {H} tonal morpheme occurs after the possessor. The morphological component would be responsible for determining the domains of tonal loss and the insertion of the "correct" tonal

morphemes. However, this is problematic in that the mere presence of a tonal morpheme would be enough to satisfy the constructional schema. Thus, a hypothetical form like the following may be passed on to phonology:

(34) mí [H] babe [L] kómmó

This assumes that the morphological component is allowed to block the loss of tone on the possessive phase. Both constructions are satisfied because the c-commanded word has lost its tone and both of the tonal morphemes have been inserted. Since the melodies are not yet mapped, there is no sense in which the melodies are at odds. The phonology would then be responsible for mapping overlays onto toneless word spans. Since overlays in Tommo So always map from left-to-right,[11] we could have an ALIGN-L constraint. The difficulty is making the phonology choose the [L] melody over the [H] melody, particularly given the fact that H appears to be privileged in Tommo So phonology (seen, for example, in the absence of lexically L words).[12] A further difficulty is to ensure spreading of the melody across all toneless syllables; we cannot propose a constraint *TONELESS, at least not postlexically, since certain elements are surface toneless in Tommo So (McPherson 2011).

To avoid these problems while maintaining a separation of morphology and phonology, we could assume that the output of the morphology includes domains tagged as "belonging to" a particular tonal melody; for example, instead of (34), we would find something like (35):

(35) mí $\{\text{babe}\}^{\text{L}}$ kómmó

[11] In contrast to lexical tone, which shows no evidence for automatic association.

[12] This could also be seen as a difficulty for Kalabari, in a case with multiple triggers, unless the output of the morphology must contain a single, uninterrupted string of toneless words.

Under this model, spans can only belong to a single melody at a time, and the phonology would then map the melody from left to right. For a language like Nanga, requiring reference to UNIFORMITY, homophonous melodies would be able to merge in the morphology (into something like L1,2) but a span could not be tagged for non-homophonous melodies. Such an analysis is but one step away from what has been proposed in this study, where the output of tone mapping is assumed to take place simultaneously with tagging domains for a particular melody.

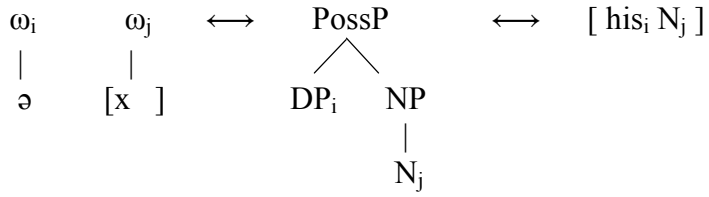
A final option is to view morphology and phonology as a single component, with the definition of domains and the mapping of overlays occurring in tandem in a single constrait set. This may well be the best solution, drawing on research on allomorph selection driven by phonological markedness (e.g. Nevins 2011, Yip 2004), but it also raises the possibility that phonological environment can play a role in determining the outcome of competitions between controllers, and I have seen no evidence for these effects in the Dogon languages.

Turning away from tone, let us consider the complicated case of Celtic consonant mutations, which brings up the question of phonological subcategorization. Consonant mutation patterns are notoriously difficult to analyze phonologically, though many have attempted. For a rule-based account of Irish, see Ni Chiosáin (1991); for autosegmental accounts, see Lieber (1983) and Wolf (2007); for a scalar account, see Gnanadesikan (1997). Others (e.g. Stewart 2004, Green 2006, Hannahs 2013) have abandoned the view that mutations belong in the phonology, proposing instead that they form part of the morphology (Stewart 2004) or the lexicon, either as part of lexicalized allomorphs for each word (Green 2006) or as networks of extracted patterns linking one consonant to another and tagging them for the environments in which they appear (Hannahs 2013). It is beyond the scope of this study to offer a full analysis of the consonant mutation facts in a constructional framework, but I will offer some preliminary thoughts on the matter.

I assume that the isolation form of words is lexicalized, this form showing what we know as the "radical" form of the consonant. This form is also used in many contexts, and these need not be lexicalized independently, but rather result from the simple concatenation of words,

such as ə *kat* 'her cat' in Irish; there is nothing idiosyncratic about this combination of words that requires lexicalization. However, with a homophonous 3sg masculine possessor, the noun undergoes Lenition, resulting in ə *xat* 'his cat'. This phonological change is idiosyncratic and requires lexicalization in the form of a phrasal construction, such as the following:

(36) Constructional schema for Irish 3sg masculine possession of *k*-initial nouns



The initial segment of the possessed noun is shown to be [x], idiosyncratic phonology for this context. The constructional schema is **subcategorized** for words beginning with *k*-. Where phonological regularities exist, more general schemas may be posited by learners, applying, for example, to all voiceless stops. While phonological regularities like these may still be found in the Celtic languages, due to the time depth with respect to restructuring, in other cases, correspondences may be completely arbitrary. An example of this type would be sandhi tones in many Sino-Tibetan languages, where one would be hard-pressed to find a phonological explanation deriving a sandhi tone from its base.

A positive side effect of having mutation correspondences for particular triggers (rather than saying that ECPLISIS or LENITION are unified processes, triggered by a list of constructions) is that it can account for exceptional cases where certain **segments** fail to undergo mutation with a particular trigger, despite the fact that others follow a completely regular pattern fo mutation. For example, in Irish, the preposition *gan* fails to lenite /f/, the only lenition-triggering preposition that fails to do so. If *gan* were simply tagged as triggering a lexical pattern LENITION, rather than designating its effects on a range of consonants, such exceptions would be unexpected.

Returning to phonological subcategorization in constructional schemas, we find an interesting difference between Celtic and the Dogon languages. In the Dogon languages, all cases

of phonological subcategorization remained surface-true in the output form of the schema. For example, Tommo So inalienable pronominal possessors assign {H} to words with two moras and {HL} to words with three or more, but this mora count remains clearly visible once the overlays are applied. In the Irish schema, on the other hand, *k-* for which the construction subcategorizes is replaced with *x-* on the surface. The same would hold true of constructional schemas in Northern Mao (Ahland 2012), where a constructional schema subcategorizing for H1-toned words demands that those same words be M on the surface. Thus, it does not appear to be a necessary condition of phonological subcategorization in constructions that idiosyncratic phonology preserve the trigger of subcategorization.

5.7 Future work

This chapter has laid out a number of predictions that the framework makes about how phrasal phonology will be restructured. In every case, the predictions are upheld by crosslinguistic data. Future work will seek to flesh out constructional analyses of the languages presented in this chapter; I suspect that in many cases, these analyses will be able to overcome difficulties that arise in trying to treat the phenomena as synchronically phonological. It will also be necessary to test these predictions against more cases of restructured phonology to find if other patterns are attested and whether these are analyzable in the constructional framework. As Chapter 6 notes, the challenge of this task is in identifying what phenomena fall into the category of restructured phonology, since many analyses in the literature still place them treat as belonging to the phonology.

CHAPTER 6

Conclusion

This study has focused on phrasal morphophonological alternations that, I argue, do not reflect morphosyntactic features or any other change in meaning but rather are restructured remnants of erstwhile phrasal phonology. These remnants belong to the morphology, the component of grammar responsible for idiosyncratic pairings of sound and meaning. I have expanded the framework of Construction Morphology (Booij 2010) to account for these cases, arguing that multi-word constructions can be lexicalized for idiosyncratic phonology as well as the previously noted idiosyncratic semantics.

The test case at the heart of this study has been Dogon replacive grammatical tone, where grammatically conditioned tonal overlays replace a word's lexical tone in contexts defined by syntactic category and structure. Given this reliance on syntax, Heath and McPherson (2013) dub these tonal patterns "tonosyntax". Though the tonal systems have been described before in work by the author and by Jeffrey Heath (McPherson 2013, Heath 2008 *et seq.*, Heath and McPherson 2013 for a semantic explanation), this study provides the first in-depth analysis Dogon tonosyntax from a theoretical standpoint. In addition to providing evidence for phrasal morphological constructions, the Dogon case points strongly to a constraint-based grammatical architecture, as competitions between constructions find variable resolutions both within a single language and between languages in the family.

Chapter 1 set the stage. First, I demonstrated how tonosyntax in the Dogon languages differs from other common tonal phenomena, including floating tones, tone spreading, tone polarity, and Chinese-type sandhi. I outlined the framework implemented in later chapters, covering the fundamentals of Construction Morphology, multiword constructions, and how

these constructions can be translated into a constraint-based grammar. While there is no recognized label in the literature for cases of phrasal morphophonological alternations, I considered various approaches to cases I find similar (especially French liaison and Celtic consonant mutations). For each approach, I showed how it could be applied to Dogon tonosyntax, but in each case, the analysis left aspects of the system unexplained.

Chapter 2 contained the heart of this study. In it, I gave a complete description of the tonosyntactic system of one Dogon language, Tommo So (McPherson 2013), to serve as the basis of comparison for the languages presented in Chapter 3. I laid out first the terminology of tonosyntax, defining a **controller** as a word of a syntactic category that triggers a tonal overlay and a **non-controller** as a word of a syntactic category that is tonally inert, though it may itself be targeted by a controller. As originally demonstrated in Heath and McPherson (2013), these two classes can be defined semantically, with reference restrictors acting as controllers and non-reference restrictors acting as non-controllers. I then turned to the three main assertions:

1. The controller status of a word is determined by syntactic category (§2.4.1).
2. A controller's tonal domain is determined by syntactic structure in the form of c-command (§2.4.2).
3. Tonosyntactic conflicts are resolved by constraint interaction (§2.4.3).

These assertions can all be accounted for in the construction-based framework proposed, where tonal overlays are idiosyncratic phonological properties tied to regular syntactic structure and semantics in phrase-level constructions. The lexicalized constructions compete with one another as constraints ("construction constraints") to have their desired surface form applied.

However, construction constraints alone, paired with a general output-to-output faithfulness constraint for tone, fail to account for cases like the following:

(1) mí bàbè^{L} kómmó (Tommo So)
1SG.PRO uncle skinny
'my skinny uncle'

Here, the possessor falls within the adjective's c-command domain, yet it does not take a {L} overlay. I proposed that this is an effect of phase-based spellout, where the possessor's DP is sent first to the morphophonology. Material that has already been spelled out is subject to an output-to-output faithfulness constraint, IDENT-OO/PHASE. Though much work on phases contends that spelled out material can never be altered by higher material, I provided evidence from other Dogon languages in Chapter 3 that IDENT-OO/PHASE is indeed a violable constraint. With construction constraints, phase-based faithfulness constraints, a few other constraints on overlay application, the full range of Tommo tonosyntax can be accounted for. Nevertheless, Chapter 2 showed that constraint evaluation cannot be through strict ranking, as in Optimality Theory. A maximum entropy model (Goldwater and John 2003, Hayes and Wilson 2008) with weighted constraints was shown to accurately model cases of both ganging and variation.

In Chapter 3, I looked beyond Tommo So to nine other languages in the family. I briefly described attested differences in tonosyntax, before showing how the construction-based analysis was able to capture the different data patterns. Seven languages were accounted for with relatively little innovation beyond the Tommo So constraint set; different weights assigned by a maximum entropy grammar were sufficient to account for the data. However, two languages, Tiranige and Togo Kan, diverge drastically enough in their data patterns to require different constraints. In particular, I showed that Tiranige appears to have restructured the tonal changes in terms of linear adjacency rather than syntactic structure, and Togo Kan vacillates between the two systems.

The last aspect of Dogon tonosyntax addressed in this study was the relative clause, the focus of Chapter 4. I provided ample data on the structure of Dogon relative clauses, which are characterized by an internal head (all languages), nominal morphology on the

verb (most languages), and an optional relative pronoun/marker (two languages). Like all other modifiers, relative clauses impose {L} on the head NP, but the fact that this head is clause-internal poses difficulties for a c-command-based analysis of tonal domains. To unify relative clauses and other modifiers, I proposed an analysis of relative clauses in which the syntactic structure contains two full copies of the head NP, one on the spine of the matrix DP and one internal to the relative clause, itself a DP in the specifier of a functional projection RelModP. Through a process of matching, the external copy (on the spine of the DP) is suppressed, leaving the overt copy internal to the relative clause; however, this internal copy inherits the morphophonological properties of the external copy, including its tonal overlay.

Relative clauses also provided evidence for phase-based faithfulness. When a relative clause is c-commanded by a demonstrative (the only higher controller), only the verb is subject to this {L} overlay; other relative clause constituents retain their regular tones, despite falling within the demonstrative's tonal domain. I argued in §4.4.4 that this is due to the fact that the relative clause DP is a phase, but that the verb raises to the phase edge, D, where it is spelled out with higher material rather than the rest of the relative clause. In Toro Tegu, where an overt relativizer occupies D, the verb is unable to raise and, as predicted, it fails to take the demonstrative's {L} overlay (applied instead to the relativizer).

Having provided a syntactic account of Dogon relative clauses and laid out the facts of their tonosyntax, I showed how the patterns could be accounted for in the same construction-based framework used for other modifiers. I expanded the constraint set to include X^{L} Rel was added to the constraint set and demonstrated its behavior with respect to faithfulness and other construction constraints.

The last chapter, Chapter 5, considered how the predictions of the constructional framework are supported by crosslinguistic evidence. In particular, I showed that restructured phrasal phonology shares a number of common features that uphold these predictions:

1. Triggers of phrasal morphology will be either lexical or semantic. (§5.2)

2. Triggers are either c-command or are linearly adjacent to their targets. (§5.3)

3. Conflicts between triggers are resolved through constraint interaction. (§5.4)

4. Phrasal morphology can be blocked by applying across phase boundaries due to phase-based faithfulness. (§5.5)

All predictions were upheld by both tonal and segmental phenomena, though differences between the two do emerge (e.g. segmental alternations tend to have lexical triggers, tonal alternations tend to involve c-command, etc.).

While this study proposes a novel framework for phrasal morphophonological alternations that provides a good account for Dogon tonosyntax, questions remain for future work. Some questions relate to the data in the various languages. For example, actual frequency data in cases of variation could help hone constraint weights, while careful semantic fieldwork could prove the intuition that these are indeed cases of free variation and not reflexes of different syntactic structures or logical forms. Future work on relative clauses should test phenomena like reconstruction, idiom chunks, or island effects to help determine the underlying syntactic structure. In the domain of phases, other data should be sought to test the idea that faithfulness to phonological spellout of a phase is violable, as the Dogon data suggest. On a higher level, I hope that in defining Dogon tonosyntax as phrasal morphology, this can provide a label for troublesome phenomena from other languages that have evaded traditional analyses. The more cases of restructured, morphologized phrasal phonology that can be amassed, the clearer an image we will have of what the framework should account for, what it should rule out, and what we expect to see crosslinguistically.

APPENDIX A

Maxent output tableaux for Tommo So

Input: PossNonP-L N	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossNonP N	0	0.001	0	0	0	1	0	0	0	0	0	0	0
PossNonP N.L	1	0.999	1	0	0	0	0	0	0	0	0	0	0
PossNonP.L N.L	0	0	2	1	1	0	0	0	0	0	1	0	0
PossNonP.L N	0	0	1	1	1	0	0	0	0	0	1	0	0

Input: PossIP-H N	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossIP N	0	0.001	0	0	0	1	0	0	0	0	0	0	0
PossIP N.HL	1	0.999	1	0	0	0	0	0	0	0	0	0	0
PossIP.HL N.L	0	0	2	0	1	0	0	0	0	0	1	0	0
PossIP.HL N	0	0	1	0	1	0	0	0	0	0	1	0	0

Input: N PossAP	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N PossAP	1	1	0	0	0	0	0	0	0	0	0	0	0
N.L PossAP	0	0	1	0	0	0	0	0	0	0	0	0	0
N PossAP.L	0	0	1	1	1	0	0	0	0	0	0	0	0

Input: N Adj	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N Adj	0	0	0	0	0	0	1	0	0	0	0	0	0
N.L Adj	1	1	1	0	0	0	0	0	0	0	0	0	0
N.L Adj.L	0	0	2	0	0	0	0	0	0	0	1	0	0
N Adj.L	0	0	1	0	0	0	0	0	0	0	1	0	0

Input: N Adj Adj	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N Adj Adj	0	0	0	0	0	0	3	0	0	0	0	0	0
N.L1 Adj Adj	0	0	1	0	0	0	2	0	0	0	0	0	0
N.L2 Adj Adj	0	0	1	0	0	0	2	0	0	0	0	0	1
N.L1 Adj.L2 Adj	0	0	2	0	0	0	1	0	0	0	0	0	0
N.L12 Adj.L2 Adj	0	0.001	2	0	0	0	0	0	0	0	0	1	0
N.L12 Adj.L12 Adj	0	0	2	0	0	0	0	0	0	0	1	2	0
N.L12 Adj.L12 Adj.L2	0	0	3	0	0	0	0	0	0	0	2	2	0
N.L2 Adj.L1 Adj	0	0	2	0	0	0	1	0	0	0	1	0	1
N.L2 Adj.L2 Adj	1	0.999	2	0	0	0	0	0	0	0	0	0	0
N Adj.L1 Adj.L2	0	0	2	0	0	0	0	0	0	0	2	0	0

Input: N Num	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N Num	1	0.999	0	0	0	0	0	0	0	0	0	0	0
N.L Num	0	0	1	0	0	0	0	0	0	0	0	0	0
N.L Num.L	0	0	2	0	0	0	0	0	0	0	0	0	0
N Num.L	0	0	1	0	0	0	0	0	0	0	0	0	0

Input: N Dem	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N Dem	0	0	0	0	0	0	0	1	0	0	0	0	0
N.L Dem	1	1	1	0	0	0	0	0	0	0	0	0	0
N.L Dem.L	0	0	2	0	0	0	0	0	0	0	1	0	0
N Dem.L	0	0	1	0	0	0	0	0	0	0	1	0	0

Input: N Adj Dem	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N Adj Dem	0	0	0	0	0	0	1	2	0	0	0	0	0
N.L1 Adj Dem	0	0	1	0	0	0	0	2	0	0	0	0	0
N.L2 Adj Dem	0	0	1	0	0	0	1	1	0	0	0	0	1
N.L2 Adj.L2 Dem	1	0.999	2	0	0	0	0	0	0	0	0	0	0
N.L1 Adj.L2 Dem	0	0	2	0	0	0	0	1	0	0	0	0	0
N.L12 Adj.L2 Dem	0	0.001	2	0	0	0	0	0	0	0	0	1	0
N.L12 Adj.L12 Dem	0	0	2	0	0	0	0	0	0	0	1	2	0
N.L2 Adj.L1 Dem	0	0	2	0	0	0	0	1	0	0	1	0	1
N.L12 Adj.L12 Dem.L2	0	0	3	0	0	0	0	0	0	0	2	2	0
N Adj.L1 Dem.L2	0	0	2	0	0	0	0	0	0	0	2	0	0

Input: N Num Dem	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N Num Dem	0	0	0	0	0	0	0	2	0	0	0	0	0
N.L Num Dem	0	0	1	0	0	0	0	1	0	0	0	0	1
N Num.L Dem	0	0	1	0	0	0	0	1	0	0	0	0	0
N.L Num.L Dem	1	1	2	0	0	0	0	0	0	0	0	0	0
N.L Num.L Dem.L	0	0	3	0	0	0	0	0	0	0	1	0	0
N Num Dem.L	0	0	1	0	0	0	0	0	0	0	1	0	0
N Num.L Dem.L	0	0	2	0	0	0	0	0	0	0	1	0	0

Input: PossANonP-L N Adj	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossNonP N Adj	0	0	0	0	0	2	1	0	0	0	0	0	0
PossNonP N.L1 Adj	0	0	1	0	0	1	1	0	0	0	0	0	0
PossNonP N.L1 Adj.L1	1	0.999	2	0	0	0	0	0	0	0	0	0	0
PossNonP N.L12 Adj.L1	0	0.001	2	0	0	0	0	0	0	0	0	1	0
PossNonP N.L12 Adj.L12	0	0	2	0	0	0	0	0	0	0	1	2	0
PossNonP N.L2 Adj.L1	0	0	2	0	0	1	0	0	0	0	0	0	1
PossNonP.L1 N.L1 Adj.L1	0	0	3	1	1	0	0	0	0	0	1	0	0
PossNonP.L1 N.L12 Adj.L12	0	0	3	1	1	0	0	0	0	0	2	2	0
PossNonP N.L1 Adj.L2	0	0	2	0	0	1	0	0	0	0	1	0	0
PossNonP N.L1 Adj.L12	0	0	2	0	0	0	0	0	0	0	1	1	0
PossNonP N.L2 Adj	0	0	1	0	0	2	0	0	0	0	0	0	0

Input: PossINonP-L N Adj	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossIP N Adj	0	0	0	0	0	1	2	0	0	0	0	0	0
PossIP N.L1 Adj	0	0	1	0	0	0	2	0	0	0	0	0	0
PossIP N.L2 Adj	0	0	1	0	0	1	1	0	0	0	0	0	0
PossIP.L1 N.L1 Adj	0	0	2	1	1	0	2	0	0	0	1	0	0
PossIP.L2 N.L2 Adj	0	0	2	1	1	0	0	0	0	0	0	0	0
PossIP.L12 N.L12 Adj	0	0	2	1	1	0	0	0	0	0	1	2	0
PossiP.L12 N.L12 Adj.L2	0	0	3	1	1	0	0	0	0	0	2	2	0
PossIP.L2 N.L12 Adj	0	0	2	1	1	0	0	0	0	0	0	1	0
PossIP.L2 N.L1 Adj	0	0	2	1	1	0	1	0	0	0	0	0	1
PossIP.L1 N.L1 Adj.L2	0	0	3	1	1	0	0	0	0	0	2	0	0
PossIP N.L12 Adj	1	1	1	0	0	0	1	0	0	0	0	1	0

Input: PossIP-H N Adj	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossIP N Adj	0	0	0	0	0	1	2	0	0	0	0	0	0
PossIP N.HL Adj	0	0	1	0	0	0	2	0	0	0	0	0	0
PossIP N.L2 Adj	1	1	1	0	0	1	1	0	0	0	0	0	0
PossIP.HL N.L1 Adj	0	0	2	0	1	0	2	0	0	0	1	0	0
PossIP.L2 N.HL Adj	0	0	2	0	1	0	1	0	0	0	0	0	1
PossIP.HL N.L2 Adj	0	0	2	0	1	0	1	0	0	0	1	0	0
PossIP.L2 N.L2 Adj	0	0	2	0	1	0	0	0	0	0	0	0	0
PossIP.L2 N.L2 Adj.L2	0	0	3	0	1	0	0	0	0	0	1	0	0
PossIP N.HL Adj.L2	0	0	2	0	0	0	0	0	0	0	1	0	0
PossIP.HL N.L12 Adj	0	0	2	0	1	0	1	0	0	0	1	1	0

Input: N Adj PossAP	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N Adj PossAP	0	0	0	0	0	0	1	0	0	0	0	0	0
N.L Adj PossAP	1	1	1	0	0	0	0	0	0	0	0	0	0
N.L Adj.L PossAP	0	0	2	0	0	0	0	0	0	0	1	0	0
N Adj.L PossAP	0	0	1	0	0	0	0	0	0	0	1	0	0
N Adj PossAP.L	0	0	1	1	1	0	1	0	0	0	0	0	0

Input: N PossAP Adj	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N PossAP Adj	0	0	0	0	0	0	2	0	0	0	0	0	0
N.L PossAP Adj	1	1	1	0	0	0	1	0	0	0	0	0	0
N.L PossAP.L Adj	0	0	2	1	1	0	0	0	0	0	0	0	0
N PossAP Adj.L	0	0	1	0	0	0	0	0	0	0	1	0	0
N.L PossAP.L Adj.L	0	0	3	1	1	0	0	0	0	0	1	0	0
N.L PossAP Adj.L	0	0	2	0	0	0	0	0	0	0	1	0	0

Input: PossANonP-L N Dem	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossNonP N Dem	0	0	0	0	0	1	0	2	0	0	0	0	0
PossNonP N.L1 Dem	0	0	1	0	0	0	0	2	0	0	0	0	0
PossNonP N.L2 Dem	0	0	1	0	0	1	0	1	0	0	0	0	0
PossNonP.L2 N.L2 Dem	0	0	2	1	1	0	0	0	0	0	0	0	0
PossNonP.L2 N.L2 Dem.L2	0	0	3	1	1	0	0	0	0	0	1	0	0
PossNonP.L1 N.L1 Dem	0	0	2	1	1	0	0	2	0	0	1	0	0
PossNonP.L1 N.L1 Dem.L2	0	0	3	1	1	0	0	0	0	0	2	0	0
PossNonP N.L12 Dem	1	1	1	0	0	0	0	1	0	0	0	1	0
PossNonP N.L1 Dem.L2	0	0	2	0	0	0	0	0	0	0	1	0	0
PossNonP.L2 N.L1 Dem	0	0	2	1	1	0	0	1	0	0	0	0	1
PossNonP N.L2 Dem.L2	0	0	2	0	0	1	0	0	0	0	1	0	0
PossNonP.L1 N.L2 Dem.L2	0	0	3	1	1	0	0	0	0	0	2	0	0
PossNonP N.L12 Dem.L2	0	0	2	0	0	0	0	0	0	0	1	1	0

Input: PossINonP-L N Dem	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossIP N Dem	0	0	0	0	0	1	0	2	0	0	0	0	0
PossIP N.L1 Dem	0	0	1	0	0	0	0	2	0	0	0	0	0
PossIP N.L2 Dem	0	0	1	0	0	1	0	1	0	0	0	0	0
PossIP.L2 N.L2 Dem	0	0	2	1	1	0	0	0	0	0	0	0	0
PossIP.L2 N.L2 Dem.L2	0	0	3	1	1	0	0	0	0	0	1	0	0
PossIP.L1 N.L1 Dem	0	0	2	1	1	0	0	2	0	0	1	0	0
PossIP.L1 N.L1 Dem.L2	0	0	3	1	1	0	0	0	0	0	2	0	0
PossIP N.L12 Dem	1	1	1	0	0	0	0	1	0	0	0	1	0
PossIP N.L1 Dem.L2	0	0	2	0	0	0	0	0	0	0	1	0	0
PossIP.L2 N.L1 Dem	0	0	2	1	1	0	0	1	0	0	0	0	1
PossIP N.L2 Dem.L2	0	0	2	0	0	1	0	0	0	0	1	0	0
PossIP.L1 N.L2 Dem.L2	0	0	3	1	1	0	0	0	0	0	2	0	0
PossIP N.L12 Dem.L2	0	0	2	0	0	0	0	0	0	0	1	1	0

Input: PossIP-H N Dem	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossIP N Dem	0	0	0	0	0	1	0	2	0	0	0	0	0
PossIP N.HL Dem	0	0	1	0	0	0	0	2	0	0	0	0	0
PossIP N.L2 Dem	1	0.998	1	0	0	1	0	1	0	0	0	0	0
PossIP.HL N.L1 Dem	0	0	2	0	1	0	0	2	0	0	1	0	0
PossIP.HL N.L2 Dem	0	0	2	0	1	0	0	1	0	0	1	0	0
PossIP N.HL Dem.L2	0	0.001	2	0	0	0	0	0	0	0	1	0	0
PossIP.HL N.L1 Dem.L2	0	0	3	0	1	0	0	0	0	0	2	0	0
PossIP.L2 N.L2 Dem	0	0	2	0	1	0	0	0	0	0	0	0	0
PossIP.L2 N.L2 Dem.L2	0	0	3	0	1	0	0	0	0	0	1	0	0
PossIP.L2 N.HL Dem	0	0	2	0	1	0	0	1	0	0	0	0	1
PossIP.HL N Dem	0	0	1	0	1	0	0	2	0	0	1	0	0
PossIP.HL N Dem.L2	0	0	2	0	1	0	0	0	0	0	2	0	0
PossIP.HL N.L12 Dem	0	0	2	0	1	0	0	1	0	0	1	1	0

Input: N PossAP Dem	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N PossAP Dem	0	0.002	0	0	0	0	0	2	0	0	0	0	0
N.L PossAP Dem	0.4	0.4	1	0	0	0	0	1	0	0	0	0	1
N.L PossAP.L Dem	0	0	2	1	1	0	0	0	0	0	0	0	0
N.L PossAP.L Dem.L	0	0	3	1	1	0	0	0	0	0	1	0	0
N.L PossAP Dem.L	0	0	2	0	0	0	0	0	0	0	1	0	1
N PossAP Dem.L	0.6	0.597	1	0	0	0	0	0	0	0	1	0	0

Input: PossANonP N Num	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossNonP N Num	0	0	0	0	0	2	0	0	0	1	0	0	0
PossNonP N.L1 Num	0	0.001	1	0	0	1	0	0	0	1	0	0	0
PossNonP N.L2 Num	0	0	1	0	0	2	0	0	0	0	0	0	0
PossNonP N.L12 Num	0	0	1	0	0	1	0	0	0	0	0	1	0
PossNonP N.L1 Num.L1	1	0.999	2	0	0	0	0	0	0	0	0	0	0
PossNonP.L1 N.L1 Num.L1	0	0	3	1	1	0	0	0	0	0	1	0	0
PossNonP N Num.L1	0	0	1	0	0	1	0	0	0	0	0	0	1
PossNonP N.L1 Num.L2	0	0	2	0	0	1	0	0	0	0	1	0	0

Input: PossINonP N Num	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossNonP N Num	0	0.001	0	0	0	1	0	0	0	2	0	0	0
PossNonP N.L1 Num	1	0.999	1	0	0	0	0	0	0	2	0	0	0
PossNonP N.L2 Num	0	0	1	0	0	1	0	0	0	1	0	0	0
PossNonP N.L12 Num	0	0.001	1	0	0	0	0	0	0	1	0	1	0
PossNonP N.L1 Num.L2	0	0	2	0	0	0	0	0	0	0	1	0	0
PossNonP.L2 N.L2 Num	0	0	2	1	1	0	0	0	0	0	0	0	0
PossNonP.L1 N.L2 Num	0	0	2	1	1	0	0	0	0	1	1	0	0

Input: PossIP-H N Num	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossIP N Num	0	0.001	0	0	0	1	0	0	0	0	0	0	0
PossIP N.HL Num	1	0.999	1	0	0	0	0	0	0	0	0	0	0
PossIP N.L2 Num	0	0	1	0	0	1	0	0	0	0	0	0	0
PossIP.HL N.L1 Num	0	0	2	0	1	0	0	0	0	0	1	0	0
PossIP.HL N.L1 Num.L2	0	0	3	0	1	0	0	0	0	0	2	0	0
PossIP.HL N.L12 Num.L2	0	0	3	0	1	0	0	0	0	0	2	1	0
PossIP.L2 N.L2 Num	0	0	2	0	1	1	0	0	0	0	0	0	0
PossIP.L2 N.L2 Num.L2	0	0	3	0	1	1	0	0	0	0	1	0	0
PossIP.HL N.L2 Num.L2	0	0	3	0	1	1	0	0	0	0	2	0	0
PossIP N.HL Num.L2	0	0	2	0	0	0	0	0	0	0	1	0	0
PossIP.L2 N.HL Num	0	0	2	0	1	0	0	0	0	0	0	0	1

Input: N Adj Num	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N Adj Num	0	0	0	0	0	0	1	0	0	0	0	0	0
N.L Adj Num	1	1	1	0	0	0	0	0	0	0	0	0	0
N Adj.L Num	0	0	1	0	0	0	0	0	0	0	1	0	0
N.L Adj.L Num	0	0	2	0	0	0	0	0	0	0	1	0	0
N Adj Num.L	0	0	1	0	0	0	1	0	0	0	0	0	0

Input: PossANonP N Adj Dem	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossANonP N Adj Dem	0	0	0	0	0	2	1	3	0	0	0	0	0
PossANonP N.L1 Adj Dem	0	0	1	0	0	1	1	3	0	0	0	0	0
PossANonP N.L2 Adj Dem	0	0	1	0	0	2	0	3	0	0	0	0	0
PossANonP N.L3 Adj Dem	0	0	1	0	0	2	1	2	0	0	0	0	0
PossANonP N.L1 Adj.L1 Dem	0	0	2	0	0	0	0	3	0	0	0	0	0
PossANonP N.L1 Adj.L2 Dem	0	0	2	0	0	1	0	3	0	0	1	0	0
PossANonP N.L1 Adj.L3 Dem	0	0	2	0	0	1	0	2	0	0	0	0	0
PossANonP N.L3 Adj.L3 Dem	0	0	2	0	0	2	0	1	0	0	0	0	0
PossANonP.L3 N.L3 Adj.L3 Dem	0	0	3	1	1	0	0	0	0	0	0	0	0
PossANonP.L1 N.L2 Adj Dem	0	0	2	1	1	0	0	3	0	0	1	0	0
PossANonP.L1 N.L2 Adj Dem.L3	0	0	3	1	1	0	0	0	0	0	2	0	0
PossANonP N.L1 Adj.L1 Dem.L3	0	0.001	3	0	0	0	0	0	0	0	1	0	0
PossANonP N.L1 Adj.L2 Dem.L3	0	0	3	0	0	1	0	0	0	0	2	0	0
PossANonP N.L12 Adj Dem	0	0	1	0	0	1	0	3	0	0	0	1	0
PossANonP N.L123 Adj Dem	0	0	1	0	0	1	0	2	0	0	0	1	0
PossANonP N.L13 Adj.L13 Dem	1	0.999	2	0	0	0	0	1	0	0	0	2	0
PossANonP.L3 N.L2 Adj Dem	0	0	2	1	1	0	0	2	0	0	0	0	1

Input: PossINonP N Adj Dem	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossINonP N Adj Dem	0	0	0	0	0	1	2	3	0	0	0	0	0
PossINonP N.L1 Adj Dem	0	0	1	0	0	0	2	3	0	0	0	0	0
PossINonP N.L2 Adj Dem	0	0	1	0	0	1	1	3	0	0	0	0	0
PossINonP N.L3 Adj Dem	0	0	1	0	0	1	2	2	0	0	0	0	0
PossINonP.L2 N.L2 Adj Dem	0	0	2	1	1	0	0	3	0	0	0	0	0
PossINonP.L3 N.L3 Adj Dem	0	0	2	1	1	0	2	1	0	0	0	0	0
PossINonP.L3 N.L3 Adj.L3 Dem	0	0	3	1	1	0	0	0	0	0	0	0	0
PossINonP N.L1 Adj.L3 Dem	0	0	2	0	0	0	0	2	0	0	0	0	0
PossINonP N.L13 Adj.L3 Dem	1	1	2	0	0	0	0	1	0	0	0	1	0
PossINonP N.L1 Adj.L2 Dem.L3	0	0	3	0	0	0	0	0	0	0	2	0	0
PossINonP N.L2 Adj Dem.L3	0	0	2	0	0	1	1	0	0	0	1	0	0
PossINonP N.L123 Adj Dem	0	0	1	0	0	0	1	2	0	0	0	1	0

Input: PossIP N Adj Dem	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
PossIP N Adj Dem	0	0	0	0	0	1	2	3	0	0	0	0	0
PossIP N.HL1 Adj Dem	0	0	1	0	0	0	2	3	0	0	0	0	0
PossIP N.L2 Adj Dem	0	0	1	0	0	1	1	3	0	0	0	0	0
PossIP N.L3 Adj Dem	0	0	1	0	0	1	2	2	0	0	0	0	0
PossIP N.HL1 Adj.L2 Dem.L3	0	0.001	3	0	0	0	0	0	0	0	1	0	0
PossIP N.HL1 Adj.L3 Dem	0	0	2	0	0	0	0	2	0	0	0	0	0
PossIP.L2 N.L2 Adj Dem	0	0	2	0	1	0	0	3	0	0	0	0	0
PossIP.L2 N.L2 Adj Dem.L3	0	0	3	0	1	0	0	0	0	0	1	0	0
PossIP.L3 N.L3 Adj.L3 Dem	0	0	3	0	1	0	0	0	0	0	0	0	0
PossIP N.L3 Adj.L3 Dem	1	0.998	2	0	0	1	0	1	0	0	0	0	0
PossIP.HL1 N.L3 Adj.L3 Dem	0	0	3	0	1	0	0	1	0	0	1	0	0
PossIP N.L23 Adj Dem	0	0	1	0	0	1	1	2	0	0	0	1	0
PossIP N.L23 Adj.L3 Dem	0	0.001	2	0	0	1	0	1	0	0	0	1	0

Input: N Rel	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N Rel	0	0	0	0	0	0	0	0	1	0	0	0	0
N.L Rel	1	1	1	0	0	0	0	0	0	0	0	0	0
N Rel.L	0	0	1	1	1	0	0	0	0	0	1	0	0

Input: N Adj Rel	Pred.	Obs.	Id(T)	Id(T)/Phase-Lex	Id(T)/Phase	Poss X.T	X.L Adj	X.L Dem	X.L Rel	X.L Num/Poss	*SelfCont	Uniformity	Locality
N Adj Rel	0	0	0	0	0	0	1	0	2	0	0	0	0
N.L1 Adj Rel	0	0	1	0	0	0	0	0	2	0	0	0	0
N.L2 Adj Rel	0	0	1	0	0	0	1	0	1	0	0	0	1
N.L1 Adj.L2 Rel	0	0	2	0	0	0	0	0	1	0	0	0	0
N.L2 Adj.L2 Rel	1	0.999	2	0	0	0	0	0	0	0	0	0	0
N.L2 Adj.L1 Rel	0	0	2	0	0	0	0	0	1	0	1	0	1
N Adj.L2 Rel	0	0	1	0	0	0	0	0	1	0	0	0	0
N Adj.L1 Rel	0	0	1	0	0	0	0	0	2	0	1	0	0
N.L1 Adj Rel.L2	0	0	2	1	1	0	0	0	0	0	1	0	0
N.L12 Adj Rel	0	0	1	0	0	0	0	0	1	0	0	1	1
N.L12 Adj.L2 Rel	0	0.001	2	0	0	0	0	0	0	0	0	1	0

APPENDIX B

T-order for Tommo So constraint set

If this input	yields this output	then this input	yields this output
PossNonP N	PossNonP N.L	PossIP N	PossIP N.HL
PossNonP N	PossNonP N.L	N PossAP	N PossAP
PossNonP N	PossNonP N.L	N Num	N Num
PossNonP N	PossNonP N.L	PossANonP N Adj	PossANonP N.L1 Adj.L1
PossNonP N	PossNonP N.L	PossANonP N Num	PossANonP N.L1 Num.L1
PossNonP N	PossNonP N.L	PossIP N Num	PossIP N.HL Num
PossNonP N	PossNonP N	PossIP N	PossIP N
PossNonP N	PossNonP N	N PossAP	N PossAP
PossNonP N	PossNonP N	N Num	N Num
PossNonP N	PossNonP N	PossIP N Num	PossIP N Num
PossIP N	PossIP N.HL	PossNonP N	PossNonP N.L
PossIP N	PossIP N.HL	N PossAP	N PossAP
PossIP N	PossIP N.HL	N Num	N Num
PossIP N	PossIP N.HL	PossANonP N Adj	PossANonP N.L1 Adj.L1
PossIP N	PossIP N.HL	PossANonP N Num	PossANonP N.L1 Num.L1
PossIP N	PossIP N.HL	PossIP N Num	PossIP N.HL Num
PossIP N	PossIP N	PossNonP N	PossNonP N
PossIP N	PossIP N	N PossAP	N PossAP
PossIP N	PossIP N	N Num	N Num
PossIP N	PossIP N	PossIP N Num	PossIP N Num
N PossAP	N PossAP	N Num	N Num
N Adj	N.L Adj	N PossAP	N PossAP
N Adj	N.L Adj	N Adj Adj	N.L2 Adj.L2 Adj
N Adj	N.L Adj	N Num	N Num
N Adj	N.L Adj	N Adj PossAP	N.L Adj PossAP
N Adj	N.L Adj	N Adj Num	N.L Adj Num

N Adj	N Adj	N PossAP	N PossAP
N Adj	N Adj	N Adj Adj	N Adj Adj
N Adj	N Adj	N Num	N Num
N Adj	N Adj	N Adj PossAP	N Adj PossAP
N Adj	N Adj	N PossAP Adj	N PossAP Adj
N Adj	N Adj	N Adj Num	N Adj Num
N Adj Adj	N.L2 Adj.L2 Adj	N PossAP	N PossAP
N Adj Adj	N.L2 Adj.L2 Adj	N Adj	N.L Adj
N Adj Adj	N.L2 Adj.L2 Adj	N Num	N Num
N Adj Adj	N.L2 Adj.L2 Adj	N Adj PossAP	N.L Adj PossAP
N Adj Adj	N.L2 Adj.L2 Adj	N Adj Num	N.L Adj Num
N Adj Adj	N Adj Adj	N PossAP	N PossAP
N Adj Adj	N Adj Adj	N Adj	N Adj
N Adj Adj	N Adj Adj	N Num	N Num
N Adj Adj	N Adj Adj	N Adj PossAP	N Adj PossAP
N Adj Adj	N Adj Adj	N PossAP Adj	N PossAP Adj
N Adj Adj	N Adj Adj	N Adj Num	N Adj Num
N Num	N Num	N PossAP	N PossAP
N Dem	N.L Dem	N PossAP	N PossAP
N Dem	N.L Dem	N Num	N Num
N Dem	N.L Dem	N Adj Dem	N.L2 Adj.L2 Dem
N Dem	N Dem	N PossAP	N PossAP
N Dem	N Dem	N Num	N Num
N Dem	N Dem	N Num Dem	N Num Dem
N Dem	N Dem	N PossAP Dem	N PossAP Dem
N Adj Dem	N.L2 Adj.L2 Dem	N PossAP	N PossAP
N Adj Dem	N.L2 Adj.L2 Dem	N Num	N Num
N Adj Dem	N.L2 Adj.L2 Dem	N Dem	N.L Dem
N Adj Dem	N Adj Dem	N PossAP	N PossAP
N Adj Dem	N Adj Dem	N Adj	N Adj
N Adj Dem	N Adj Dem	N Adj Adj	N Adj Adj
N Adj Dem	N Adj Dem	N Num	N Num
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N Adj Dem	N Adj Dem	N Num Dem	N Num Dem
N Adj Dem	N Adj Dem	N Adj PossAP	N Adj PossAP
N Adj Dem	N Adj Dem	N PossAP Adj	N PossAP Adj
N Adj Dem	N Adj Dem	N PossAP Dem	N PossAP Dem
N Adj Dem	N Adj Dem	N Adj Num	N Adj Num

N Adj Dem	N.L1 Adj Dem	N PossAP	N PossAP
N Adj Dem	N.L1 Adj Dem	N Adj	N.L Adj
N Adj Dem	N.L1 Adj Dem	N Adj Adj	N.L2 Adj.L2 Adj
N Adj Dem	N.L1 Adj Dem	N Num	N Num
N Adj Dem	N.L1 Adj Dem	N Dem	N Dem
N Adj Dem	N.L1 Adj Dem	N Num Dem	N Num Dem
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N Adj Dem	N.L1 Adj Dem	N PossAP Dem	N PossAP Dem
N Adj Dem	N.L1 Adj Dem	N Adj Num	N.L Adj Num
N Num Dem	N.L Num.L Dem	N PossAP	N PossAP
N Num Dem	N.L Num.L Dem	N Num	N Num
N Num Dem	N.L Num.L Dem	N Dem	N.L Dem
N Num Dem	N.L Num.L Dem	N Adj Dem	N.L2 Adj.L2 Dem
N Num Dem	N Num Dem	N PossAP	N PossAP
N Num Dem	N Num Dem	N Num	N Num
N Num Dem	N Num Dem	N Dem	N Dem
N Num Dem	N Num Dem	N PossAP Dem	N PossAP Dem
N Num Dem	N Num Dem.L	N PossAP	N PossAP
N Num Dem	N Num Dem.L	N Num	N Num
N Num Dem	N Num Dem.L	N Dem	N.L Dem
N Num Dem	N Num Dem.L	N Adj Dem	N.L2 Adj.L2 Dem
N Num Dem	N Num Dem.L	N PossAP Dem	N PossAP Dem.L

PossANonP N Adj	PossANonP N.L1 Adj.L1	PossNonP N	PossNonP N.L
PossANonP N Adj	PossANonP N.L1 Adj.L1	PossIP N	PossIP N.HL
PossANonP N Adj	PossANonP N.L1 Adj.L1	N PossAP	N PossAP
PossANonP N Adj	PossANonP N.L1 Adj.L1	N Num	N Num
PossANonP N Adj	PossANonP N.L1 Adj.L1	PossANonP N Num	PossANonP N.L1 Num.L1
PossANonP N Adj	PossANonP N.L1 Adj.L1	PossIP N Num	PossIP N.HL Num
PossANonP N Adj	PossANonP N Adj	PossNonP N	PossNonP N
PossANonP N Adj	PossANonP N Adj	PossIP N	PossIP N
PossANonP N Adj	PossANonP N Adj	N PossAP	N PossAP
PossANonP N Adj	PossANonP N Adj	N Adj	N Adj
PossANonP N Adj	PossANonP N Adj	N Adj Adj	N Adj Adj
PossANonP N Adj	PossANonP N Adj	N Num	N Num
PossANonP N Adj	PossANonP N Adj	PossINonP N Adj	PossIP N Adj
PossANonP N Adj	PossANonP N Adj	PossIP N Adj	PossIP N Adj
PossANonP N Adj	PossANonP N Adj	N Adj PossAP	N Adj PossAP
PossANonP N Adj	PossANonP N Adj	N PossAP Adj	N PossAP Adj
PossANonP N Adj	PossANonP N Adj	PossIP N Num	PossIP N Num
PossANonP N Adj	PossANonP N Adj	N Adj Num	N Adj Num
PossANonP N Adj	PossANonP N.L2 Adj	PossNonP N	PossNonP N
PossANonP N Adj	PossANonP N.L2 Adj	PossIP N	PossIP N
PossANonP N Adj	PossANonP N.L2 Adj	N PossAP	N PossAP
PossANonP N Adj	PossANonP N.L2 Adj	N Adj	N.L Adj
PossANonP N Adj	PossANonP N.L2 Adj	N Adj Adj	N.L2 Adj.L2 Adj
PossANonP N Adj	PossANonP N.L2 Adj	N Num	N Num
PossANonP N Adj	PossANonP N.L2 Adj	N Adj PossAP	N.L Adj PossAP
PossANonP N Adj	PossANonP N.L2 Adj	PossIP N Num	PossIP N Num
PossANonP N Adj	PossANonP N.L2 Adj	N Adj Num	N.L Adj Num

PossINonP N Adj	PossINonP N.L12 Adj	N PossAP	N PossAP
PossINonP N Adj	PossINonP N.L12 Adj	N Num	N Num
PossINonP N Adj	PossINonP N Adj	PossNonP N	PossNonP N
PossINonP N Adj	PossINonP N Adj	PossIP N	PossIP N
PossINonP N Adj	PossINonP N Adj	N PossAP	N PossAP
PossINonP N Adj	PossINonP N Adj	N Adj	N Adj
PossINonP N Adj	PossINonP N Adj	N Adj Adj	N Adj Adj
PossINonP N Adj	PossINonP N Adj	N Num	N Num
PossINonP N Adj	PossINonP N Adj	PossANonP N Adj	PossANonP N Adj
PossINonP N Adj	PossINonP N Adj	PossIP N Adj	PossIP N Adj
PossINonP N Adj	PossINonP N Adj	N Adj PossAP	N Adj PossAP
PossINonP N Adj	PossINonP N Adj	N PossAP Adj	N PossAP Adj
PossINonP N Adj	PossINonP N Adj	PossIP N Num	PossIP N Num
PossINonP N Adj	PossINonP N Adj	N Adj Num	N Adj Num
PossINonP N Adj	PossINonP N.L1 Adj	PossNonP N	PossNonP N.L
PossINonP N Adj	PossINonP N.L1 Adj	PossIP N	PossIP N.HL
PossINonP N Adj	PossINonP N.L1 Adj	N PossAP	N PossAP
PossINonP N Adj	PossINonP N.L1 Adj	N Num	N Num
PossINonP N Adj	PossINonP N.L1 Adj	PossANonP N Adj	PossANonP N.L1 Adj.L1
PossINonP N Adj	PossINonP N.L1 Adj	PossANonP N Num	PossANonP N.L1 Num.L1
PossINonP N Adj	PossINonP N.L1 Adj	PossIP N Num	PossIP N.HL Num
PossINonP N Adj	PossINonP N.L2 Adj	N PossAP	N PossAP
PossINonP N Adj	PossINonP N.L2 Adj	N Adj	N.L Adj
PossINonP N Adj	PossINonP N.L2 Adj	N Adj Adj	N.L2 Adj.L2 Adj
PossINonP N Adj	PossINonP N.L2 Adj	N Num	N Num
PossINonP N Adj	PossINonP N.L2 Adj	N Adj PossAP	N.L Adj PossAP
PossINonP N Adj	PossINonP N.L2 Adj	N Adj Num	N.L Adj Num
PossINonP N Adj	PossINonP.L2 N.L2 Adj	N PossAP	N PossAP
PossINonP N Adj	PossINonP.L2 N.L2 Adj	N Adj	N.L Adj
PossINonP N Adj	PossINonP.L2 N.L2 Adj	N Adj Adj	N.L2 Adj.L2 Adj
PossINonP N Adj	PossINonP.L2 N.L2 Adj	N Num	N Num
PossINonP N Adj	PossINonP.L2 N.L2 Adj	N Adj PossAP	N.L Adj PossAP
PossINonP N Adj	PossINonP.L2 N.L2 Adj	N Adj Num	N.L Adj Num

PossIP N Adj	PossIP N.L2 Adj	N PossAP	N PossAP
PossIP N Adj	PossIP N.L2 Adj	N Adj	N.L Adj
PossIP N Adj	PossIP N.L2 Adj	N Adj Adj	N.L2 Adj.L2 Adj
PossIP N Adj	PossIP N.L2 Adj	N Num	N Num
PossIP N Adj	PossIP N.L2 Adj	N Adj PossAP	N.L Adj PossAP
PossIP N Adj	PossIP N.L2 Adj	N PossAP Adj	N.L PossAP Adj
PossIP N Adj	PossIP N.L2 Adj	N Adj Num	N.L Adj Num
PossIP N Adj	PossIP N Adj	PossNonP N	PossNonP N
PossIP N Adj	PossIP N Adj	PossIP N	PossIP N
PossIP N Adj	PossIP N Adj	N PossAP	N PossAP
PossIP N Adj	PossIP N Adj	N Adj	N Adj
PossIP N Adj	PossIP N Adj	N Adj Adj	N Adj Adj
PossIP N Adj	PossIP N Adj	N Num	N Num
PossIP N Adj	PossIP N Adj	PossANonP N Adj	PossANonP N Adj
PossIP N Adj	PossIP N Adj	PossINonP N Adj	PossINonP N Adj
PossIP N Adj	PossIP N Adj	N Adj PossAP	N Adj PossAP
PossIP N Adj	PossIP N Adj	N PossAP Adj	N PossAP Adj
PossIP N Adj	PossIP N Adj	PossIP N Num	PossIP N Num
PossIP N Adj	PossIP N Adj	N Adj Num	N Adj Num
PossIP N Adj	PossIP N.HL Adj	PossNonP N	PossNonP N.L
PossIP N Adj	PossIP N.HL Adj	PossIP N	PossIP N.HL
PossIP N Adj	PossIP N.HL Adj	N PossAP	N PossAP
PossIP N Adj	PossIP N.HL Adj	N Num	N Num
PossIP N Adj	PossIP N.HL Adj	PossANonP N Adj	PossANonP N.L1 Adj.L1
PossIP N Adj	PossIP N.HL Adj	PossANonP N Num	PossANonP N.L1 Num.L1
PossIP N Adj	PossIP N.HL Adj	PossIP N Num	PossIP N.HL Num
PossIP N Adj	PossIP.L2 N.L2 Adj	N PossAP	N PossAP
PossIP N Adj	PossIP.L2 N.L2 Adj	N Adj	N.L Adj
PossIP N Adj	PossIP.L2 N.L2 Adj	N Adj Adj	N.L2 Adj.L2 Adj
PossIP N Adj	PossIP.L2 N.L2 Adj	N Num	N Num
PossIP N Adj	PossIP.L2 N.L2 Adj	N Adj PossAP	N.L Adj PossAP
PossIP N Adj	PossIP.L2 N.L2 Adj	N Adj Num	N.L Adj Num
PossIP N Adj	PossIP N.HL Adj.L2	N PossAP	N PossAP
PossIP N Adj	PossIP N.HL Adj.L2	N Adj	N.L Adj
PossIP N Adj	PossIP N.HL Adj.L2	N Adj Adj	N.L2 Adj.L2 Adj
PossIP N Adj	PossIP N.HL Adj.L2	N Num	N Num
PossIP N Adj	PossIP N.HL Adj.L2	N Adj PossAP	N.L Adj PossAP
PossIP N Adj	PossIP N.HL Adj.L2	N PossAP Adj	N PossAP Adj.L
PossIP N Adj	PossIP N.HL Adj.L2	N Adj Num	N.L Adj Num

N Adj PossAP	N.L Adj PossAP	N PossAP	N PossAP
N Adj PossAP	N.L Adj PossAP	N Adj	N.L Adj
N Adj PossAP	N.L Adj PossAP	N Adj Adj	N.L2 Adj.L2 Adj
N Adj PossAP	N.L Adj PossAP	N Num	N Num
N Adj PossAP	N.L Adj PossAP	N Adj Num	N.L Adj Num
N Adj PossAP	N Adj PossAP	N PossAP	N PossAP
N Adj PossAP	N Adj PossAP	N Adj	N Adj
N Adj PossAP	N Adj PossAP	N Adj Adj	N Adj Adj
N Adj PossAP	N Adj PossAP	N Num	N Num
N Adj PossAP	N Adj PossAP	N PossAP Adj	N PossAP Adj
N Adj PossAP	N Adj PossAP	N Adj Num	N Adj Num
N PossAP Adj	N.L PossAP Adj	N PossAP	N PossAP
N PossAP Adj	N.L PossAP Adj	N Adj	N.L Adj
N PossAP Adj	N.L PossAP Adj	N Adj Adj	N.L2 Adj.L2 Adj
N PossAP Adj	N.L PossAP Adj	N Num	N Num
N PossAP Adj	N.L PossAP Adj	N Adj PossAP	N.L Adj PossAP
N PossAP Adj	N.L PossAP Adj	N Adj Num	N.L Adj Num
N PossAP Adj	N PossAP Adj	N PossAP	N PossAP
N PossAP Adj	N PossAP Adj	N Adj	N Adj
N PossAP Adj	N PossAP Adj	N Adj Adj	N Adj Adj
N PossAP Adj	N PossAP Adj	N Num	N Num
N PossAP Adj	N PossAP Adj	N Adj PossAP	N Adj PossAP
N PossAP Adj	N PossAP Adj	N Adj Num	N Adj Num
N PossAP Adj	N.L PossAP.L Adj	N PossAP	N PossAP
N PossAP Adj	N.L PossAP.L Adj	N Adj	N.L Adj
N PossAP Adj	N.L PossAP.L Adj	N Adj Adj	N.L2 Adj.L2 Adj
N PossAP Adj	N.L PossAP.L Adj	N Num	N Num
N PossAP Adj	N.L PossAP.L Adj	PossINonP N Adj	PossINonP.L2 N.L2 Adj
N PossAP Adj	N.L PossAP.L Adj	PossIP N Adj	PossIP.L2 N.L2 Adj
N PossAP Adj	N.L PossAP.L Adj	N Adj PossAP	N.L Adj PossAP
N PossAP Adj	N.L PossAP.L Adj	N Adj Num	N.L Adj Num
N PossAP Adj	N PossAP Adj.L	N PossAP	N PossAP
N PossAP Adj	N PossAP Adj.L	N Adj	N.L Adj
N PossAP Adj	N PossAP Adj.L	N Adj Adj	N.L2 Adj.L2 Adj
N PossAP Adj	N PossAP Adj.L	N Num	N Num
N PossAP Adj	N PossAP Adj.L	N Adj PossAP	N.L Adj PossAP
N PossAP Adj	N PossAP Adj.L	N Adj Num	N.L Adj Num

PossANonP N Dem	PossANonP N.L12 Dem	N PossAP	N PossAP
PossANonP N Dem	PossANonP N.L12 Dem	N Num	N Num
PossANonP N Dem	PossANonP N.L12 Dem	PossINonP N Dem	PossINonP N.L12 Dem
PossANonP N Dem	PossANonP N.L12 Dem	PossANonP N Adj Dem	PossANonP N.L13 Adj.L13 Dem
PossANonP N Dem	PossANonP N Dem	PossNonP N	PossNonP N
PossANonP N Dem	PossANonP N Dem	PossIP N	PossIP N
PossANonP N Dem	PossANonP N Dem	N PossAP	N PossAP
PossANonP N Dem	PossANonP N Dem	N Num	N Num
PossANonP N Dem	PossANonP N Dem	N Dem	N Dem
PossANonP N Dem	PossANonP N Dem	N Num Dem	N Num Dem
PossANonP N Dem	PossANonP N Dem	PossINonP N Dem	PossINonP N Dem
PossANonP N Dem	PossANonP N Dem	PossIP N Dem	PossIP N Dem
PossANonP N Dem	PossANonP N Dem	N PossAP Dem	N PossAP Dem
PossANonP N Dem	PossANonP N Dem	PossIP N Num	PossIP N Num
PossANonP N Dem	PossANonP N.L1 Dem	PossNonP N	PossNonP N.L
PossANonP N Dem	PossANonP N.L1 Dem	PossIP N	PossIP N.HL
PossANonP N Dem	PossANonP N.L1 Dem	N PossAP	N PossAP
PossANonP N Dem	PossANonP N.L1 Dem	N Num	N Num
PossANonP N Dem	PossANonP N.L1 Dem	PossANonP N Adj	PossANonP N.L1 Adj.L1
PossANonP N Dem	PossANonP N.L1 Dem	PossINonP N Dem	PossINonP N.L1 Dem
PossANonP N Dem	PossANonP N.L1 Dem	PossANonP N Num	PossANonP N.L1 Num.L1
PossANonP N Dem	PossANonP N.L1 Dem	PossIP N Num	PossIP N.HL Num
PossANonP N Dem	PossANonP N.L2 Dem	N PossAP	N PossAP
PossANonP N Dem	PossANonP N.L2 Dem	N Num	N Num
PossANonP N Dem	PossANonP N.L2 Dem	N Dem	N.L Dem
PossANonP N Dem	PossANonP N.L2 Dem	N Adj Dem	N.L2 Adj.L2 Dem
PossANonP N Dem	PossANonP N.L2 Dem	N Num Dem	N.L Num.L Dem
PossANonP N Dem	PossANonP N.L2 Dem	PossINonP N Dem	PossINonP N.L2 Dem
PossANonP N Dem	PossANonP N.L2 Dem	PossANonP N Adj Dem	PossANonP N.L3 Adj.L3 Dem
PossANonP N Dem	PossANonP.L2 N.L2 Dem	N PossAP	N PossAP
PossANonP N Dem	PossANonP.L2 N.L2 Dem	N Num	N Num
PossANonP N Dem	PossANonP.L2 N.L2 Dem	N Dem	N.L Dem
PossANonP N Dem	PossANonP.L2 N.L2 Dem	N Adj Dem	N.L2 Adj.L2 Dem
PossANonP N Dem	PossANonP.L2 N.L2 Dem	PossINonP N Dem	PossINonP.L2 N.L2 Dem
PossANonP N Dem	PossANonP.L2 N.L2 Dem	PossIP N Dem	PossIP.L2 N.L2 Dem
PossANonP N Dem	PossANonP.L2 N.L2 Dem	PossANonP N Adj Dem	PossANonP.L3 N.L3 Adj.L3 Dem
PossANonP N Dem	PossANonP.L2 N.L2 Dem	PossIP N Adj Dem	PossIP.L3 N.L3 Adj.L3 Dem

PossANonP N Dem	PossANonP N.L1 Dem.L2	N PossAP	N PossAP
PossANonP N Dem	PossANonP N.L1 Dem.L2	N Num	N Num
PossANonP N Dem	PossANonP N.L1 Dem.L2	N Dem	N.L Dem
PossANonP N Dem	PossANonP N.L1 Dem.L2	N Adj Dem	N.L2 Adj.L2 Dem
PossANonP N Dem	PossANonP N.L1 Dem.L2	PossINonP N Dem	PossINonP N.L1 Dem.L2
PossANonP N Dem	PossANonP N.L1 Dem.L2	N PossAP Dem	N PossAP Dem.L
PossANonP N Dem	PossANonP N.L1 Dem.L2	PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem.L3
PossINonP N Dem	PossINonP N.L12 Dem	N PossAP	N PossAP
PossINonP N Dem	PossINonP N.L12 Dem	N Num	N Num
PossINonP N Dem	PossINonP N.L12 Dem	PossANonP N Dem	PossANonP N.L12 Dem
PossINonP N Dem	PossINonP N.L12 Dem	PossANonP N Adj Dem	PossANonP N.L13 Adj.L13 Dem
PossINonP N Dem	PossINonP N Dem	PossNonP N	PossNonP N
PossINonP N Dem	PossINonP N Dem	PossIP N	PossIP N
PossINonP N Dem	PossINonP N Dem	N PossAP	N PossAP
PossINonP N Dem	PossINonP N Dem	N Num	N Num
PossINonP N Dem	PossINonP N Dem	N Dem	N Dem
PossINonP N Dem	PossINonP N Dem	N Num Dem	N Num Dem
PossINonP N Dem	PossINonP N Dem	PossANonP N Dem	PossANonP N Dem
PossINonP N Dem	PossINonP N Dem	PossIP N Dem	PossIP N Dem
PossINonP N Dem	PossINonP N Dem	N PossAP Dem	N PossAP Dem
PossINonP N Dem	PossINonP N Dem	PossIP N Num	PossIP N Num
PossINonP N Dem	PossINonP N.L1 Dem	PossNonP N	PossNonP N.L
PossINonP N Dem	PossINonP N.L1 Dem	PossIP N	PossIP N.HL
PossINonP N Dem	PossINonP N.L1 Dem	N PossAP	N PossAP
PossINonP N Dem	PossINonP N.L1 Dem	N Num	N Num
PossINonP N Dem	PossINonP N.L1 Dem	PossANonP N Adj	PossANonP N.L1 Adj.L1
PossINonP N Dem	PossINonP N.L1 Dem	PossANonP N Dem	PossANonP N.L1 Dem
PossINonP N Dem	PossINonP N.L1 Dem	PossANonP N Num	PossANonP N.L1 Num.L1
PossINonP N Dem	PossINonP N.L1 Dem	PossIP N Num	PossIP N.HL Num
PossINonP N Dem	PossINonP N.L2 Dem	N PossAP	N PossAP
PossINonP N Dem	PossINonP N.L2 Dem	N Num	N Num
PossINonP N Dem	PossINonP N.L2 Dem	N Dem	N.L Dem
PossINonP N Dem	PossINonP N.L2 Dem	N Adj Dem	N.L2 Adj.L2 Dem
PossINonP N Dem	PossINonP N.L2 Dem	N Num Dem	N.L Num.L Dem
PossINonP N Dem	PossINonP N.L2 Dem	PossANonP N Dem	PossANonP N.L2 Dem
PossINonP N Dem	PossINonP N.L2 Dem	PossANonP N Adj Dem	PossANonP N.L3 Adj.L3 Dem

PossINonP N Dem	PossINonP.L2 N.L2 Dem	N PossAP	N PossAP
PossINonP N Dem	PossINonP.L2 N.L2 Dem	N Num	N Num
PossINonP N Dem	PossINonP.L2 N.L2 Dem	N Dem	N.L Dem
PossINonP N Dem	PossINonP.L2 N.L2 Dem	N Adj Dem	N.L2 Adj.L2 Dem
PossINonP N Dem	PossINonP.L2 N.L2 Dem	PossANonP N Dem	PossANonP.L2 N.L2 Dem
PossINonP N Dem	PossINonP.L2 N.L2 Dem	PossIP N Dem	PossIP.L2 N.L2 Dem
PossINonP N Dem	PossINonP.L2 N.L2 Dem	PossANonP N Adj Dem	PossANonP.L3 N.L3 Adj.L3 Dem
PossINonP N Dem	PossINonP.L2 N.L2 Dem	PossIP N Adj Dem	PossIP.L3 N.L3 Adj.L3 Dem
PossINonP N Dem	PossINonP N.L1 Dem.L2	N PossAP	N PossAP
PossINonP N Dem	PossINonP N.L1 Dem.L2	N Num	N Num
PossINonP N Dem	PossINonP N.L1 Dem.L2	N Dem	N.L Dem
PossINonP N Dem	PossINonP N.L1 Dem.L2	N Adj Dem	N.L2 Adj.L2 Dem
PossINonP N Dem	PossINonP N.L1 Dem.L2	PossANonP N Dem	PossANonP N.L1 Dem.L2
PossINonP N Dem	PossINonP N.L1 Dem.L2	N PossAP Dem	N PossAP Dem.L
PossINonP N Dem	PossINonP N.L1 Dem.L2	PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem.L3
PossIP N Dem	PossIP N.L2 Dem	N PossAP	N PossAP
PossIP N Dem	PossIP N.L2 Dem	N Num	N Num
PossIP N Dem	PossIP N.L2 Dem	N Dem	N.L Dem
PossIP N Dem	PossIP N.L2 Dem	N Adj Dem	N.L2 Adj.L2 Dem
PossIP N Dem	PossIP N.L2 Dem	N Num Dem	N.L Num.L Dem
PossIP N Dem	PossIP N.L2 Dem	PossIP N Adj Dem	PossIP N.L3 Adj.L3 Dem
PossIP N Dem	PossIP N Dem	PossNonP N	PossNonP N
PossIP N Dem	PossIP N Dem	PossIP N	PossIP N
PossIP N Dem	PossIP N Dem	N PossAP	N PossAP
PossIP N Dem	PossIP N Dem	N Num	N Num
PossIP N Dem	PossIP N Dem	N Dem	N Dem
PossIP N Dem	PossIP N Dem	N Num Dem	N Num Dem
PossIP N Dem	PossIP N Dem	PossANonP N Dem	PossANonP N Dem
PossIP N Dem	PossIP N Dem	PossINonP N Dem	PossINonP N Dem
PossIP N Dem	PossIP N Dem	N PossAP Dem	N PossAP Dem
PossIP N Dem	PossIP N Dem	PossIP N Num	PossIP N Num

PossIP N Dem	PossIP N.HL Dem	PossNonP N	PossNonP N.L
PossIP N Dem	PossIP N.HL Dem	PossIP N	PossIP N.HL
PossIP N Dem	PossIP N.HL Dem	N PossAP	N PossAP
PossIP N Dem	PossIP N.HL Dem	N Num	N Num
PossIP N Dem	PossIP N.HL Dem	PossANonP N Adj	PossANonP N.L1 Adj.L1
PossIP N Dem	PossIP N.HL Dem	PossANonP N Num	PossANonP N.L1 Num.L1
PossIP N Dem	PossIP N.HL Dem	PossIP N Num	PossIP N.HL Num
PossIP N Dem	PossIP N.HL Dem.L2	N PossAP	N PossAP
PossIP N Dem	PossIP N.HL Dem.L2	N Num	N Num
PossIP N Dem	PossIP N.HL Dem.L2	N Dem	N.L Dem
PossIP N Dem	PossIP N.HL Dem.L2	N Adj Dem	N.L2 Adj.L2 Dem
PossIP N Dem	PossIP N.HL Dem.L2	PossANonP N Dem	PossANonP N.L1 Dem.L2
PossIP N Dem	PossIP N.HL Dem.L2	PossINonP N Dem	PossINonP N.L1 Dem.L2
PossIP N Dem	PossIP N.HL Dem.L2	N PossAP Dem	N PossAP Dem.L
PossIP N Dem	PossIP N.HL Dem.L2	PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem.L3
PossIP N Dem	PossIP N.HL Dem.L2	PossIP N Adj Dem	PossIP N.HL1 Adj.L2 Dem.L3
PossIP N Dem	PossIP.L2 N.L2 Dem	N PossAP	N PossAP
PossIP N Dem	PossIP.L2 N.L2 Dem	N Num	N Num
PossIP N Dem	PossIP.L2 N.L2 Dem	N Dem	N.L Dem
PossIP N Dem	PossIP.L2 N.L2 Dem	N Adj Dem	N.L2 Adj.L2 Dem
PossIP N Dem	PossIP.L2 N.L2 Dem	PossIP N Adj Dem	PossIP.L3 N.L3 Adj.L3 Dem
N PossAP Dem	N.L PossAP Dem	N PossAP	N PossAP
N PossAP Dem	N.L PossAP Dem	N Num	N Num
N PossAP Dem	N.L PossAP Dem	N Dem	N.L Dem
N PossAP Dem	N.L PossAP Dem	N Adj Dem	N.L2 Adj.L2 Dem
N PossAP Dem	N.L PossAP Dem	N Num Dem	N.L Num.L Dem
N PossAP Dem	N PossAP Dem	N PossAP	N PossAP
N PossAP Dem	N PossAP Dem	N Num	N Num
N PossAP Dem	N PossAP Dem.L	N PossAP	N PossAP
N PossAP Dem	N PossAP Dem.L	N Num	N Num
N PossAP Dem	N PossAP Dem.L	N Dem	N.L Dem
N PossAP Dem	N PossAP Dem.L	N Adj Dem	N.L2 Adj.L2 Dem

N PossAP Dem	N.L PossAP.L Dem	N PossAP	N PossAP
N PossAP Dem	N.L PossAP.L Dem	N Num	N Num
N PossAP Dem	N.L PossAP.L Dem	N Dem	N.L Dem
N PossAP Dem	N.L PossAP.L Dem	N Adj Dem	N.L2 Adj.L2 Dem
N PossAP Dem	N.L PossAP.L Dem	N Num Dem	N.L Num.L Dem
N PossAP Dem	N.L PossAP.L Dem	PossANonP N Dem	PossANonP.L2 N.L2 Dem
N PossAP Dem	N.L PossAP.L Dem	PossINonP N Dem	PossINonP.L2 N.L2 Dem
N PossAP Dem	N.L PossAP.L Dem	PossIP N Dem	PossIP.L2 N.L2 Dem
N PossAP Dem	N.L PossAP.L Dem	PossANonP N Adj Dem	PossANonP.L3 N.L3 Adj.L3 Dem
N PossAP Dem	N.L PossAP.L Dem	PossINonP N Adj Dem	PossINonP.L3 N.L3 Adj.L3 Dem
N PossAP Dem	N.L PossAP.L Dem	PossIP N Adj Dem	PossIP.L3 N.L3 Adj.L3 Dem
PossANonP N Num	PossANonP N.L1 Num.L1	PossNonP N	PossNonP N.L
PossANonP N Num	PossANonP N.L1 Num.L1	PossIP N	PossIP N.HL
PossANonP N Num	PossANonP N.L1 Num.L1	N PossAP	N PossAP
PossANonP N Num	PossANonP N.L1 Num.L1	N Num	N Num
PossANonP N Num	PossANonP N.L1 Num.L1	PossANonP N Adj	PossANonP N.L1 Adj.L1
PossANonP N Num	PossANonP N.L1 Num.L1	PossIP N Num	PossIP N.HL Num
PossANonP N Num	PossANonP N Num	PossNonP N	PossNonP N
PossANonP N Num	PossANonP N Num	PossIP N	PossIP N
PossANonP N Num	PossANonP N Num	N PossAP	N PossAP
PossANonP N Num	PossANonP N Num	N Num	N Num
PossANonP N Num	PossANonP N Num	PossINonP N Num	PossINonP N Num
PossANonP N Num	PossANonP N Num	PossIP N Num	PossIP N Num
PossANonP N Num	PossANonP N.L2 Num	PossNonP N	PossNonP N
PossANonP N Num	PossANonP N.L2 Num	PossIP N	PossIP N
PossANonP N Num	PossANonP N.L2 Num	N PossAP	N PossAP
PossANonP N Num	PossANonP N.L2 Num	N Num	N Num
PossANonP N Num	PossANonP N.L2 Num	PossIP N Num	PossIP N Num
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PossANonP N Num	PossANonP N.L12 Num	N PossAP	N PossAP
PossANonP N Num	PossANonP N.L12 Num	N Num	N Num
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PossINonP N Num	PossINonP N.L1 Num	N PossAP	N PossAP
PossINonP N Num	PossINonP N.L1 Num	N Num	N Num
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PossINonP N Num	PossINonP N.L1 Num	PossANonP N Num	PossANonP N.L1 Num.L1
PossINonP N Num	PossINonP N.L1 Num	PossIP N Num	PossIP N.HL Num
PossINonP N Num	PossINonP N Num	PossNonP N	PossNonP N
PossINonP N Num	PossINonP N Num	PossIP N	PossIP N
PossINonP N Num	PossINonP N Num	N PossAP	N PossAP
PossINonP N Num	PossINonP N Num	N Num	N Num
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PossINonP N Num	PossINonP N Num	PossIP N Num	PossIP N Num
PossINonP N Num	PossINonP N.L2 Num	N PossAP	N PossAP
PossINonP N Num	PossINonP N.L2 Num	N Num	N Num
PossINonP N Num	PossINonP N.L12 Num	N PossAP	N PossAP
PossINonP N Num	PossINonP N.L12 Num	N Num	N Num
PossINonP N Num	PossINonP N.L1 Num.L2	N PossAP	N PossAP
PossINonP N Num	PossINonP N.L1 Num.L2	N Num	N Num
PossINonP N Num	PossINonP.L2 N.L2 Num	N PossAP	N PossAP
PossINonP N Num	PossINonP.L2 N.L2 Num	N Num	N Num
PossIP N Num	PossIP N.HL Num	PossNonP N	PossNonP N.L
PossIP N Num	PossIP N.HL Num	PossIP N	PossIP N.HL
PossIP N Num	PossIP N.HL Num	N PossAP	N PossAP
PossIP N Num	PossIP N.HL Num	N Num	N Num
PossIP N Num	PossIP N.HL Num	PossANonP N Adj	PossANonP N.L1 Adj.L1
PossIP N Num	PossIP N.HL Num	PossANonP N Num	PossANonP N.L1 Num.L1
PossIP N Num	PossIP N Num	PossNonP N	PossNonP N
PossIP N Num	PossIP N Num	PossIP N	PossIP N
PossIP N Num	PossIP N Num	N PossAP	N PossAP
PossIP N Num	PossIP N Num	N Num	N Num

N Adj Num	N.L Adj Num	N PossAP	N PossAP
N Adj Num	N.L Adj Num	N Adj	N.L Adj
N Adj Num	N.L Adj Num	N Adj Adj	N.L2 Adj.L2 Adj
N Adj Num	N.L Adj Num	N Num	N Num
N Adj Num	N.L Adj Num	N Adj PossAP	N.L Adj PossAP
N Adj Num	N Adj Num	N PossAP	N PossAP
N Adj Num	N Adj Num	N Adj	N Adj
N Adj Num	N Adj Num	N Adj Adj	N Adj Adj
N Adj Num	N Adj Num	N Num	N Num
N Adj Num	N Adj Num	N Adj PossAP	N Adj PossAP
N Adj Num	N Adj Num	N PossAP Adj	N PossAP Adj
PossANonP N Adj Dem	PossANonP N.L13 Adj.L13 Dem	N PossAP	N PossAP
PossANonP N Adj Dem	PossANonP N.L13 Adj.L13 Dem	N Num	N Num
PossANonP N Adj Dem	PossANonP N.L13 Adj.L13 Dem	PossANonP N Dem	PossANonP N.L12 Dem
PossANonP N Adj Dem	PossANonP N.L13 Adj.L13 Dem	PossINonP N Dem	PossINonP N.L12 Dem
PossANonP N Adj Dem	PossANonP N Adj Dem	PossNonP N	PossNonP N
PossANonP N Adj Dem	PossANonP N Adj Dem	PossIP N	PossIP N
PossANonP N Adj Dem	PossANonP N Adj Dem	N PossAP	N PossAP
PossANonP N Adj Dem	PossANonP N Adj Dem	N Adj	N Adj
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PossANonP N Adj Dem	PossANonP N Adj Dem	N Num	N Num
PossANonP N Adj Dem	PossANonP N Adj Dem	N Dem	N Dem
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PossANonP N Adj Dem	PossANonP N Adj Dem	N Num Dem	N Num Dem
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PossANonP N Adj Dem	PossANonP N Adj Dem	PossINonP N Adj	PossINonP N Adj
PossANonP N Adj Dem	PossANonP N Adj Dem	PossIP N Adj	PossIP N Adj
PossANonP N Adj Dem	PossANonP N Adj Dem	N Adj PossAP	N Adj PossAP
PossANonP N Adj Dem	PossANonP N Adj Dem	N PossAP Adj	N PossAP Adj
PossANonP N Adj Dem	PossANonP N Adj Dem	PossANonP N Dem	PossANonP N Dem
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PossANonP N Adj Dem	PossANonP N Adj Dem	N PossAP Dem	N PossAP Dem
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PossANonP N Adj Dem	PossANonP N Adj Dem	N Adj Num	N Adj Num
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PossANonP N Adj Dem	PossANonP N Adj Dem	PossIP N Adj Dem	PossIP N Adj Dem

PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	PossNonP N	PossNonP N
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	PossIP N	PossIP N
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	N PossAP	N PossAP
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	N Adj	N.L Adj
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	N Adj Adj	N.L2 Adj.L2 Adj
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	N Num	N Num
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PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	N Adj Dem	N.L1 Adj Dem
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	N Num Dem	N Num Dem
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	PossANonP N Adj	PossANonP N.L2 Adj
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	N Adj PossAP	N.L Adj PossAP
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	PossANonP N Dem	PossANonP N Dem
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	PossINonP N Dem	PossINonP N Dem
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	PossIP N Dem	PossIP N Dem
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	N PossAP Dem	N PossAP Dem
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	PossIP N Num	PossIP N Num
PossANonP N Adj Dem	PossANonP N.L2 Adj Dem	N Adj Num	N.L Adj Num
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PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem	PossNonP N	PossNonP N.L
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem	PossIP N	PossIP N.HL
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem	N PossAP	N PossAP
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem	N Num	N Num
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem	PossANonP N Adj	PossANonP N.L1 Adj.L1
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem	PossANonP N Dem	PossANonP N.L1 Dem
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem	PossINonP N Dem	PossINonP N.L1 Dem
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem	PossANonP N Num	PossANonP N.L1 Num.L1
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem	PossIP N Num	PossIP N.HL Num
PossANonP N Adj Dem	PossANonP N.L3 Adj.L3 Dem	N PossAP	N PossAP
PossANonP N Adj Dem	PossANonP N.L3 Adj.L3 Dem	N Num	N Num
PossANonP N Adj Dem	PossANonP N.L3 Adj.L3 Dem	N Dem	N.L Dem
PossANonP N Adj Dem	PossANonP N.L3 Adj.L3 Dem	N Adj Dem	N.L2 Adj.L2 Dem
PossANonP N Adj Dem	PossANonP N.L3 Adj.L3 Dem	N Num Dem	N.L Num.L Dem
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PossANonP N Adj Dem	PossANonP N.L3 Adj.L3 Dem	PossINonP N Dem	PossINonP N.L2 Dem

PossANonP N Adj Dem	PossANonP.L3 N.L3 Adj.L3 Dem	N PossAP	N PossAP
PossANonP N Adj Dem	PossANonP.L3 N.L3 Adj.L3 Dem	N Num	N Num
PossANonP N Adj Dem	PossANonP.L3 N.L3 Adj.L3 Dem	N Dem	N.L Dem
PossANonP N Adj Dem	PossANonP.L3 N.L3 Adj.L3 Dem	N Adj Dem	N.L2 Adj.L2 Dem
PossANonP N Adj Dem	PossANonP.L3 N.L3 Adj.L3 Dem	PossANonP N Dem	PossANonP.L2 N.L2 Dem
PossANonP N Adj Dem	PossANonP.L3 N.L3 Adj.L3 Dem	PossINonP N Dem	PossINonP.L2 N.L2 Dem
PossANonP N Adj Dem	PossANonP.L3 N.L3 Adj.L3 Dem	PossIP N Dem	PossIP.L2 N.L2 Dem
PossANonP N Adj Dem	PossANonP.L3 N.L3 Adj.L3 Dem	PossIP N Adj Dem	PossIP.L3 N.L3 Adj.L3 Dem
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem.L3	N PossAP	N PossAP
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem.L3	N Num	N Num
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem.L3	N Dem	N.L Dem
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem.L3	N Adj Dem	N.L2 Adj.L2 Dem
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem.L3	PossANonP N Dem	PossANonP N.L1 Dem.L2
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem.L3	PossINonP N Dem	PossINonP N.L1 Dem.L2
PossANonP N Adj Dem	PossANonP N.L1 Adj.L1 Dem.L3	N PossAP Dem	N PossAP Dem.L
PossANonP N Adj Dem	PossANonP N.L123 Adj Dem	PossNonP N	PossNonP N
PossANonP N Adj Dem	PossANonP N.L123 Adj Dem	PossIP N	PossIP N
PossANonP N Adj Dem	PossANonP N.L123 Adj Dem	N PossAP	N PossAP
PossANonP N Adj Dem	PossANonP N.L123 Adj Dem	N Adj	N.L Adj
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