Morphology without morphemes: Scalar shift as an argument in favor of process morphology [*]

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1 Introduction

This talk addresses the underlying representation of tonal morphemes, with a specific look at scalar tone shift in Guébie (Kru) [Côte d'Ivoire].

Phenomenon: A scalar tone shift is triggered in imperfective contexts in Guébie.

- The result is tone lowering of the verb, or tone raising of the subject.

(1) **Subject tone raises when the verb is already low**

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

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

c. ɛ^{3} ɓɔ^{1}
3SG.NOM wither.PFV
'It withered'

d. ɛ^{4} ɓɔ^{1}
3SG.NOM wither.IPFV
'It withers'

- This data, and the data presented throughout this talk, comes from three years of original work on Guébie, including three field trips to Gnagbodougnoa, Côte d'Ivoire.

Question: What underlying representation of the imperfective tonal morpheme could result in surface lowering sometimes, but raising other times?

Preview of findings: I demonstrate that the Guébie imperfective aspect is best modeled without an underlying segmental or suprasegmental representation.

- Instead, a process or set of constraints results in a morphophonological shift.

Implications: The data presented here bears on the distinction between a process solely triggered by an underlying morpheme versus a process solely caused by morphologically sensitive constraints (cf. Anderson (1992)).

[*]Thanks to my Guébie consultants Sylvain Bodji, Olivier Agodio, Serikpa Emil, and Gnakouri. Thanks also to Sharon Inkelas, Larry Hyman, Peter Jenks, Darya Kavitskaya, and audiences at UC Berkeley, UC Santa Cruz, and NELS 46 for comments on various versions of this work. I use the following abbreviations: SG = singular, PL = plural, IPFV = imperfective, PFV = perfective, IRR = irrealis, NOM = nominative, ACC = accusative, Q = polar question particle, 1 = first person, 2 = second person, 3 = third person.

2 Guébie scalar tone shift

- Guébie is a tonal language with four distinct tone heights, marked here with numbers 1-4 where 4 is high.
- Word order alternates between SAuxOV and SVO.
  - When auxiliaries are present, there is no inflection on verbs.
  - When there is no auxiliary, the verb surfaces immediately after the subject.
  - Nothing can ever intervene between subject and auxiliary or subject and inflected verb.
- A given verb shows the same tone melody in all contexts but the imperfective, (2).

(2) **Default tone constructions**

a. *SAuxOV*

e^{4} ji^{3} ɟa^{31} li^{3}
1SG.NOM FUT coconuts eat

'I will eat a coconut.'

b. *Imperative*

li^{3}
eat.IMP

'Eat!'

c. *Perfective*

e^{4} li^{3} ɟa-ɓe$^{3.1}$ kubə$^{3.1}$
1SG.NOM eat.PFV coconuts-SG yesterday

'I ate a coconut yesterday.'

- In imperfective contexts (SVO), tone on the verb surfaces one step lower on the four-height tone scale, (3).

(3) **Tone one step below default in imperfective contexts**

Imperfective

e^{4} li^{2} ɟa^{31} koko$^{4.4}$
1SG.NOM eat.IPFV coconuts everyday

'I eat coconuts everyday.'

- Only the first tone level of a verb is affected by the tone lowering process, (4, 5).

(4) **Only the first syllable lowers**

a. ju^{4} gbala$^{3.4}$ si^{3}
boy climb.PFV trees

'A boy climbed trees'

b. ju^{4} gbala$^{2.4}$ si^{3}
boy climb.IPFV trees

'A boy climbs trees'

(5) **Only the first tone of a contour lowers**

a. ɟaci$^{23.1}$ pa^{31} gɔlɔ$^{3.3}$
Jachi flip.PFV boat

'Jachi flipped the boat.'

b. ɟaci$^{23.1}$ pa^{21} gɔlɔ$^{3.3}$
Jachi flip.IPFV boat

'Jachi flips the boat.'

(6) **The OCP effect at play in Guébie scalar tone shift**

a. a^{2} ka^{3} dibo-ə$^{3.1.2}$ bala$^{2.2}$
1PL.NOM IRR plantain-PL harvest

'We would harvest plantains'

b. a^{2} bala$^{1.1}$ dibo-ə$^{3.1.2}$
1PL.NOM harvest.IPFV plantain-PL
trans 'We harvest plantains'

- We can restate this shift by saying that the first tone level of a verbal tone melody surfaces one step lower in imperfective contexts than other contexts.

(7) **Imperfective scalar tone shift**

Default tone	≫	**Imperfective tone**
4		3
3		2
2		1
1		1

- Verbs with low tone in non-imperfective contexts do not lower to super-low tone, 0, in the imperfective.
- But, we do not see complete neutralization between perfective and imperfective contexts either.
- Instead, contrast between perfective and imperfective verbs is maintained by raising the final tone of the subject when the verb is already low, (8).

(8) **Contrast for low-toned verbs maintained by raising the preceding tone**

a. ɛ^{3} ɓɔ^{1}
3SG.NOM wither.PFV

'It withered'

b. ɛ^{4} ɓɔ^{1}
3SG.NOM wither.IPFV

'It withers'

c. ɟaci$^{23.1}$ pa^{1}
Djatchi runPFV

'Djatchi ran'

d. ɟaci$^{23.2}$ pa^{1}
Djatchi run.IPFV

'Djatchi runs'

e. [ju^{4} e^{4} ji^{2} ne^{2}] pa^{1}
boy I know REL run.PFV
'The boy that I know ran.'

f. [ju^{4} e^{4} ji^{2} ne^{3}] pa^{1}
boy I know REL run.IPFV
'The boy that I know runs.'

- This subject raising occurs even when the result is a super-high tone, tone 5, which is not found elsewhere in the language, (9).

(9) **Contrast is maintained even when it results in a super-high tone**

a. e^{4} pa^{1}
1SG.NOM run.PFV
'I ran'

b. e^{5} pa^{1}
1SG.NOM run.IPFV
'I run'

- This tonal shift affects the difference in tone height between the subject and verb, where the difference increases by one between the perfective and imperfective.
  - Such a scalar shift is as yet unattested in other languages (Mortensen 2006).
  - This consistent tone change is represented in (10), where FST stands for Final Subject Tone, and IVT stands for Initial Verb Tone. *n* represents some number, namely, the difference between subject and verb tone in perfective contexts.

(10) **Consistent arithmetic relationship between perfective and imperfective**

Perfective	**Imperfective**
FST - IVT = n	FST - IVT = n + 1

- **Data summary**: The first tone height of a verb surfaces one step lower in the imperfective than elsewhere, unless the verb is already low, in which case the final subject tone raises one step in the imperfective.

3 Possible piece-based analyses

- To model the scalar tone shift in Guébie, we can begin by asking the following:

  Question: What is the underlying phonological representation of the imperfective morpheme in Guébie?

- In other words, what drives the scalar tone shift?
  - Floating feature(s)
  - Floating tone
  - Downstep
- I demonstrate that commonly used tonal underlying representations such as those listed above cannot adequately account for the Guébie data.

3.1 A featural account

- Many analyses of morphologically conditioned tone changes involve feature affixation (cf. Trommer and Zimmerman (2015)).
- However, we will see that feature affixation fails to account for the Guébie data because there is no single feature that will get us lowering one step in every case (and raising when lowering is impossible).
- Three previously proposed sets of binary features for four-tone systems are shown in (11).

(11) **Proposed features for 4-tone systems** (adapted from Hyman 2010, 57)

Yip (1980)[1]	4	3	2	1
Upper	+	+	-	-
High	+	-	+	-

Clements (1983)[2]	4	3	2	1
Feature 1	H	H	L	L
Feature 2	H	L	H	L

Bao (1999)	4	3	2	1
Stiff	+	+	-	-
Slack	-	+	-	+

- If we assume that the scalar tone shift in Guébie is a unitary process, we expect a unitary featural change between each step of the four-tone scale.
- Such a unitary change is not possible given the above featural specifications.
  - While there is a single featural difference between tones 4 and 3 and tones 2 and 1, tone 3 differs from tone 2 in two features (for example, both Upper and High for Yip (1980)).
  - The natural classes captured by the above featural specifications are (4,3), (2,1), (4,2), and (3,1), but never (3,2) (Hyman 2010).
- We cannot add or change a single consistent feature in an imperfective environment with the result of uniform verb tone lowering.
- See Contreras (1969) for perhaps the first generative discussion of why gradient processes are problematic for binary features, and see Hyman (2010) for a more recent discussion.
- I conclude that the evidence in favor of a featural representation of scalar tone is not very strong, not only for Guébie, but across languages (Contreras 1969; Hyman 2010).

3.2 A floating tone account

- Rather than treating the phonological content of the imperfective morpheme in Guébie as a tonal feature, we could say that there is a floating tone.
- To address a floating tone analysis, we must know a bit more about the tonal inventory of Guébie.
- All of the following underlying tone melodies are possible on monomorphemic items in Guébie:

(12) **Guébie underlying tone melodies**

Level	**Falling**	**Rising**
4	41	
3	42	24
2	31	13
1	32	23

- Though all of the above melodies exist in Guébie, but none of them ever results in scalar tone shift.
- If the imperfective is a floating tone with one of the above melodies, that particular melody must have a scalar effect only in this one environment.

- Given the inventory of four level tones in Guébie, there are a few predicted tonal contours that do not exist underlyingly:

(13) **Unattested underlying tone melodies in Guébie**[3]

Falling	Rising
43	34
21	12
	14

- We could say that one of these tones is the underlying form of the imperfective.
  - This tone would lower the following verb tone sometimes, and raise the preceding subject tones other times.
  - However, tones in Guébie tend to act as a series of level tones, rather than as contour or melodic units.
    - So, a 14 floating tone, for example, would raise the preceding tone as long as it has not lowered the following tone. However, neither a level 1 or 4 elsewhere has this effect.
- No matter which tone we choose to posit as the underlying tone, we have to say the same thing about the phonological process that it triggers:
  - Floating tone X lowers the following tone level one step.
  - If the following tone is already low (tone 1), tone X does not lower it further.
  - Instead, tone X then affects the preceding tone, raising it one step.
- It seems arbitrary, then, to choose one particular floating tone level (or contour) over another, since we have no evidence for a single tone level in that position, only for a scalar tonal process that sometimes affects the verb and other times the subject.
- I conclude that a floating tone analysis should be a last resort for Guébie scalar tone, since it involves a level of phonological abstraction that we have no evidence for, and we must state the tonal change as a process whether or not we posit a floating tone.

3.3 A brief look into a downstep account

- Downstep is a tonal phenomenon which lowers a given tone in particular contexts, often following another similar tone.

(14) **Downstepped consecutive high tones in Dafing (Mande)** (Peter Jenks, personal notes)

wúrú-ꜜú ꜜní ʃwó-ꜜó ɲìmì zònà-zònà
dog-DEF PFV meat-DEF eat quickly
'The dog ate the meat quickly.'

- Downstep has been analyzed in terms of features and floating level tones (cf. Anderson 1978; Hyman 1993, 2010).
- One benefit of a downstep analysis is that downstep is often preceded by anticipatory raising (see, for example, Laniran and Clements (2003) on high-tone raising in anticipation of downstep in Yoruba).

[3] The 21, 12, and 14 tonal melodies are possible in derived contexts.

- Under such an analysis, we could say that verbal tone lowering in imperfective contexts is actually the result of downstep.

  (15) Subject + $^{\downarrow}$ + Verb → Subject $^{\downarrow}$Verb

- Additionally, we could say that downstep is always preceded by anticipatory raising in Guébie.

  (16) Subject$^{\uparrow}$ $^{\downarrow}$Verb

- When the verbal tone cannot lower to super-low, the only remaining cue of the imperfective downstep is the raised subject tone.

  (17) Subject$^{\uparrow}$ Verb

- This analysis makes a clear prediction: There should be anticipatory raising of the final tone of the subject in *all* imperfective clauses, not just when the verbal tone fails to lower, (17).
  - Initial acoustic examination fails to show such an effect, suggesting that the Guébie imperfective scalar shift is not, in fact, downstep with anticipatory raising.
- No matter what underlying form the downstep analysis takes, and no matter whether it results in anticipatory raising, we still need a set of rules or constraints resulting in verb lowering and subject raising in the appropriate contexts.

3.4 Summarizing piece-based analyses

- The downfall of each piece-based analyses we have seen is this:
  - No matter what phonological representation we choose for the imperfective morpheme, we must still state the facts of the scalar tone shift with rules or constraints.
  - These rules or constraints then are doing all of the work, and the underlying form of the imperfective morpheme is irrelevant.
  - Other piece-based analyses have the same downfall: Autosegmental Phonology (Goldsmith 1976), Dynamic Tone Theory (Clark 1978), Particle Phonology (Schane 1984) and others.
- I conclude that there is no best underlying representation of the imperfective morpheme in Guébie; instead, a scalar *process* is triggered in imperfective environments.

4 Process morphology in a constraint-based account

- Here I propose a constraint-based model of phonology whose input includes phonological strings and morphosyntactic features that are the output of morphology[4].
- This model relies on morpheme-specific grammars of constraint evaluation as per Cophonology Thoery (Itô and Mester 1995; Anttila 2002; Inkelas and Zoll 2005).

[4]Note that in this model, morphosyntactic features are preserved through morphology, including Linearization, and are available to the phonology (cf. Gribanova and Harizanov 2015; Winchester 2016; contra Halle 1990; Bobaljik 2000).

Constraint-based analysis:

- Here I follow Cophonology Theory in saying that languages have multiple morpheme-specific phonological grammars.
  - If the phase being evaluated contains a morpheme for which there is a morpheme-specific phonological grammar, that grammar applies, as in the Guébie imperfective.
  - Otherwise, the 'elsewhere' phonological grammar applies, as in the Guébie perfective.
- The phonological constraints specific to the imperfective and elsewhere cophonologies are what determine the tonal difference between perfective and imperfective forms in Guébie ([e^4 li^3] vs [e^4 li^2]).
- Crucial to the analysis of Guébie scalar tone shift is that despite input similarity, imperfective and perfective subject-verb strings must differ in tone in the output.
  - Thus, there must be a constraint which motivates a difference between input and output tone in the imperfective cophonology.
  - I propose the use of Transderivational Antifaithfulness (Alderete 2001), which assumes that every faithfulness constraint has a converse antifaithfulness constraint[5].

(18) **¬ID-TONE**
Assign one violation if the tone pattern of the candidate in question is identical to the tone of the input.

- With ¬ID-TONE active in the imperfective-specific grammar, candidates whose tone melody differs from the input (and thus from the optimal elsewhere (perfective) grammar candidate) will be preferred.
- Along with the antifaithfulness constraint ¬ID-TONE, we need a corresponding faithfulness constraint.
  - This identity constraint must be defined in a scalar manner, where the further along the scale an output element is from the original input, the more violations are incurred (cf. Kirchner 1997).

(19) **ID-TONE**
Assign one violation for each step on the tone scale that an output tone differs from its corresponding input tone.

- The following tableau shows the ranking of the antifaithfulness and corresponding faithfulness constraint in the imperfective grammar. I set aside discussion of the elsewhere grammar for now.

(20) **¬ID-TONE ≫ ID-TONE**

e^4 li$^3_{ipfv}$	¬ID-TONE	ID-TONE
a. ☞e^4 li^2		*
b. e^4 li^3	*!	
c. e^4 li^1		**!

- Candidates must consist of both subject and verb, because the imperfective scalar tone shift can affect subject or verb tone (8, 9).

[5]The faithfulness and antifaithfulness constraints used here are theoretically equivalent to Mortensen (2006)'s scalar identity and anti-identity constraints, and to Kurisu (2001)'s definition of REALIZEMORPHEME.

- For this reason I evaluate multiword candidates of subject and verb together.
  - Support for the subject and verb being simultaneously evaluated in the phonology comes from the fact that they are in the same spellout domain (phase) (Marvin 2002; Embick 2010).
  - In Distributed Morphology (Halle and Marantz 1993, 1994) there is no distinction between words and phrases, so if we assume a DM-based morphological component, there is no need to treat inflectional paradigms within words differently from those that span words within a syntactic phase.
- While the above constraints get us the unfaithful candidate in the imperfective, there are four possible ways in which a multiword candidate could satisfy the ¬ID-Tone constraint, but only two are attested in Guébie:

(21) **Options for tone antifaithfulness**

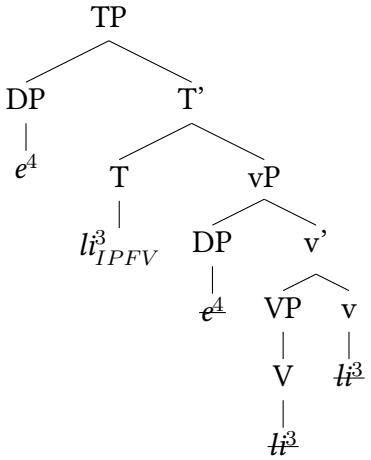
	Raising	**Lowering**
Subject	✓	-
Verb	-	✓

- We need to ensure tone lowering on the verb and tone raising on the subject, each in the right context, and avoid verb tone raising and subject tone lowering.

(22) **PitchDrop** (adapted from Mortensen 2006[6])
Assign one violation if the juncture between a DP immediately preceding T is not associated with more of a pitch drop in the output than in the input.

- The above constraint refers to hierarchical structure (or to morphosytnactic features, if every terminal node bears a feature equivalent to its label).
- The hierarchical structure relevant for Guébie is given in (23).

(23) **The hierarchical structure of an imperfective construction** (adapted from Sande In Press)



- To ensure verb lowering is preferred to subject raising, ID-Noun is proposed. Such a constraint is motivated by a general category difference between nouns and verbs across languages (Smith 2011).

(24) **ID-Noun**
Assign one violation for every output element that differs between an output noun and its corresponding input.

[6]This single constraint could be replaced by Mortensen's (2006) NoHigher and Higher constraints, which account for scalar processes across languages.

(25) **¬ID-Tone ≫ ID-Tone, PitchDrop ≫ ID-Noun**

$e^4\ li^3_{ipfv}$	¬ID-Tone	ID-Tone	PitchDrop	ID-Noun
a. $e^4\ li^3$	*!		*	
b. ☞$e^4\ li^2$		*		
c. $e^4\ li^1$		**!		
d. $e^4\ li^4$		*	*!	
e. $e^3\ li^3$		*	*!	*
f. $e^5\ li^3$		*		*!

- The above ranking accounts for those cases where the verb has input tone higher than 1; however, these constraints are not enough to account for cases of subject tone raising when the verb is already low.

(26) **¬ID-Tone ≫ ID-Tone, PitchDrop ≫ ID-Noun**

$e^4\ pa^1_{ipfv}$	¬ID-Tone	ID-Tone	PitchDrop	ID-Noun
a. $e^4\ pa^1$	*!		*	
b. ☹ $e^4\ pa^0$		*		
c. $e^4\ pa^2$		*	*!	
d. $e^3\ pa^1$		*	*!	*
e. $e^5\ pa^1$		*		*!

- In order to ensure that candidate b in (26) does not win, I propose a markedness constraint *0 which ensures no superlow tones in the output.

(27) ***0**
Assign one violation for every instance of a superlow tone in the output.

- The addition of this constraint results in the desired optimal candidate, (28).

(28) **¬ID-Tone, *0 ≫ ID-Tone, PitchDrop ≫ ID-Noun**

$e^4\ pa^1_{ipfv}$	¬ID-Tone	*0	ID-Tone	PitchDrop	ID-Noun
a. $e^4\ pa^1$	*!			*	
b. $e^4\ pa^0$		*!	*		
c. $e^4\ pa^2$			*	*!	
d. $e^3\ pa^1$			*	*!	*
e. ☞$e^5\ pa^1$			*		*

- The tableaux in (25) and (28) show that the proposed constraint ranking accounts for tonal shift in the imperfective grammar.
- The only crucial ranking in the elsewhere grammar is that ID-Tone outrank all markedness and anti-faithfulness constraints.
  - This results in the faithful candidate always surfacing as optimal outside of imperfective contexts.
- Cophonology Theory also accounts for other instances of morphologically conditioned phonology in Guébie, as shown in Appendix A.
  - Other models, such as an Optimal Paradigms account (McCarthy 2005), could account for the imperfective scalar tone shift but not for other alternations in the same language.

5 Conclusion

- Scalar tone shift in Guébie demonstrates that not all morphology is best analyzed with an underlying morpheme, contra (Bermúdez-Otero 2012; Köhnlein 2016).
    - Tone features and floating tone levels are inadequate underlying representations of the imperfective morpheme in Guébie.
- I provide a grammatical account of the tone delta increase in imperfective contexts as a morphological process via constraint enforcement, rather than as a floating feature or tone.
- Under this analysis, the imperfective scalar tone increase falls out from phonologically optimizing constraints in Cophonology Theory (Inkelas and Zoll 2005).
- This data raises two questions:
    1. Is there any reasonable cross-linguistic underlying representation for tonal morphemes?
    2. Where can we draw the line between morphological items versus processes?
- While I cannot answer these questions here, I propose that some morphological processes such as Guébie scalar tone shift lack underlying phonological representations.

A Other instances of tonal morphology in Guébie

- In addition to the imperfective scalar tone shift, there are other instances of tonal morphology in Guébie.
  - Another possible tone shift for case marking on pronouns
  - A tonal overlay (in McPherson and Heath 2016's terms) or replacive tone in noun-noun compounds.
- All three instances of tonal morphology in Guébie are similar in that they involve a systematic tone change in the environment of a particular morphosyntactic feature.
- For this reason, a Cophonologies model can account for all three instances of tonal morphology in Guébie.

A.1 Scalar tone shift as case marking

- Object pronouns in Guébie, those that surface as enclitics on the auxiliary or inflected verb, display default or lexical tone (29).

(29) **Object pronouns in Guébie**

	Human			Non-human	
	Singular	**Plural**		**Singular**	**Plural**
1st	e^3	a^1	**1st**	–	–
2nd	e^1	a^2	**2nd**	–	–
3rd	$ɔ^2$	wa^2	**3rd**	e^2,$ə^2$,u^2	i^2,wa^2

- When they appear in subject position, pronouns systematically surface with tone one step higher than their subject counterparts.

(30) **Subject pronouns in Guébie**

	Human			Non-human	
	Singular	**Plural**		**Singular**	**Plural**
1st	e^4	a^2	**1st**	–	–
2nd	e^2	a^3	**2nd**	–	–
3rd	$ɔ^3$	wa^3	**3rd**	e^3,$ə^3$,u^3	i^3,wa^3

- I assume that the difference between subject and object pronouns is nominative versus accusative case.
- If we assume that the tone on object pronouns is the tone on the vocabulary item for that set of person/number features, we can say that the same constraints at work in imperfective contexts also apply in the environment of a nominative case feature.
  - The fact that the same constraints are needed elsewhere in the grammar supports their use to account for imperfective scalar tone shift.
- The empirical reasons for calling the object pronoun default are two:
  - Nominative case is often the marked case in African languages (Creissels et al. 2008)
  - The same constraints that raise subject tones in imperfective contexts are responsible for raising the tone of subject pronouns; whereas we would need to specify a new set of DP lowering constraints if the object pronoun were the derived one.
- The model and constraints presented in section 4 can be used to account for both aspect and pronoun tone shift in Guébie.

A.2 Tone replacement in noun-noun compounds

- Noun-noun compounds in Guébie have an associative, or genitive, meaning.
- The tone of the second noun in a noun-noun compound is replaced with a level tone-2 melody.

(31) **Default tone**

	Noun with default tone	**Gloss**
a.	ɲitɔ$^{3.1}$	'fiancé'
b.	ju^{4}	'child'
c.	mana$^{3.3}$	'meat'
d.	di^{3}	'cut'
e.	ɲɔ^{31}	'person'
f.	bitə$^{2.3}$	'house'
g.	wəli$^{3.2}$	'top'

(32) **Noun-noun compounds in Guébie**

a. ɲitɔ$^{3.1}$ ju^{2}
fiancé child
'daughter in-law'

b. mana$^{3.3}$ di-ɲɔ$^{2.2}$
meat cut-AGT
'butcher'

c. bitə$^{2.3}$ wəli$^{2.2}$
house top
'top of house'

- While this process is not scalar like the other two instances of tonal morphology in Guébie, it still involves a tonal process in the environment of a particular morphosyntactic feature, here genitive.
- We could imagine that the presence of a genitive feature triggers a genitive-specific phonological grammar where a constraint like the one in (33), in the style of McPherson and Heath (2016)'s tone overlay constraints, ensures that the second noun of a compound surfaces with tone 2.

(33) **Noun Noun^{2}**
Assign one violation for every noun immediately following another noun that does not have a level tone melody of 2.

- While there are instances of nouns followed immediately by other nouns in Guébie (indirect and direct objects), the constraint above will be crucially outranked in the elsewhere grammar, and its effects will only apply in the genitive-specific phonology.

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