The importance of language documentation and description for phonological theory

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Documentation and description of indigenous languages can be mutually beneficial for the community of speakers and for the academic linguistics community.
For speaker groups,

- Linguistic research can inform creation of language resources and orthographies.
Introduction

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- Linguistic research can inform creation of language resources and orthographies.
- Publishing and archiving language data can legitimize and valorize the language, and can influence language policy decisions.
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- Publishing and archiving language data can legitimize and valorize the language, and can influence language policy decisions.
- Interest from academics in a language and speaker group can increase language attitudes and encourage speakers to continue using their indigenous languages.
- Collaboration with speakers can result in minority populations being involved in the research process, publishing, and becoming academics.
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In order to do this accurately and successfully, we need to know as much about how human language systems work as possible.
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Incorporating data from understudied minority and indigenous languages into theoretical conversations is crucial to building an informed linguistic model.
In this talk I show how data from Guébie, an endangered Kru language of Côte d’Ivoire, has informed our models of the morphology/phonology interface.
Case studies

1. Morpheme-specific scalar tone shift
2. Phonologically determined nominal concord
3. Doubly morphologically conditioned vowel harmony
Case studies

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Preview of what we have learned

The grammar of Guébie has implications for the following theoretical linguistics questions:

- What kinds of information can phonological rules or constraints be sensitive to?
- Are all morphemes associated with an underlying phonological representation? In other words, is all morphology concatenative?
- What is the architecture of a generative grammar? Does phonology apply before, after, or alongside morphology and syntax?
- How can we distinguish between competing formal models of language?
Overview

1. Introduction
2. Language Background
3. Scalar tone shift
4. Phonologically determined concord
5. Doubly conditioned harmony
6. Conclusion
Language Background
Guébie is an endangered Kru language spoken in southwest Côte d’Ivoire.

The data presented here comes from original fieldwork on Guébie over the past 5+ years.

Before I started working on Guébie in 2013, there was no extant documentation or description of the language.

The Kru family in general is drastically understudied,

- but there are lots of fascinating grammatical patterns of interest to the theoretical literature,
- and many Kru languages are endangered, so time is of the essence in documentation.
Where is Guébie spoken?
Where is Guébie spoken?
Gnagbodougnoa
Field elicitation
Collaborative data collection
(1) **Consonant inventory**

<table>
<thead>
<tr>
<th></th>
<th>Bilabial</th>
<th>Labiodent.</th>
<th>Alveopal.</th>
<th>Palatal</th>
<th>Velar</th>
<th>Labiovelar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plosive</td>
<td>p</td>
<td>b</td>
<td>t</td>
<td>c</td>
<td>ŋ</td>
<td>k</td>
</tr>
<tr>
<td>Nasal</td>
<td>m</td>
<td></td>
<td>n</td>
<td>ŋ</td>
<td>ŋ</td>
<td></td>
</tr>
<tr>
<td>Fricative</td>
<td>f</td>
<td>v</td>
<td>s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approx</td>
<td>ħ</td>
<td></td>
<td>l</td>
<td>j</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(2) Vowel inventory
Guébie is a tonal language, with four distinct underlying tone heights (here labeled 1-4, where 4 is high).

There are five distinct heights on the surface, 1-5, where 5 is super high.
Syllables are maximally CV, and words tend to be monosyllabic.
- Ex: li³ ‘eat’, no⁴ ‘mother’

Though there are also a number of disyllabic roots.
- Ex: bala³.³ ‘hit’, ḳeḵp³.¹ ‘person’
Word order alternates between SAuxOV and SVO.
When there is no auxiliary, the verb undergoes V-to-T movement, surfacing in the inflectional position (Sande, In Press).
While there are a few inflectional suffixes, and a number of derivational affixes, most morphology is non-concatenative:

- Tone shift
- Tone replacement
- Vowel replacement
- Phonologically determined agreement
Scalar tone shift
Scalar tone shift in Guébie

- A given verb shows the same tone melody in most contexts, (4).

\[(4) \quad \begin{align*}
    \text{a. } & \text{SAuxOV} \\
    & e^4 \quad ji^3 \quad ja^{31} \quad li^3 \\
    & \text{1SG.NOM FUT coconuts eat} \\
    & \text{‘I will eat a coconut.’}
\end{align*}
\]

- b. Imperative
  \[
  \text{li}^3 \\
  \text{eat.IMP}
  \]
  ‘Eat!’

- c. Perfective
  \[
  e^4 \quad li^3 \quad ja-be^{3.1} \quad kubə^{3.1} \\
  \text{1SG.NOM eat.PFV coconuts-SG yesterday} \\
  \text{‘I ate a coconut yesterday.’ (syl_20131024)}
  \]
In the imperfective (SVO), the tone on the verb is one step lower than elsewhere.

The only exponent of imperfective aspect in Guébie is a shift in surface tone.

(5) Imperfective

\[1\text{SG.NOM } \text{eat.IPFV } \text{coconuts every.day}\]

‘I eat coconuts everyday.’ (syl_20131024)
Scalar tone shift minimal pair

(6)  

a. **Perfective**  
   e⁴ li³ ja³¹  
   1SG.NOM eat.PFV coconuts  
   ‘I ate coconuts.’

b. **Imperfective**  
   e⁴ li² ja³¹  
   1SG.NOM eat.IPVF coconuts  
   ‘I eat coconuts.’ (oli_20160801)
Scalar tone shift minimal pair

(7)  
a.  Imperfective
   \[\omega^3 \text{ li\textipa{6}e^1.3}\]
   3SG.NOM dine.IPFW
   ‘I am dining’

b.  Perfective
   \[\omega^3 \text{ li\textipa{6}e^2.3}\]
   3SG.NOM dine.PFW
   ‘I dined’ (oli_20160801)
Scalar lowering of the first verbal tone level

(8) a. ju⁴  gbala³.⁴  si³  
    boy  climb.PFV  trees  
    ‘A boy climbed trees’

b. ju⁴  gbala².⁴  si³  
    boy  climb.IPFW  trees  
    ‘A boy climbs trees’
Scalar lowering of the first verbal tone level

(8)  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’

c.  e$^4$  na$^{42}$
    1SG.NOM say.PFV
    ‘I said’

d.  e$^4$  na$^{32}$
    1SG.NOM say.IPfV
    ‘I say’ (syl.20140314)
The first tone level of a verbal tone melody surfaces one step lower in imperfective contexts than other contexts.

<table>
<thead>
<tr>
<th>Default tone</th>
<th>Imperfective tone</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

(9)
Scalar shift for low-toned verbs

- When the tone of a verb is already low we do not see lowering to super low (tone 0).
Scalar shift for low-toned verbs

- When the tone of a verb is already low we do not see lowering to super low (tone 0).
- But we also do not see neutralization between perfective and imperfective contexts.
Scalar shift for low-toned verbs

- When the tone of a verb is already low we do not see lowering to super low (tone 0).
- But we also do not see neutralization between perfective and imperfective contexts.
- Instead, the scalar tone shift affects the final tone of the subject!
Subject tone raising

(10)  

a. \( \epsilon^3 \ 6\omega^1 \)  
\( 3\text{SG.NOM} \) \( \text{wither.PFV} \)  
‘It withered’

b. \( \epsilon^4 \ 6\omega^1 \)  
\( 3\text{SG.NOM} \) \( \text{wither.IPfv} \)  
‘It withers’

c. \( \text{jaci}^{23.1} \ 6\omega^1 \)  
\( \text{Djatchi} \) \( \text{run.PFV} \)  
‘Djatchi ran’

d. \( \text{jaci}^{23.2} \ 6\omega^1 \)  
\( \text{Djatchi} \) \( \text{run.IPfv} \)  
‘Djatchi runs’ (oli_20160801)
Subject tone raising before low-toned verbs occurs even when the result is a super high tone.
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(11)  

a. \( \text{e}^4 \quad \text{pa}^1 \)  
\( \text{1SG.NOM run.PFV} \)  
‘I ran’

b. \( \text{e}^5 \quad \text{pa}^1 \)  
\( \text{1SG.NOM run.IPFV} \)  
‘I run’ (syl.20140314)
Subject tone raising before low-toned verbs occurs even when the result is a super high tone.

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1SG.NOM run.PFV \\
‘I ran’

b. e\textsuperscript{5} \underline{pa}\textsuperscript{1} \\
1SG.NOM run.IPFV \\
‘I run’ (syl_20140314)

Super high tones are not found anywhere else in the language.
### Subject raising

<table>
<thead>
<tr>
<th>Default subject tone</th>
<th>Raised subject tone</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

(12)
Scalar tone shift summary

This tonal shift affects the difference in tone height between the subject and verb. 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.

A scalar shift affecting multiple words, like this one, is otherwise unattested cross-linguistically (Mortensen, 2006).
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- In analyzing the imperfective scalar tone shift, we might start by asking: ”What is the underlying phonological representation of the imperfective morpheme in Guébie?”
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- **Short answer:** There isn't one.
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- In analyzing the imperfective scalar tone shift, we might start by asking: “What is the underlying phonological representation of the imperfective morpheme in Guébie?”
- **Short answer:** There isn’t one.
- **Problem:** No matter what featural affix or floating tone we posit as the underlying representation of the imperfective morpheme, we must still state the following process in terms of rules or constraints (Sande, 2018a):
  - The first tone of a verb lowers one step, unless it is already low, in which case the final tone of the subject raises one step.
A reasonable candidate for the underlying form of the imperfective is a 41 floating tone.
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The low second portion could have a lowering effect, while the high initial portion could have a raising effect.
Attempting a UR analysis: Floating tones

- A reasonable candidate for the underlying form of the imperfective is a 41 floating tone.
- The low second portion could have a lowering effect, while the high initial portion could have a raising effect.
- We must still explain the following:
  - Why we get verb tone lowering in the default case.
  - Why the verb doesn’t lower to super low.
  - When the subject raises.
  - Why 41 has a scalar effect in imperfective contexts, but not elsewhere.
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If the imperfective UR was any other tone, our constraints or rules would look the same as for the 41 analysis.
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- **Problem:** No single UR better predicts when and where these scalar effects occur than any other UR.
Proposed features for 4-tone systems

(13)

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper</td>
<td>Feature 1</td>
<td>Feature 2</td>
</tr>
<tr>
<td></td>
<td>+ + - -</td>
<td>H H L L</td>
<td>H L H L</td>
</tr>
<tr>
<td></td>
<td>High/Raised</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ - + -</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stiff</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ + - -</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slack</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- + - +</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No single feature change results in scalar lowering.
Proposal: An analysis that need not stipulate an underlying phonological form for the imperfective is preferable. We avoid an extra layer of unnecessary and arbitrarily chosen abstraction.
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Instead, a phonological constraint ranking (or weighting) specific to the imperfective context can derive the scalar tone shift (Sande, 2018a).
(14) Imperfective constraint ranking

<table>
<thead>
<tr>
<th>/[φ[ω e⁴]][φ[ω li³][ω ja³¹]]/</th>
<th>*0</th>
<th>PDROP</th>
<th>Id-T(R, φ)</th>
<th>Id-T</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. [φ[ω e⁴]][φ[ω li³][ω ja³¹]]</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1.5</td>
<td>4</td>
</tr>
<tr>
<td>b. [φ[ω e⁴]][φ[ω li²][ω ja³¹]]</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td>c. [φ[ω e⁵]][φ[ω li³][ω ja³¹]]</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.5</td>
<td>3</td>
</tr>
<tr>
<td>d. [φ[ω e⁴]][φ[ω li⁰][ω ja³¹]]</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1.5</td>
<td>3</td>
</tr>
</tbody>
</table>
### Imperfective evaluation of low-toned verb

(15) **Imperfective constraint ranking for low-toned verb**

<table>
<thead>
<tr>
<th>/[φ [ω e⁴]] [φ [ω pa¹]]/</th>
<th>*0 3</th>
<th>PDROP 4</th>
<th>Id-T(R, φ) 2</th>
<th>Id-T 1.5</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. [φ [ω e⁴ ]] [φ [ω pa¹ ]]</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>b. [φ [ω e⁴ ]] [φ [ω pa⁰ ]]</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>4.5</td>
</tr>
<tr>
<td>c. [φ [ω e⁵ ]] [φ [ω pa¹ ]]</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td>3.5</td>
</tr>
</tbody>
</table>
In the elsewhere grammar, which applies in perfective and all other non-imperfective contexts, faithfulness outranks markedness:
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\[(16) \quad \text{IDENT} \]
\[
\downarrow
\]
\[
*0, \text{PitchDrop}
\]
In the elsewhere grammar, which applies in perfective and all other non-imperfective contexts, faithfulness outranks markedness:

\[
\text{Ident} \quad | \quad ^*0, \text{PitchDrop}
\]

This ranking results in the faithful candidate always surfacing as optimal in all contexts outside of the imperfective.
Theoretical Consequences

1. Typologically, the Guébie scalar tone shift is unique among scalar shifts in affecting multiple words (Mortensen, 2006).
2. The imperfective scalar tone shift in Guébie can be modeled without underlying representations.
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2. The imperfective scalar tone shift in Guébie can be modeled without underlying representations.
   - Using underlying representations complicates the grammar, because we need both an abstract representation and a morpheme-specific constraint ranking or set of rules to get a pitch drop in the right place.
   - This bears on the item vs. process debate in morphophonology, demonstrating that not all morphology involves underlying phonological representations (items).
Phonologically determined concord
Phonologically determined agreement

Phonologically determined agreement

Pronouns and adjectives agree with nouns in Guebie. Non-human pronouns and adjective agreement are not determined by semantics, but by phonological features of the noun.

We will see that phonologically determined nominal concord has consequences for the architecture of grammar.
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We will see that phonologically determined nominal concord has consequences for the architecture of grammar.
Guébie subject pronouns occur immediately before the auxiliary or inflected verb.
Pronoun forms

- Guébie subject pronouns occur immediately before the auxiliary or inflected verb.
- Object pronouns have the same segmental form as subject pronouns, with tone one step lower than their subject counterparts.
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Object pronouns have the same segmental form as subject pronouns, with tone one step lower than their subject counterparts.

(17) **Human and non-human subject pronouns**

<table>
<thead>
<tr>
<th></th>
<th>Human</th>
<th>Non-human</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Singular</td>
<td>Plural</td>
</tr>
<tr>
<td>1st</td>
<td>e⁴</td>
<td>a³</td>
</tr>
<tr>
<td>2nd</td>
<td>e²</td>
<td>a²</td>
</tr>
<tr>
<td>3rd</td>
<td>ɔ³</td>
<td>wa³</td>
</tr>
</tbody>
</table>
Human pronouns always surface as \([\mathrm{\textsc{\textipa{c}}}^3]\), singular, and \([\mathrm{\textsc{\textipa{wa}}}^3]\), plural.

(18) **Human third-person pronouns**

a. \(\text{nudi-ja}^{3.1.3} \; \text{\textsc{c}^3} \quad \text{wa}^2 \quad \text{j\v{e}r\v{e}-lili}^{3.2.2.2}\)

\text{man-DEF} \quad \text{3SG.NOM} \quad \text{like.IPFV} \quad \text{spice-food}

‘As for the man, he likes spicy food.’

b. \# \(\text{nudi-ja}^{3.1.3} \; \text{\textsc{e}^3} \quad \text{wa}^2 \quad \text{j\v{e}r\v{e}-lili}^{3.2.2.2}\)

\text{man-DEF} \quad \text{3SG.NOM} \quad \text{like.IPFV} \quad \text{spice-food}

Intended: ‘As for the man, he likes spicy food.’

(syl_20151113)
Non-human pronouns

(19) **Phonologically determined object pronoun agreement** (syl_20140130)

<table>
<thead>
<tr>
<th>Noun</th>
<th>Gloss</th>
<th>Object pronoun</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. jie(^2.2)</td>
<td>‘a prison’</td>
<td>e(^{-4}) ni(^{-4}) e(^2) ji(^3)</td>
<td>‘I saw it (prison)’</td>
</tr>
<tr>
<td>b. k(^w)ala(^4.2)</td>
<td>‘a farm’</td>
<td>e(^{-4}) ni(^{-4}) ø(^2) ji(^3)</td>
<td>‘I saw it (farm)’</td>
</tr>
<tr>
<td>c. to(^3)</td>
<td>‘battle’</td>
<td>e(^{-4}) ni(^{-4}) u(^2) ji(^3)</td>
<td>‘I saw it (battle)’</td>
</tr>
</tbody>
</table>
The backness of the noun determines its corresponding pronoun vowel.

\[ (20) \text{ Mapping of Guébie stem-final vowels to pronoun vowels } \]

<table>
<thead>
<tr>
<th>Final vowel</th>
<th>3.SG pronoun</th>
<th>Plural suffix</th>
<th>3.PL pronoun</th>
</tr>
</thead>
<tbody>
<tr>
<td>i, í, e, ê</td>
<td>e</td>
<td>-i</td>
<td>i</td>
</tr>
<tr>
<td>ø, a</td>
<td>ø</td>
<td>-a</td>
<td>wa</td>
</tr>
<tr>
<td>u, ü, o, ū</td>
<td>u</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lack of semantic coherence for a given vowel

<table>
<thead>
<tr>
<th>Word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>kwəli^2.4</td>
<td>‘face’</td>
</tr>
<tr>
<td>ɲate^3.1</td>
<td>‘yam’</td>
</tr>
<tr>
<td>nove^2.3</td>
<td>‘bee’</td>
</tr>
<tr>
<td>dʒe^2</td>
<td>‘leopard’</td>
</tr>
<tr>
<td>dʒakʷɛlɛ^2.3.2</td>
<td>‘small spider’</td>
</tr>
<tr>
<td>dʒakʷɛlɛ^2.3.2</td>
<td>‘small spider’</td>
</tr>
<tr>
<td>kwəli^2.3</td>
<td>‘bird’</td>
</tr>
<tr>
<td>gbele^3.2</td>
<td>‘cola nut’</td>
</tr>
<tr>
<td>nove^2.4-kpe^2</td>
<td>‘honey’</td>
</tr>
<tr>
<td>tɛlɛ^3.2</td>
<td>‘snake’</td>
</tr>
<tr>
<td>pɔpe^2.3</td>
<td>‘leaf’</td>
</tr>
</tbody>
</table>

(21) Words that take the front vowel pronoun, /e/
Lack of semantic coherence for a given vowel

(22) Words that take the central vowel pronoun, /ə/

<table>
<thead>
<tr>
<th>Word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>gama².²</td>
<td>‘big spider’</td>
</tr>
<tr>
<td>takʷa³.²</td>
<td>‘basket’</td>
</tr>
<tr>
<td>dʒa₆e³.¹</td>
<td>‘coconut’</td>
</tr>
<tr>
<td>bɪtə².³</td>
<td>‘house’</td>
</tr>
<tr>
<td>ma¹</td>
<td>‘butt’</td>
</tr>
<tr>
<td>nove².⁴-ɡubə³.¹</td>
<td>‘bee hive’</td>
</tr>
<tr>
<td>dʒukpə³.¹</td>
<td>‘bracelet’</td>
</tr>
<tr>
<td>uə³.¹</td>
<td>‘head’</td>
</tr>
</tbody>
</table>
Lack of semantic coherence for a given vowel

(23) **Words that take the back vowel pronoun, /u/**

- nukpu^4.4^ ‘quill (pen)’
- sabu^3.2^ ‘night’
- sio^2.2^ ‘snail’
- go^3^ ‘abdomen’
- kasu^3.2^ ‘fire’
- nɔŋpɔŋu^2.4.3^ ‘palmwine’
- gbo^2^ ‘dispute’
- takpɔ^2.3^ ‘cheek’
Noun class agreement is phonologically determined

(24) **Phonological agreement in loan words from English/French**

a. sukulu₁.₁.₃ kọda.₃.₂₁ e-⁴ ni-⁴
   school exist.IPfv 1SG.NOM see.PFv
   u² ji³
   3SG.ACC see
   ‘There is a school. I saw it (the school).’

b. baraʒε₂.₃.₂ kọda.₃.₂₁ e-⁴ ni-⁴
   dam exist.IPfv 1SG.NOM see.PFv
   e² ji³
   3SG.ACC see
   ‘There is a dam. I saw it (the dam)’

(syl_20140130)
Further evidence that agreement in Guébie is phonologically determined comes from suffixed nouns.
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Besides the plural suffix there is one other nominal suffix: the definite marker.
Noun class agreement is phonologically determined

- Further evidence that agreement in Guébie is phonologically determined comes from suffixed nouns.
- Besides the plural suffix there is one other nominal suffix: the definite marker.

(25) a. sukulu\textsuperscript{1.1.3} ‘school’
   b. sukulu-a\textsuperscript{1.1.3.3} ‘the school’
Further evidence that agreement in Guébie is phonologically determined comes from suffixed nouns.

Besides the plural suffix there is one other nominal suffix: the definite marker.

\[
\begin{align*}
(25) & \quad \text{a. } \text{sukulu}^{1.1.3} \quad \text{‘school’} \\
& \quad \text{b. } \text{sukulu-}a^{1.1.3.3} \quad \text{‘the school’}
\end{align*}
\]

The definite marker is used in a narrower set of contexts in Guébie than, for example, in English.

However, when referring to a noun that would take the definite marker, the central vowel pronoun must be used: \( \emptyset, \#e, \#u \)
Adjectives also agree phonologically with nouns.

(26) **Noun-modifier phonological agreement**

(syl.20151117)

a. \( \text{bit}_2.3 \text{ lel}_1.2 \text{ el}_a^{1.1} \)

house new red

‘A new red house’

b. \( \text{fu}_3 \text{ lelo}_1.2 \text{ el}_c^{1.1} \)

sponge new red

‘A new red sponge’
(27) Pronoun features and realization

<table>
<thead>
<tr>
<th>Human</th>
<th>Nonhuman</th>
</tr>
</thead>
<tbody>
<tr>
<td>[+HUMAN]</td>
<td>[-HUMAN]</td>
</tr>
<tr>
<td>/ɔ, wa/</td>
<td>/e, ə, u, i, wa/</td>
</tr>
<tr>
<td>semantically</td>
<td>phonologically</td>
</tr>
<tr>
<td>determined</td>
<td>determined</td>
</tr>
</tbody>
</table>

References
Theoretical consequences

While this could be the vestige of a historically semantically-determined noun class system, synchronically, nominal concord with non-human nouns in Gubie is phonologically predictable. Phonologically determined concord has consequences for our presumed order of grammatical modules, and for the timing of nominal concord in the derivation.
Theoretical consequences

- While this could be the vestige of a historically semantically-determined noun class system, synchronically, nominal concord with non-human nouns in Guébie is phonologically predictable.
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- Phonologically determined concord has consequences for our presumed order of grammatical modules, and for the timing of nominal concord in the derivation.
Most generative frameworks assume the Y-model of grammar, where syntactic operations occur before morphology and phonology:

(28) **The Y-model of grammar**

```
Syntax
  Phonological Form  Logical Form
```

Most generative frameworks assume the Y-model of grammar, where syntactic operations occur before morphology and phonology:
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(28) **The Y-model of grammar**

```
Syntax

Phonological Form   Logical Form
```

- An analysis where phonological features are present during the syntactic module makes pathological predictions (Pullum and Zwicky, 1988, 1986).
  - Ex: We would expect word orders and other syntactic properties to be sensitive to segmental properties.
Because nominal concord is phonologically determined in Guébie, we know that either

1. Syntactic operations have access to phonological information, OR
Because nominal concord is phonologically determined in Guébie, we know that either

1. Syntactic operations have access to phonological information, OR
2. The operation that results in nominal concord occurs late in the derivation, after phonological information is available (e.g. after Insertion of Vocabulary Items applies in Distributed Morphology (Halle and Marantz, 1994)).
A possible analysis

One possible analysis is to say that nominal concord is a post-syntactic operation (Kramer, 2010; Norris, 2014; Baier, 2015; Sande, 2018b).
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- Post-syntactically, AGR-nodes are inserted into the structure.
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For pronouns and adjectives in Guébie, the AGR vocabulary items for non-human nouns have the shape /V/ (Sande, 2018b).
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- Post-syntactically, AGR-nodes are inserted into the structure.
- AGR vocabulary items are inserted into the AGR-nodes.

For pronouns and adjectives in Guébie, the AGR vocabulary items for non-human nouns have the shape /V/ (Sande, 2018b).

- During phonological evaluation, features of the V are filled in from the nearby Noun vowel.
In looking across languages, we see that nominal concord in a number of other languages seems to be entirely or partially phonologically determined:

- Bainuk (Atlantic; Senegal and Guinea) (Sauvageot, 1967)
- Abuq/Abu’ (Arapesh; Papua New Guinea) (Nekitel, 1986; Aronoff, 1992; Dobrin, 1995)
Cross-linguistic findings

In looking across languages, we see that nominal concord in a number of other languages seems to be entirely or partially phonologically determined:

- Bainuk (Atlantic; Senegal and Guinea) (Sauvageot, 1967)
- Abuq/Abu’ (Arapesh; Papua New Guinea) (Nekitel, 1986; Aronoff, 1992; Dobrin, 1995)

The analysis just presented can also account for phonologically determined agreement in these languages, and could potentially account for the partially phonologically determined concord systems in more widely represented languages such as Spanish and French.
Doubly conditioned harmony
Doubly conditioned phenomena

- Not all phonological alternations occur across the board in a language.
- Phonological processes can be sensitive to grammatical morpheme, lexical item, and syntactic domain.
Not all phonological alternations occur across the board in a language.

Phonological processes can be sensitive to grammatical morpheme, lexical item, and syntactic domain.

Various theoretical frameworks have been developed to account for morphologically conditioned phonology.
Not all phonological alternations occur across the board in a language.

Phonological processes can be sensitive to grammatical morpheme, lexical item, and syntactic domain.

Various theoretical frameworks have been developed to account for morphologically conditioned phonology.

In Guébie we will see that there are phonological processes that require two simultaneous morphological or lexical triggers in order to surface.
There is a phonological process in Guébie which only surfaces in the environment of both 1) a subset of affixes, and 2) a subset of lexical items.
Affix-controlled vowel harmony

- A subset of morphemes, namely object-marking enclitics and plural suffixes, trigger full vowel harmony on roots.
Affix-controlled vowel harmony

A subset of morphemes, namely object-marking enclitics and plural suffixes, trigger full vowel harmony on roots.

(29) **Full vowel harmony**

a. ə³ bala³.³
3SG.NOM hit.PFV
‘He hit’

b. ə³ bəɬ=ə³.²
3SG.NOM hit.PFV-3SG.ACC
‘He hit him’
Morphemes that trigger full vowel harmony

- All third-person object-marking enclitics trigger full vowel harmony.

(30) **Guébie object markers**

<table>
<thead>
<tr>
<th></th>
<th>Human</th>
<th>Non-human</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Singular</td>
<td>Plural</td>
</tr>
<tr>
<td>1st</td>
<td>$e^3$, $\emptyset$</td>
<td>$a^1$, $\eta\varepsilon^{1.1}$</td>
</tr>
<tr>
<td>2nd</td>
<td>$e^1$, $m\varepsilon^2$</td>
<td>$a^2$, $\eta\varepsilon^{2.2}$</td>
</tr>
<tr>
<td>3rd</td>
<td>$\sigma^2$</td>
<td>$wa^2$</td>
</tr>
</tbody>
</table>
Morphemes that trigger full vowel harmony

- All third-person object-marking enclitics trigger full vowel harmony.

(31) **Guébie object markers**

<table>
<thead>
<tr>
<th></th>
<th>Human</th>
<th>Non-human</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Singular</td>
<td>Plural</td>
</tr>
<tr>
<td>1st</td>
<td>$e^3$, $\emptyset$</td>
<td>$a^1$, $\eta e^1.1$</td>
</tr>
<tr>
<td>2nd</td>
<td>$e^1$, $m\varepsilon^2$</td>
<td>$a^2$, $\eta e^2.2$</td>
</tr>
<tr>
<td>3rd</td>
<td>$o^2$</td>
<td>$wa^2$</td>
</tr>
</tbody>
</table>
Object markers trigger full harmony

<table>
<thead>
<tr>
<th>Verb</th>
<th>Object</th>
<th>Verb+Obj</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>jili(^2.3)</td>
<td>=c(^2)</td>
<td>jol=(c^{2.32}), *jil=(c^{2.32})</td>
<td>‘steal him’</td>
</tr>
<tr>
<td>jili(^2.3)</td>
<td>=(\epsilon)(^2)</td>
<td>j(\epsilon)=(\epsilon^{2.32}), *jil=(\epsilon^{2.32})</td>
<td>‘steal it’</td>
</tr>
<tr>
<td>jili(^2.3)</td>
<td>=(\iota)(^2)</td>
<td>jil=(\iota^{2.32}), *jil=(\iota^{2.32})</td>
<td>‘steal them’</td>
</tr>
<tr>
<td>jila(^3.2)</td>
<td>=c(^2)</td>
<td>jol=(c^{3.2}), *jil=(c^{3.2})</td>
<td>‘ask him’</td>
</tr>
<tr>
<td>jila(^3.2)</td>
<td>=(\epsilon)(^2)</td>
<td>j(\epsilon)=(\epsilon^{3.2}), *jil=(\epsilon^{3.2})</td>
<td>‘ask it’</td>
</tr>
<tr>
<td>jila(^3.2)</td>
<td>=(\iota)(^2)</td>
<td>jil=(\iota^{3.2}), *jil=(\iota^{3.2})</td>
<td>‘ask them’</td>
</tr>
<tr>
<td>bala(^3.3)</td>
<td>=c(^2)</td>
<td>bol=(c^{3.2}), *bal=(c^{3.2})</td>
<td>‘hit him’</td>
</tr>
<tr>
<td>bala(^3.3)</td>
<td>=(\epsilon)(^2)</td>
<td>b(\epsilon)=(\epsilon^{3.2}), *bal=(\epsilon^{3.2})</td>
<td>‘hit it’</td>
</tr>
<tr>
<td>bala(^3.3)</td>
<td>=(\iota)(^2)</td>
<td>bil=(\iota^{3.2}), *bal=(\iota^{3.2})</td>
<td>‘hit them’</td>
</tr>
</tbody>
</table>
Additionally, there are two plural suffixes, /-i, -a/., which both trigger full vowel harmony.

(32) **Full harmony in plural contexts**

<table>
<thead>
<tr>
<th>Singular</th>
<th>Plural</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. bele(^2.2)</td>
<td>bil-i(^2.2)</td>
<td>‘cow’</td>
</tr>
<tr>
<td>b. mënë(^3.3)</td>
<td>man-a(^3.2)</td>
<td>‘animal’</td>
</tr>
</tbody>
</table>
Morphemes that trigger full vowel harmony

- There are other enclitics and suffixes that are phonologically identical to object enclitics or plural suffixes, but do not trigger full harmony.
There are other enclitics and suffixes that are phonologically identical to object enclitics or plural suffixes, but do not trigger full harmony.

Recall that the shape of the 3SG.HUM object enclitic is [ɔ²].
Morphemes that trigger full vowel harmony

- There are other enclitics and suffixes that are phonologically identical to object enclitics or plural suffixes, but do not trigger full harmony.
- Recall that the shape of the 3SG.HUM object enclitic is [ɔ2].
- The passive suffix, which is phonologically identical, does not trigger harmony.

(33) **No harmony in passive contexts**

<table>
<thead>
<tr>
<th>Verb</th>
<th>Verb+Pass</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. bala3.3</td>
<td>bal-ɔ3.2, *bɔal-ɔ3.2</td>
<td>‘be hit’</td>
</tr>
<tr>
<td>b. jila3.2</td>
<td>jil-ɔ3.2, *jɔal-ɔ3.2</td>
<td>‘be asked’</td>
</tr>
</tbody>
</table>
Additionally, morphemes that attach outside the object enclitic or plural suffix fail to undergo harmony:

(34) \textbf{Root}+\textbf{Obj}+\textbf{Nominalizer}

<table>
<thead>
<tr>
<th>\textit{Root}</th>
<th>=3SG.ACC</th>
<th>=NMLZ</th>
<th>\textit{Gloss}</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. bala$^{3.3}$</td>
<td>bOl=O$^{3.2}$</td>
<td>bOl=O=li$^{3.2.2}$</td>
<td>‘hit’</td>
</tr>
<tr>
<td>b. tulu$^{4.4}$</td>
<td>tOl=O$^{4.2}$</td>
<td>tOl=O=li$^{4.2.2}$</td>
<td>‘chase’</td>
</tr>
<tr>
<td>c. jila$^{3.2}$</td>
<td>jOl=O$^{3.2}$</td>
<td>jOl=O=li$^{3.2.2}$</td>
<td>‘ask’</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>(34) Root + Obj + Nominalizer</th>
<th>Root</th>
<th>=3SG.ACC</th>
<th>=NMLZ</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. bala³.3</td>
<td>bɔl=ɔ³.2</td>
<td>bɔl=ɔ=li³.2.2</td>
<td>‘hit’</td>
<td></td>
</tr>
<tr>
<td>b. tulu⁴.4</td>
<td>tɔl=ɔ⁴.2</td>
<td>tɔl=ɔ=li⁴.2.2</td>
<td>‘chase’</td>
<td></td>
</tr>
<tr>
<td>c. jilə³.2</td>
<td>jɔl=ɔ³.2</td>
<td>jɔl=ɔ=li³.2.2</td>
<td>‘ask’</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(35) Root + Pl + Definite</th>
<th>Singular</th>
<th>Plural</th>
<th>-Def</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. bɛle².2</td>
<td>bɪl-i².2</td>
<td>bɪl-i-a².2.2</td>
<td>‘cow’</td>
<td></td>
</tr>
<tr>
<td>b. mɛnɛ³.3</td>
<td>man-a³.2</td>
<td>man-a-a³.2.2</td>
<td>‘animal’</td>
<td></td>
</tr>
</tbody>
</table>
This full vowel harmony process only applies to a subset of Guébie roots.

About 33.5%, based on a corpus of 1839 disyllabic roots, where 614 of them are subject to full vowel harmony.
Roots affected by full vowel harmony

- The subset of roots affected by full vowel harmony does not form a semantic or phonological natural class.
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- Phonologically, there is a tendency for roots that undergo full harmony to be of the shape CVCV, where the second C is /l/, and where the two vowels are identical.
- However, no set of phonological traits exhaustively and exclusively picks out the correct set of roots.
  - For example, there are minimal pairs like jili\textsuperscript{2.2} ‘be fat’, which undergoes harmony, and jili\textsuperscript{2.2} ‘fish’, which does not.
The subset of roots affected by full vowel harmony does not form a semantic or phonological natural class.

Phonologically, there is a tendency for roots that undergo full harmony to be of the shape CVCV, where the second C is /l/, and where the two vowels are identical.

However, no set of phonological traits exhaustively and exclusively picks out the correct set of roots.

For example, there are minimal pairs like jili\(^{2.2}\) ‘be fat’, which undergoes harmony, and jili\(^{2.2}\), ‘fish’, which does not.

Semantically, there is no coherent feature of verbal or nominal roots that picks out all and only the roots that alternate.

For example, ɕwɔɕ\(^{4.4}\), ‘woman’, and ȵɔkɛ\(^{3.1}\) ‘person’, undergo full harmony, while ȵudi\(^{3.1}\), ‘man’, does not.
Certain morphemes (object enclitics and plural suffixes) condition full vowel harmony on roots.

However, only 33.5% of roots in the language are affected by the process.

Both the triggering morpheme and alternating lexical item must be present for harmony to surface.
Distribution of harmony

<table>
<thead>
<tr>
<th></th>
<th>Object enclitic</th>
<th>Passive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternating rt</td>
<td>Harmony</td>
<td>No harmony</td>
</tr>
<tr>
<td>Non-alternating rt</td>
<td>No harmony</td>
<td>No harmony</td>
</tr>
</tbody>
</table>
Doubly conditioned phonology as a cross-linguistic phenomena

This doubly morphologically conditioned harmony in Guébie prompted me to look for similar cases in other languages.
Doubly conditioned phonology as a cross-linguistic phenomena

This doubly morphologically conditioned harmony in Guébie prompted me to look for similar cases in other languages.

- **Vowel lengthening in Sacapultec:** Final vowels lengthen in a subset of lexical items, only in the presence of possesive prefixes, but not other prefixes.

- **Ablaut in Siouan languages:** Vowel ablaut applies only for certain lexical items, and only in the presence of certain affixes.

Double morphological conditioning seems to be a fairly widespread phenomenon that has not been previously characterized as such.

- We want our theoretical frameworks to be able to account for it.
Theoretical consequences

- Phonological alternations can target constructions where multiple specific morphemes are present.
- Numerous frameworks model morphologically conditioned phonology:
Theoretical consequences

- Phonological alternations can target constructions where multiple specific morphemes are present.
- Numerous frameworks model morphologically conditioned phonology:
  - Exception features (Chomsky and Halle, 1968)
  - Lexical Morphology and Phonology, Stratal OT (Kiparsky et al., 1982; Bermúdez-Otero, 1999; Kiparsky, 2000, 2008)
  - Indexed constraints (Itô and Mester, 1995; Pater, 2010)
  - Cophonology Theory (Orgun, 1996; Inkelas et al., 1997; Inkelas and Zoll, 2005)
  - Cophonologies by Phase (Sande and Jenks, 2018; Sande et al., Submitted)
  - Generalized Non-linear Affixation (and other representational accounts) Bermúdez-Otero (2012); Zimmermann (2013)
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  - Lexical Morphology and Phonology, Stratal OT (Kiparsky et al., 1982; Bermúdez-Otero, 1999; Kiparsky, 2000, 2008)
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Conclusion
Documentation and description of indigenous languages is useful for many purposes:
Conclusions

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- Creating language pedagogy resources
- Language maintenance and revitalization
- Typological understanding of possible grammars
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Documentation and description of indigenous languages is useful for many purposes:

- Creating language pedagogy resources
- Language maintenance and revitalization
- Typological understanding of possible grammars
- **Informing theoretical models of human language.**
Conclusions

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- **Doubly morphologically conditioned phonology:**
  - Phonological alternations can apply in the context of pairs of morphemes, helping to distinguish between competing frameworks.
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- There are lots of great documentary and descriptive resources out there in language grammars and archives that have not yet been connected to the theoretical linguistics literature.

Knowledge of indigenous language grammars is necessary for improving our theoretical models, so I encourage you all to find a way to incorporate data from a lesser studied language into your work!
Thank you!
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