“First-last harmony or outward-looking allomorphy in Cilungu grammatical tone”
Nicholas Rolle, Leibniz-Zentrum Allgemeine Sprachwissenschaft (ZAS) – September 10, 2020
[in collaboration with Lee Bickmore – University at Albany]

1 Topic

(1) Bobaljik (2000) "The Ins and Outs of Contextual Allomorphy":
    a. "Under what conditions may one morpheme (M1) condition allomorphy for (including the appearance or absence of) another morpheme (M2)?"

(2) Intersection of two issues in allomorphy
    a. Phonologically-conditioned allomorphy (PCA) – multiple underlying forms of the same morpheme whose distribution is conditioned based on phonological environment
    b. Directionality – The directional relation (inward, outward) of the target of allomorphy with respect to the trigger of the allomorphy, dictated by the morphosyntactic structure

(3) Inward-looking PCA: \text{Target} \at \text{Trigger} vs. \text{Target} \an \text{Trigger}

(4) Hypothetical outward-looking PCA: \text{Trigger} \at \text{Target} vs. \text{Target} \to \text{Trigger}

    a. Consonant-final P (\at, with, in, during) \rightarrow a \ [INDEF]
    b. Vowel-final P (to, by, below, via) \rightarrow na \ [INDEF]

(5) Thesis: outward-looking phonologically-conditioned allomorphy is possible
    a. Evidence from grammatical tone allomorphy in Cilungu
    b. Supporting other empirical claims
        (Hannahs & Tallerman 2006; Anderson 2008; Wolf 2008, 2013, 2015; Svenonius 2012; Deal & Wolf 2017)
    c. Contra typological and theoretical claims
        (Bobaljik 2000; Paster 2006, 2009, 2015; Embick 2010, 2015; Arregi et al. 2013, inter alia)

2 The Bantu language Cilungu

(6) Cilungu [ISO: mgr] – Bantu language, Zambia and Tanzania (Bantu zone M14)
    a. Data from Bickmore (2007, 2014), and ongoing collaboration

(7) Typical ‘verbal template’ for a Bantu language:
    \[ V \ SM- (NEG-) TAM- [MACRO-STEM (OM-) STEM ROOT (-DERIV) -TAM -FV ] ]
    (V = verb, SM = subject marker, TAM = tense/aspect/mood, OM = object marker, NEG = negative, DERIV = derivational, FV = final vowel)

(8) Tone system contrasts /H/ vs. $\emptyset$ (toneless) – low tone inserted by default on toneless vowels
(9) General tonal rules

a. **Word-level spreading**: Unbounded when final in utterance

\[ /\text{tú-} /_{\text{MS}} \text{mu-sükilil-}a / \rightarrow (\text{tú-kú}_{\text{MS}} \text{mu-sükilil} \text{-}a)_{0} \]

we-TAM-OM-accompany-FV ‘we are accompanying him/her’ [B07:148]

b. **Word-level spreading**: Bounded when non-final in utterance

\[ /\text{tú-} /_{\text{MS}} \text{mu-}fúl-a \text{ ningó } / \rightarrow (\text{tú-kú}_{\text{MS}} \text{mu-fúl} \text{-}a)_{0} (\text{niingó})_{0} \]

we-TAM-OM-wash-FV well ‘we are washing him/her well’ [B07:156]

c. **MStem-level spreading**: Unbounded when final in utterance

\[ /\text{tú-} /_{\text{MS}} \text{mu-}páapaatik-a / \rightarrow (\text{tú-kú}_{\text{MS}} \text{mu-páapaátik} \text{-}a)_{0} \]

we-TAM-OM-flatten-FV ‘we are flattening him/her’ [B07:148]

d. **MStem-level spreading**: Unbounded when non-final in utterance

\[ /\text{tú-} /_{\text{MS}} \text{yá-suel-il-a \text{ ningó} } / \rightarrow (\text{tú-kú}_{\text{MS}} \text{yá-swéél-él} \text{-}a)_{0} (\text{niingó})_{0} \]

we-TAM-OM-brew-APPL-FV well ‘we are brewing for them well’ [B07:158]

e. **Binary spreading** (bounded)

\[ /\text{tú-} /_{\text{MS}} \text{sí} \text{-a} \text{ Choola } / \rightarrow (\text{tú-kú}_{\text{MS}} \text{shá})_{0} (\text{Chóól} \text{à})_{0} \]

we-TAM-leave-FV Chola ‘we are leaving Chola’ [B07:172]

(10) The trigger of allomorphy: Subject markers (SMs)

a. SMs agree with the subject in noun class (and in number/person where applicable)

b. Individual SMs either have inherent high tone (H) or are toneless (Ø)

(11) Subject marker tonal minimal pair

a. \[ /\text{ú-a-mu-}_{\text{STEM}} \\text{fuk-il-il-e} \text{ } \text{H}^{2-} / \rightarrow [ \text{wáámúfükílé} ] \]

‘you (sg.) harvested for him/her’ [B07:8,280,282]

b. \[ /\text{u-a-mu-}_{\text{STEM}} \\text{fuk-il-il-e} \text{ } \text{H}^{2-} / \rightarrow [ \text{wàámúfükílé} ] \]

‘he/she harvested for him/her’ [B07:8]

(12) Table of SMs

<table>
<thead>
<tr>
<th>Classes</th>
<th>1SG</th>
<th>2SG</th>
<th>Cl.1 (3SG)</th>
<th>1PL</th>
<th>2PL</th>
<th>Cl.2 (3PL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2:</td>
<td>ñ-</td>
<td>ú-</td>
<td>a- ~ u-</td>
<td>tú-</td>
<td>mú-</td>
<td>yá-</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>classes:</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
</tr>
</tbody>
</table>

- gú- i- lí- yá- cí- ví- 1- zí-
- lú- ká- tú- gú- kú- pá- kú- mú-

(13) The target of allomorphy: Tense/Aspect/Mood (TAM) system and grammatical tone

a. \[ [ \text{V SM- (NEG-)} \text{TAM-} \text{[MACRO-STEM (OM-)} \text{[STEM ROOT (-DERIV) -TAM -FV} \text{ட]} ] ] \]

b. 0, 1, or 2 prefixes in pre-radical TAM position

c. 0 or 1 suffix in post-radical TAM position

d. Shape of the final vowel (-a/-e)

e. A floating high tone ḍ which associates within the stem
(14) Three-way grammatical tone (surface) minimal pair with toneless root /sukilil/ ‘accompany’

a. Past Inceptive(aa-...-a Ø

/ýá-aa-l st sukilil-a Ø/ ýá-aa-|ST sukilil-a [yáásúkililá]  
‘and then they started to accompany’ [B14:42]

b. Recent Perfect(á-...-a Ⓔ

/yá-á-|ST sukilil-á Ⓔ/ yá-á-|ST sukilil-á [yáásúkililá]  
‘they have just accompanied’ [B14:45]

c. Remote Perfect(a-...-a Ⓔ

/yá-á-|ST sukilil-á Ⓔ-F/ yá-á-|ST sukílí-á  
‘they have already accompanied’ [B14:48]

(15) Table showing restricted inventory of grammatical tones

<table>
<thead>
<tr>
<th>Group</th>
<th>TAM designation</th>
<th>Prefix</th>
<th>Suffix</th>
<th>FV</th>
<th>Gram. Tone</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. No grammatical</td>
<td>Past Inceptive</td>
<td>Ⓔ</td>
<td></td>
<td></td>
<td>Ø</td>
</tr>
<tr>
<td>tone</td>
<td>Contrastive Habitual</td>
<td></td>
<td>ma-áa-</td>
<td>-a</td>
<td>Ø</td>
</tr>
<tr>
<td>Persistive Potential</td>
<td>ngá-aa-</td>
<td>-a</td>
<td></td>
<td></td>
<td>Ø</td>
</tr>
<tr>
<td>Future Continuous</td>
<td>ka-áa-</td>
<td>-a</td>
<td></td>
<td></td>
<td>Ø</td>
</tr>
<tr>
<td>Future Progressive</td>
<td>la-áa-</td>
<td>-a</td>
<td></td>
<td></td>
<td>Ø</td>
</tr>
<tr>
<td>Hortative</td>
<td>áá-</td>
<td>-a</td>
<td></td>
<td></td>
<td>Ø</td>
</tr>
<tr>
<td>Immediate Future</td>
<td>máa-</td>
<td>-a</td>
<td></td>
<td></td>
<td>Ø</td>
</tr>
<tr>
<td>Present Progressive</td>
<td>ku-</td>
<td>-a</td>
<td></td>
<td></td>
<td>Ø</td>
</tr>
<tr>
<td>Habitual</td>
<td>káa-</td>
<td>-a</td>
<td></td>
<td></td>
<td>Ø</td>
</tr>
<tr>
<td>Persitve</td>
<td>cí-líí-</td>
<td>-a</td>
<td></td>
<td></td>
<td>Ø</td>
</tr>
<tr>
<td>b. High tone on final</td>
<td>Potential</td>
<td></td>
<td>ngá-</td>
<td>-a</td>
<td>Ⓔ</td>
</tr>
<tr>
<td>2nd to final</td>
<td>Far Past</td>
<td>a-</td>
<td>...-il</td>
<td>-e</td>
<td>Ⓔ</td>
</tr>
<tr>
<td>Far Past 2</td>
<td>a-cí-</td>
<td>...-il</td>
<td></td>
<td>-e</td>
<td>Ⓔ</td>
</tr>
<tr>
<td>Far Past Progressive</td>
<td>a-</td>
<td>...-ang</td>
<td>-a</td>
<td></td>
<td>Ⓔ</td>
</tr>
<tr>
<td>Remote Perfect</td>
<td>a-</td>
<td></td>
<td></td>
<td>-a</td>
<td>Ⓔ</td>
</tr>
<tr>
<td>Narrative Past</td>
<td>la-</td>
<td></td>
<td></td>
<td>-a</td>
<td>Ⓔ</td>
</tr>
</tbody>
</table>

(16) Tone is idiosyncratic property of the TAM designation

a. Bickmore (2007:254): “it does not seem possible to assign the [grammatical tone] any consistent meaning that it contributes the form”

(17) TAM designations which show no grammatical tone allomorphy
TAM designations with grammatical tone allomorphy

<table>
<thead>
<tr>
<th>Group</th>
<th>TAM designation</th>
<th>Prefix</th>
<th>Suffix</th>
<th>FV</th>
<th>Gram. Tone</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Grammatical tone allomorphy (conditioned by SM)</td>
<td>Yesterday Past</td>
<td>á-</td>
<td>-il</td>
<td>-e</td>
<td>$\Phi^F / \emptyset$</td>
</tr>
<tr>
<td></td>
<td>Yesterday Past Progressive</td>
<td>á-</td>
<td>-ang</td>
<td>-a</td>
<td>$\Phi^F / \emptyset$</td>
</tr>
<tr>
<td></td>
<td>Recent Perfect</td>
<td>á-</td>
<td>...</td>
<td>-a</td>
<td>$\Phi^F / \emptyset$</td>
</tr>
<tr>
<td></td>
<td>Recent Perfect 2</td>
<td>á-cí-</td>
<td>...</td>
<td>-a</td>
<td>$\Phi^F / \emptyset$</td>
</tr>
<tr>
<td></td>
<td>Recent Past Progressive</td>
<td>á-cí-</td>
<td>-ang</td>
<td>-a</td>
<td>$\Phi^F / \emptyset$</td>
</tr>
<tr>
<td></td>
<td>Recent Past</td>
<td>á-cí-</td>
<td>-il</td>
<td>-e</td>
<td>$\Phi^F / \emptyset^2$</td>
</tr>
<tr>
<td></td>
<td>Perfect</td>
<td></td>
<td>-il</td>
<td>-e</td>
<td>$\emptyset^2-F / \emptyset^2$</td>
</tr>
</tbody>
</table>

3 The relevant allomorphy patterns: Core data

(19) **First allomorphy pairing:** $\Phi^F/\emptyset$
   a. e.g. *Yesterday Past* á- ... -il -e $\Phi^F / \emptyset$

(20) Recall: **trigger** = SM, **target** = TAM grammatical tone

(21) **Toneless root** /fuk/ ‘harvest’ with *Yesterday Past (YP)*
   a. H-toned SM /ú-/ triggering $\Phi^F$
      / ú-á-mu- [STEM fuk-il-il-e] $\Phi^F$/ \ú-á-mu-fuk-il-il-[e] \ [wáámúfükille]\]
      SM-TAM-OM-harvest-APPL-TAM-FV TAM
      ‘you (sg.) harvested for him/her (yesterday)’ [B07:8]
   b. Toneless SM /u-/ triggering Ø
      / u-á-mu- [STEM fuk-il-il-e] $\emptyset$/ \u-á-mu-fuk-il-[e] \ [wàámúfükille]\]
      SM-TAM-OM-harvest-APPL-TAM-FV TAM
      ‘he/she harvested for him/her (yesterday)’ [B07:8]

(22) **High-toned root** /fúk/ ‘turn up hem’ with *Yesterday Past (YP)*
   a. H-toned SM /ú-/ triggering $\Phi^F$
      / ú-á-mu- [STEM fúk-il-il-e] $\Phi^F$/ \ú-á-mu-fúk-il-il-[e] \ [wáámúfúkille]\]
      SM-TAM-OM-turn.up.hem-APPL-TAM-FV TAM
      ‘you (sg.) turned up hem for him/her (yesterday)’ [B07:8]
   b. Toneless SM /u-/ triggering Ø
      / u-á-mu- [STEM fúk-il-il-e] $\emptyset$/ \u-á-mu-fúk-il-[e] \ [wàámúfúkille]\]
      SM-TAM-OM-turn.up.hem-APPL-TAM-FV TAM
      ‘he/she turned up hem for him/her (yesterday)’ [B07:8]
(23) Parallel behavior of class 1 (3SG) and class 4 /i-/ and 9 /i-/  

[X]  

| Class | Yesterday Past | Recent Perfect | Recent Past Progressive | Other  

|  3   | /gu-á-ful-il-e (H^F) / | /gu-á-ful-il-ë/ [wááfúzilé] | /i-á-ful-il-e (Ø) / | /i-á-ful-il-e / [yáafúzilé]  

|  4   | /i-á-ful-il-e (H^F) / | /i-á-ful-il-ë/ [lyáafúzilé] | /i-á-ful-il-e (Ø) / | /i-á-ful-il-e / [zyáafúzilé]  


|  9   | /i-á-ful-il-e (Ø) / | /i-á-ful-il-e / [yáafúzilé] | /i-á-ful-il-e (Ø) / | /i-á-ful-il-e / [zyáafúzilé]  

| 10  | /zi-á-ful-il-e (H^F) / | /zi-á-ful-il-ë/ [lyáafúzilé] | /zi-á-ful-il-e (Ø) / | /zi-á-ful-il-e / [zyáafúzilé]  


(24) Other (H^F)/Ø allomorphy: Same distribution, e.g. Yesterday Past Progressive  /á-...-ang-a/  

a. /tú-á-mu-léet-il-ang-a (H^F) / | /tú-á-mu-léet-il-ang-a/ [twáamúlététélàangà]  

SM-TAM-OM-bury-APPL-TAM-FV TAM  ‘we were bringing for him/her’ [B07:259]  
b. /u-á-mu-léet-il-ang-a (Ø) / | /u-á-mu-léet-il-ang-a/ [wààmúlélétàangà]  

SM-TAM-OM-bring-TAM-FV TAM  ‘he/she was bringing him/her’ [B07:260]  

(25) Recent Perfect /á-...-a/  

a. /vá-á-sópolol-a (H^F) / | /vá-á-sópolol-á/ [yáásópolólá]  

‘they have just untied’ [B14:45]  
b. /u-á-sópolol-a (Ø) / | /u-á-sópolol-a/ [wààsópolólà]  

‘he/she has just untied’ [B07:269]  

(26) Recent Past Progressive /á-cí-...-ang-a/  

a. /vá-á-cí-ful-ang-a (H^F) / | /vá-á-cí-ful-ang-a/ [yáácífúlààngá]  

‘they recently washing’ [B14:45]  
b. /u-á-cí-mu-ful-ang-a (Ø) / | /u-á-cí-mu-ful-ang-a/ [wààcímúfúlààngá]  

‘he/she was recently washing him/her’ [B14:45]  

(27) Second allomorphy pairing  

Recent Past: /á- cí-...-il-e (H^F) / (H^2)  

a. /tu-á-cí-STEM sópolol-il-e (H^F) / | /tu-á-cí-sópolol-il-ë/ [twáácísópolwíllé]  

SM-TAM-TAM-untie-TAM-FV TAM  ‘we recently untied’ [B14:49]  
b. /u-á-cí-STEM sópolol-il-e (H^F) / | /u-á-cí-sópolol-il-e/ [wààcísópolwíllé]  

SM-TAM-TAM-untie-TAM-FV TAM  ‘he/she recently untied’ [B14:49]  

(28) Third allomorphy pairing  

Perfect: /...-il-e (H^2-F) / (H^2)  

a. /tu-STEM ful-il-e (H^2-F) / | /tú-fúzil-ë/ [tíúfúzílé]  

‘we have washed’ [B07:293]  
b. /a-STEM ful-il-e (H^2-F) / | /a-ful-il-e/ [afúzilé]  

‘he/she has washed’ [B07:294]
(29) **Observation 1**: Non-local trigger and target – $H^F/H^2$ pairing

a. \( H \ H \ H \ H \) \( H^F \)  
   \( \text{tu-á-ci-sópolol-il-e} \) \( \text{twáácisópolwíllé} \) ‘we recently untied’ \[B14:49\]

b. \( O \ H \ H \ H \) \( H^2 \)  
   \( \text{u-á-ci-sópolol-il-e} \) \( \text{wàácisópolwíllé} \) ‘we recently untied’ \[B14:49\]

(30) **Observation 2** – First-last tone conspiracy: in all of the allomorphic TAMs, the first and last TBUs of the verbal phonological word have the same tonal value (either both H or both toneless)

(31) **Observation 3**: Other TAMs are unaffected by tone of SM

(32) **No** allomorphy with Far Past /a-...-il-e $H^2$-

a. /ú-a-mu-fuk-il-il-e $H^2$  
   \( \text{ú-a-mu-fuk-il-il-e} \) \( \text{wáámu Fukíllé} \) ‘you (sg.) harvested for him/her’ \[B07:8,282\]

b. /u-a-mu-fuk-il-il-e $H^2$  
   \( \text{u-a-mu-fuk-il-il-e} \) \( \text{wàámufkíllé} \) ‘he/she harvested for him/her’ \[B07:8\]

(33) **No** allomorphy with Potential /Øngá-...-a $H^F$/

a. /tú-Øngá-pón-a $H^F$/  
   \( \text{tu-Øngá-pón-a} \) \( \text{túungápóná} \) ‘we can fall’ \[B07:513\]

b. /a-Øngá-pón-a $H^F$/  
   \( \text{a-Øngá-pón-a} \) \( \text{ààngápóná} \) ‘he/she can fall’ \[B07:513\]

(34) **No** allomorphy with Past Inceptive /Øaa-...-a $Ø$/

a. /tú-Øaa-ful-a $Ø$/  
   \( \text{tu-Øaa-ful-a} \) \( \text{twááfúlà} \) ‘and then we started to wash’ \[B07:195\]

b. /a-Øaa-ful-a $Ø$/  
   \( \text{a-Øaa-ful-a} \) \( \text{ááfúlà} \) ‘and then he/she started to wash’ \[B07:196\]

4 **Debate: Morphology vs. Phonology**

(35) **Option 1**: Morphological account

(36) The prefix /á-/ co-varies with $H^F$–$Ø$ grammatical tone (table repeated from above)

<table>
<thead>
<tr>
<th>TAM designation</th>
<th>Prefix</th>
<th>Suffix</th>
<th>FV</th>
<th>Gram. Tone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yesterday Past</td>
<td>á-</td>
<td>...-il</td>
<td>-e</td>
<td>$H^F/Ø$</td>
</tr>
<tr>
<td>Yesterday Past Progressive</td>
<td>á-</td>
<td>...-ang</td>
<td>-a</td>
<td>$H^F/Ø$</td>
</tr>
<tr>
<td>Recent Perfect</td>
<td>á-</td>
<td>...-a</td>
<td></td>
<td>$H^F/Ø$</td>
</tr>
<tr>
<td>Recent Perfect 2</td>
<td>á-cí-</td>
<td>...-a</td>
<td></td>
<td>$H^F/Ø$</td>
</tr>
<tr>
<td>Recent Past Progressive</td>
<td>á-cí-</td>
<td>...-ang</td>
<td>-a</td>
<td>$H^F/Ø$</td>
</tr>
<tr>
<td>Recent Past</td>
<td>á-cí-</td>
<td>...-il</td>
<td>-e</td>
<td>$H^F/H^2$</td>
</tr>
<tr>
<td>Perfect</td>
<td>-il</td>
<td>-e</td>
<td></td>
<td>$H^2$–$H^2$</td>
</tr>
</tbody>
</table>
(37) **Grammatical tone suppletion:**

\[ \text{T:RECENT} \leftrightarrow \text{á-} \quad \text{H}^\text{F} / \quad \text{H}^\text{F} - \text{[SM]} \]

(38) **Paradigmatic contrast of /á-/ [RECENT] vs. /a-/ [REMOTE]**

a. Yesterday Past Obligative

\[ / \text{tú-á-lí (H}^\text{2-F} \text{) na ú-ku-lim-a} / \text{\空前ú-á-lí na ú-ku-lim-a} \quad \text{[twááli nú}\text{’kúlimà]} \]

\['we had to farm’, ‘we were to farm’ [B07:398]

b. Far Past Obligative

\[ / \text{tú-a-lí (H}^\text{F} \text{) na ú-ku-lim-a} / \text{\空前ú-a-lí na ú-ku-lim-a} \quad \text{[twááli nú}\text{’kúlimà]} \]

\['we had to farm’, ‘we were to farm’ [B07:399]

(39) **Remote vs. recent temporal parallels across TAM designations**

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Suffix</th>
<th>Remote Perfect</th>
<th>Far Past</th>
<th>Far Past Progressive</th>
</tr>
</thead>
<tbody>
<tr>
<td>/á- /</td>
<td>-Ø</td>
<td>Remote Perfect</td>
<td>Far Past</td>
<td>Far Past Progressive</td>
</tr>
<tr>
<td>/á- /</td>
<td>-il</td>
<td>Recent Perfect</td>
<td>Yesterday Past</td>
<td>Yesterday Past Progressive</td>
</tr>
<tr>
<td>/á-cí- /</td>
<td>-il</td>
<td>Recent Perfect 2</td>
<td>Recent Past</td>
<td>Recent Past Progressive</td>
</tr>
</tbody>
</table>

(40) **/-il/ expresses perfect aspect**

a. / tú-Ø-mu-ziik-il-e \( \text{(H}^\text{2-F}) \)/ \( \text{tú-mu-ziík-il-e} \) \( \text{[túmúziisílé]} \) ‘we have buried him/her’

b. / a-Ø-mu-ziik-il-e \( \text{(H}^\text{2}) \)/ \( \text{a-mu-ziík-il-e} \) \( \text{[àmùzììsílè]} \) ‘he/she has buried him/her’

(41) **Imperfective /-ang/ used transparently**

a. / ful-a \( \text{(H}^\text{2-F}) \)/ \( \text{ful-á} \) \( \text{[fülà]} \) ‘wash!’

b. / ful-ang-a \( \text{(H}^\text{2-F}) \)/ \( \text{ful-áng-á} \) \( \text{[fúlángá]} \) ‘keep washing!’ [B07:306]

(42) **[ASP:PERFECT]**

\[ \leftrightarrow -\text{il} \quad \text{H}^\text{F} / \quad \text{H}^\text{F} - \text{[SM]} \]

\[ \leftrightarrow -\text{il} \quad \text{H}^\text{2} / \quad \text{H}^\text{F} - \text{[’just’]} \]

\[ \leftrightarrow -\text{il} \quad \text{H}^\text{2} / \quad \text{H}^\text{2} \]

(43) **Brief aside: Issues of compositionality**

<table>
<thead>
<tr>
<th>TAM</th>
<th>Perfect</th>
<th>Remote Perfect</th>
<th>Far Past</th>
<th>Yesterday Past</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect</td>
<td>... - il ( \text{H}^\text{2-F} / \text{H}^\text{2} )</td>
<td>Perfect</td>
<td>... - il ( \text{H}^\text{2-F} / \text{H}^\text{2} )</td>
<td></td>
</tr>
<tr>
<td>Remote Perfect</td>
<td>a-... -il ( \text{H}^\text{2-F} )</td>
<td>Recent Perfect</td>
<td>á-... ( \text{H}^\text{F} / \text{Ø} )</td>
<td></td>
</tr>
<tr>
<td>Far Past</td>
<td>a-... -il ( \text{H}^\text{2-F} )</td>
<td>Yesterday Past</td>
<td>á-... -il ( \text{H}^\text{F} / \text{Ø} )</td>
<td></td>
</tr>
</tbody>
</table>

(44) “The -Ø-...-ile pattern occurs predominantly as a present anterior, where the reference point is the present or some other time established. Where it and -a-...-ile co-occur, -a-...-ile always indicates a time further removed, suggesting that a- is added to encode the past component. a-...-ile has often been recategorized from anterior to middle or far past perfective.” (Nurse 2008:157)
(45) **Option 2: Phonological account**

(46) Uniform realization rules (no allomorphy)
   a. [T:RECENT] ↔ á- \( \hat{\text{B}}^F \)
   b. [ASP:PERFECT] ↔ -il \( \hat{\text{B}}^{2-F} \)

(47) **First/last tone agreement**: For some domain D, the first/leftmost TBU \( \tau_{\text{FIRST}} (\tau_i) \) has the same tone value as the last/rightmost TBU \( \tau_{\text{LAST}} (\tau_L) \)

(48) **Uniform exponence** with [T:RECENT] ↔ /á- \( \hat{\text{B}}^F / \\
   a. / yá-á-sópolol-a \( \hat{\text{B}}^F \) / → yá-á-sópolol-á → [yáásópólóá] ‘they have just untied’ [B14:45]
   b. / u-á-sópolol-a \( \hat{\text{B}}^F \) / → u-á-sópolol-á → [wásópólóá] ‘he/she has just untied’ [B07:269]

(49) Bantu 'tonal harmony' or the 'Law of Initials and Finals' (Meeussen 1967, 1971; Hyman 2012)
   a. Meeussen's (1971:10) interpretation, with reference to Proto-Bantu:
      “Instead of tonal harmony at a distance, there is a repetition of the initial morpheme at the end of the word, but in such a way that it is reduced to mere [high] tone — except if this repetition is propped up by a pronominal (-e) or anaphoric (-o) support, as in Swahili”

(50) 'Morphologically-conditioned phonology' (Inkelas 2014 for an overview)
   a. Two responses in Turkish to *VV: glide epenthesis (majority), or vowel deletion
   b. / anla-Iver / 'understand-FACILITATIVE' → [ anla-juver ]
   c. / anla-Ijor / 'understand-PROGRESSIVE' → [ anl-uajor ]

(51) Morphologically-conditioned constraints (informal)

(52) **Note**: whatever the domain D is, not a known prosodic domain (e.g. phonological word)

**Relative clauses**: Specifically not the leftmost TBU, but rather the subject marker specifically
   a. / Ŷ-cí-á-ziiik-il-u-e REL-SM.7-REC-bury-PERF-PASS-FV → i-cí-á-ziiik-il-u-é → [ícááziíilwé] ‘that (C7) which was buried’
   b. / Ŷ-i-á-ziiik-il-u-e REL-SM.4-REC-bury-PERF-PASS-FV → í-i-á-ziiik-il-u-e → [íyááziíilwé] ‘they (C4) which were buried’
(53) **Interim summary** of two accounts

<table>
<thead>
<tr>
<th>MORPHOLOGICAL ACCOUNT</th>
<th>PHONOLOGICAL ACCOUNT</th>
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<tbody>
<tr>
<td><strong>Morph.</strong></td>
<td><strong>Phon.</strong></td>
</tr>
<tr>
<td>Irregular – Stored allomorphy</td>
<td>Regular – No stored allomorphs</td>
</tr>
<tr>
<td>[RECENT] ↔ á- $\overline{\mathbb{H}}^F$ / $H\tau$-[SM] ___</td>
<td>[RECENT] ↔ á- $\overline{\mathbb{H}}^F$</td>
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<td></td>
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<tr>
<td>Irregular – Morph.-conditioned phonology</td>
<td>Irregular – Morph.-conditioned phonology</td>
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5 Support for morphological account

(54) A **morphological account** essentially is a question about **suppletion**: *"The theory of contextual allomorphy in Distributed Morphology is, in effect a theory of suppletion"* (Embick 2010:43)

(55) Basis for assessing suppletion for Cilungu

a. **Phonological distance of forms**: two forms $F_1$ and $F_2$ are suppletive if they exhibit phonological distance past a threshold $T$, measured with respect to phonological structure

(e.g. Carstairs 1990:17; Bobaljik 2012:1; Borer 2013; Vafaeian 2013:114; Bauer 2016:341; Smith et al. 2019:1030)

b. **Uniqueness of alternation**: two forms $F_1$ and $F_2$ are suppletive if the alternation is not found in comparable morpho-phonological contexts

(e.g. Carstairs 1990:18; Mel'čuk 1994:390; Veselinova 2006:47ff.; Embick 2010:43; Inkelas 2014:153-154 fn5; Paster 2016:96)

c. **Phonological naturalness of alternation**: two forms $F_1$ and $F_2$ are suppletive if the alternation cannot be derived via a phonologically natural rule, e.g. with respect to phonological locality and typological precedence (Kiparsky 1996; Paster 2006, 2016)

(56) **Criterion 1: Phonological distance of forms**

Fairly straightforward in most cases: *a* vs. *an*, -heit vs. –keit, *good* vs. *bett*-, etc.

(57) How should we do this with floating tones which target specific positions?

(58) Abstract 'phantom structure' representations (Rolle & Lionnet 2020)

a. 'Substantive structure' (white), i.e. the actual phonological substance

b. 'Phantom structure' (gray with dashed outlined): 'desired' structure, a kind of 'blueprint' of what output structure should look like if material is (incidentally) supplied by other morphs

(59) Allomorphs of [RECENT] with phantom structure (in grey)

```
H       \ H
|       |
á      (\ t^* \ t) 
STEM
```

vs.

```
H
| 
á
```
Allomorphs of [PERFECT] with phantom structure (in grey)

 Hentai vs. Hentai

 “…phonological distance past a threshold T” – what should this threshold T be?

a. Strong vs. weak suppletion distinction (Dressler 1985)

b. Highly dependent on analysis of underlying representations: -il vs. -il

To test predictions of morphological theory, we need way to include and exclude potential cases

Criterion 2: Uniqueness of alternation
Alternation between two forms F1 and F2 not found in comparable morpho-phonological contexts

Boundedness of Cilungu patterns:

a. Bounded trigger: phonological identity of SMs and only SMs which trigger allomorphy

b. Bounded target: grammatical tone of certain TAMs and only these are target of allomorphy

Double-boundedness: Do we want to use phonology for this?

a. Irregular change: Alex does it / du + z / → [dʌ-z]

b. Bounded trigger: A list of do's and don'ts / du + z / → [du-z]

c. Bounded target: Alex brews it / bɪu + z / → [bɪu-z]

Morphologically-conditioned phonology:
Bulk of cases in Inkelas (2014) illustrate that the target by default is not bounded

Example of morphologically-conditioned phonology in Mam (Mayan - England 1983; Willard 2004; Inkelas 2014)

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. /luk-b'il/</td>
<td>[luk-b'il]</td>
</tr>
<tr>
<td>pull.up-INST</td>
<td>'instrument for pulling up'</td>
</tr>
<tr>
<td>/ooq-b'il/</td>
<td>[ooq-b'il]</td>
</tr>
<tr>
<td>cry-INST</td>
<td>'something which causes crying'</td>
</tr>
<tr>
<td>b. /toq-na</td>
<td>[toq-na]</td>
</tr>
<tr>
<td>break-PART</td>
<td>'broken'</td>
</tr>
<tr>
<td>/yuup-na</td>
<td>[yup-na]</td>
</tr>
<tr>
<td>put.out.PART</td>
<td>'put out'</td>
</tr>
<tr>
<td>/nooq-na</td>
<td>[noq-na]</td>
</tr>
<tr>
<td>fill-PART</td>
<td>'full'</td>
</tr>
</tbody>
</table>

Bounded trigger: The number of suffixes which trigger vowel shortening is limited

Target is not bounded: /-na/ is productive suffix
Criterion 3: Phonological naturalness of alternation
Must assess "the plausibility of the proposed rule", embedded within "a commitment to some formal model for which it is clear what constitutes an allowable operation, trigger, target, and so forth, so that the plausibility of a rule can be assessed" (Paster 2016:113)

First/last tone agreement: For some domain D, the first/leftmost TBU $\tau_{\text{FIRST}}$ ($\tau_F$) has the same tone value as the last/rightmost TBU $\tau_{\text{LAST}}$ ($\tau_L$)

Assess along three dimensions:
- Typological precedence of rule
- Learnability of rule in a laboratory setting
- Computational complexity of rule

1st] Typological precedence of rule:
- No case in large surveys of tone (Pike 1948; Fromkin 1978; Yip 2002; Hyman 2011; Wee 2019)
- No case in common historical changes affecting tones (Hyman & Schuh 1974; Hyman 2007)

2nd] Learnability of rule in a laboratory setting
- Artificial language designs to probe the learnability of first/last harmony rules
- For the most part, participants are unsuccessful (Lai 2012, 2015; Finley 2012, 2017; Avcu & Hestvik 2020)
- Finley (2012): Success with 'morphemic' patterns which "mark a distinction between singular and plural", e.g., $\text{kidat}$ (SG) vs. $\text{gidad}$ (PL), $\text{topak}$ (SG) vs. $\text{dopag}$ (PL), etc.

3rd] Computational complexity: Principled reason why such a pattern is phonologically unnatural, namely that its computational properties exceed that of natural phonological patterns
Chomsky Hierarchy (Heinz 2010, Lai 2015, Avcu 2020):

Phonology: outer limit are still deeply embedded
a. Common phonological rules can be modeled with subregular relations
b. Such as epenthesis, metathesis, and deletion (Chandlee 2014)

Sub-regular hypothesis
a. **Strictly Local & Tier-Based Strictly Local:**
e.g. vowel harmony CVCVCVC → ĊV ĊV ĊV (on different tiers)
b. **Strictly Piecewise:** subclass of regular languages which encode certain kinds of long-distance dependencies that are found in natural languages (Heinz & Rogers 2010)

c. A particularly clear explanation: "The Strictly Piecewise (SP) languages differ minimally from the [Strictly Local] SL languages in that they are described with grammars of subsequences of length $k$ instead of substrings. The difference is that a subsequence is not necessarily contiguous. So the substrings of length 2 of the string $abca$ include \{#a, ab, bc, ca, a#\}, while the subsequences of length 2 include \{a...b, a...c, a...a, b...c, b...a, c...a\}. In other words, subsequences encode restrictions in terms of precedence instead of contiguity."

(Chandlee 2014:143-144 – formatting original)
(80) **How would first/last tone harmony be different?**
  b. Non-assertive verb stems: Limited to H-toned vs. L-toned on initial V; all else predictable
  c. Superficially a first-last pattern: Both positions tonally identical

(81) **Karanga Shona**

<table>
<thead>
<tr>
<th>σ°</th>
<th>1σ</th>
<th>2σ</th>
<th>3σ</th>
<th>4σ</th>
<th>5σ</th>
<th>6σ</th>
<th>7σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. H-toned roots:</td>
<td>H</td>
<td>HL</td>
<td>HLH</td>
<td>HHLH</td>
<td>HHHLH</td>
<td>HHHLLH</td>
<td>HHHLLLH</td>
</tr>
<tr>
<td>b. L-toned roots:</td>
<td>H</td>
<td>HL</td>
<td>HLH</td>
<td>LHH</td>
<td>LHHLL</td>
<td>LHHLLL</td>
<td>LHHLLLL</td>
</tr>
</tbody>
</table>

(82) Jardine (2020): Can be captured using strictly local terms
  a. Contiguous **forbidden substrings**
  b. Forbidden melody set: A **finite** set {#HL*, HLHL, LHLH} (on the tone tier)
  c. No direct appeal to long-distance first/last harmony

(83) Compare Cilungu patterns
  b. Cannot be expressed via a **finite** set of forbidden substring constraints
  c. 'Melodies of these can strings can be arbitrarily long...: mldy(HLHL) = HLHL,
     mldy(HLHLHL) = HLHLHL, mldy(HLHLHLHL) = HLHLHLHL, ad infinitum'

(84) Despite the fact that it is possible to model such a pattern with OT constraints, it will never arise due
to cognitive/UG restrictions

6 **Implication: Outward-looking phonologically-conditioned allomorph**

(85) What are the implications of Cilungu grammatical tone being treated as suppletion?

(86) Returning to our original characterizations:
  a. **Phonologically-conditioned allomorphy (PCA)** – multiple underlying forms of the same
     morpheme whose distribution is conditioned based on phonological environment
  b. **Directionality** – The directional relation (inward, outward) of the target of allomorphy with
     respect to the **trigger** of the allomorphy, dictated by the morphosyntactic structure

(87) PCA
  a. [T:RECENT] ↔ á- [H] [F] / H—τ—[SM] __
  b. [ASP:PERFECT] ↔ -il [H] [2-F] / H—τ—[SM] __

(88) Directionality
  a. RECENT [V SM- [MACRO-STEM (OM-) [STEM ROOT (-DERIV) -ASP -FV [T]]]]
  b. PERFECT [V SM- T- [MACRO-STEM (OM-) [STEM ROOT (-DERIV) -ASP -FV [T]]]]
Arguments for outward-looking PCA

a. With respect to linear structure, T and Asp appear closer to the root than SMs
b. With respect to syntactic structure, Agreement nodes are higher compared to TAM nodes
c. With respect to morphological constituency, aspetual suffixes are in an inner constituent (the stem) compared to SMs
d. With respect to the prosodic domains, grammatical tone affects only an inner constituent (again, the stem), evidenced in the $\Theta^{2-F}$ and $\Theta^{2}$ cases

Syntax of Bantu verbs:

a. **Makhuwa-Enahara** (Van der Wal 2009:168)
   
   kha-ni-ń-lówa   ehópa
   
   NEG-1PL-PRES-fish.DJ 9.fish
   
   ‘we don’t catch fish’

b. Polarity (NEG), agreement (1PL), and tense (PRES) spelled-out as prefixes

```
NegP /
    /
    kha- AgrSP
    /
    /   TAM
    /
    /   AspP
    /
    /   vP
    /
    /   t\ehópa
```

c. AGR $\geq$ T $\geq$ ASP (Bybee 1985:35; Chomsky 1989:68ff; Belletti 1990; Speas 1991:183ff; Harford 2008; Cinque 2014)

Does subject agreement constitutes a separate projection in verbal syntax?

a. Pietraszko (2018): A phi-feature bundle $[\varphi]$ under the highest head of the projection, e.g. T
b. Insertion of ‘ornamental’/‘dissociated’ morphology, quite common within DM analyses
   

c. Issues of node-counting vs. XP-counting (Myler 2017)

So… **why typologically vanishingly rare**: Paster (2009) presents a typological survey of 137 instances of PCA, and finds that “135 indisputably have ‘inside-out’ conditioning”

And… **insightfully linked to procedure of exponence** (Bobaljik 2000; Embick 2010, 2015; Arregi et al. 2013; *i.a.)

a. Terminal nodes spelled out cyclically – most deeply embedded node, moving outwards
b. Inner VIs (exponed earlier) would have no access to the phonological features of outer VIs

**Response 1 – Exponent still one rule at a time**

a. May not respect linear order (Myler 2017, Kalin 2020)
b. May not respect hierarchical structure (Deal & Wolf 2017)
c. Or may not for neither (Hannahs & Tallerman 2006:810)
Response 2 – Simultaneous exponence: Within relevant domain, all exponence is at once

Exponence targets larger constituents, e.g. Nanosyntax (Starke 2009; Caha 2009; Svenonius 2016; i.a.)

a. ‘Spanning’: expone multiple syntactic heads at once
b. A prerequisite is access to multiple heads simultaneously
c. If we allow multiple heads exponed as one unit (many-to-one exponence), why not expone multiple heads as multiple units (many-to-many exponence, i.e. simultaneous exponence)

7 References


Appendix 1: Phonological account implementation

(97) Tone and Agreement by Correspondence (Shih & Inkelas 2018)
   a. Propose capturing tone spreading, plateauing, absorption, polarity, contour tone copying, among other tonal phenomena using the same ABC formalisms

(98) First/last tone agreement in TAM Recent Perfect /á-...-a/
   a. /yá-á-sukilil-a \(\mathbb{H}^F\) / → yá-á-sukilil-á → yá-á-sukilil-á → [ yáásúkililá ]
      'they have just accompanied' [B14:45]
   b. /u-á-sópolol-a \(\mathbb{H}^F\) / → u-á-sópolol-á → u-á-sópolol-a → [ wàásópolólà ]
      'he/she has just untied' [B07:269]

(99) Standing similarity between edges:
   a. Edge TBUs by virtue of being at a domain edge are sufficiently similar to one another
   b. Lai (2015), Heinz (2018), and Jardine (2020) all highlight that edge positions are articulatorily and perceptually prominent; many phonological generalizations reference them

(100) Adjusting their constraints for Cilungu first/last harmony
   a. CORR-\(\tau_F\tau_L\): the first (\(\tau_F\)) and last (\(\tau_L\)) TBUs within the domain D are in correspondence
   b. IDENT-\(\tau_F\tau_L(T)\): TBUs in correspondence have the same tone value (both H or both toneless)
   c. DEP-IO(H): all H tonemes in the output have correspondents in the input (i.e. don't insert H)
   d. MAX-IO(H): all H tonemes in the input have correspondents in the output (i.e. don't delete H)
9 Appendix 2: More on experimental studies on learning first/last rules

Lai (2015) experiment
a. 'Sibilant Harmony' (an attested pattern): All sibilants in a word must be identical ([s…s…s], [ʃ…ʃ…ʃ], *[s…s…ʃ])
b. 'First-Last Assimilation' (unattested): First and last sibilants must be identical, but intervening sibilants can be of any type ([s…ʃ…s], [ʃ…s…ʃ], *[ʃ…s…s])

Predictions are met: "Intensive First-Last participants definitely failed to internalize the First-Last Assimilation grammar that was intended in this study", showing that "First-Last Assimilation is harder to learn than Sibilant Harmony" (Lai 2015:445)
(104) Avcu & Hestvik (2020): largely replicated Lai's findings though not entirely
   a. Observed "a residual sensitivity to the [First-Last Assimilation] rule in the [First-Last] and [Intensive First-Last] groups, which contradicts Lai’s previous conclusion" (p. 15)
   b. But, in fact, interpret this as an artifact of the laboratory learning situation rather than reflecting linguistic-specific learnability