Notion of ‘spell-out’ invoked in discussing linguistic interfaces across disciplines

a. Syntax e.g. Minimalism/Generative syntax

b. Morphology e.g. Distributed Morphology

c. Phonology e.g. Match Theory, Direct vs. Indirect Interface debates

This has left the field of interface studies – and particular ‘interface-ists’, e.g. Scheer 2011 – wondering how to fit it all together

Big picture questions: what constitutes spell-out? and is spell-out (i) serial and rule-based, (ii) parallel and constraint-based, (iii) something else/in-between?

I argue / have argued for a hybrid OT-DM framework, which has commitments both to a realizational, syntax-driven morphology but also constraint-based parallelism

But more interesting…: what can looking at post-syntax as a parallel and optimizing system get us? What are its predictions and how do they pan out?

Three predictions:

a. Outward-looking phonologically-conditioned allomorphy

b. No opacity at spell-out

c. No access to syntax post-spell-out

Roadmap:

a. What is an OT-DM framework?

b. A case study of Cilungu tonal allomorphy which looks like outward-looking phonologically-conditioned allomorphy (though it’s complicated…)

Take away point: spell-out is a mapping between modules, and post-syntactic operations themselves constitute the substance of this mapping

---

1 Thank you to my colleagues Laura Kalin, Byron Ahn, Sam Zukoff, and Florian Lionnet for initial feedback, and many others at Princeton and Berkeley for talking to me over the years.
1 AN OT-DM FRAMEWORK

1.1 A rocky start…

OT & morphology theory: In many approaches to morphology, an OT model and parallelism have been welcomed

[Cophonology Theory - Inkelas & Zoll 2007; Optimal Construction Morphology - Cabellero & Inkelas 2013; Stratal OT - Kiparsky 2015; see summary of OT approaches to morphology in Xu 2016]

Optimality Theory and Distributed Morphology – emerging in the same (North American) generative period in the 90s – are assumed to be at odds with one another

a. Embick (2010:ix) - DM “is incompatible with the dominant view in phonological theory, Optimality Theory (OT), which posits competition among infinite sets of complex objects” [emphasis mine; see also observations by Tucker 2011:200]

Since their respective inceptions, however, there have been many rumblings regarding the relationship between OT and DM (or at least some principle belonging to one or the other), and even some recent nascent debates


A cline from DM to OT:

(1) DM
(2) R&C-DM
(3) OT-DM
(4) OT-CC/OI
(5) OT

(1) Distributed Morphology (DM)

(2) Rules & Constraints Distributed Morphology R&C-DM
[Arregi & Nevins 2012]

(3) Optimality-Theoretic Distributed Morphology (OT-DM)

(4) OT with Candidate Chains (OT-CC) / Optimal Interleaving (OI)

(5) Optimality Theory (OT)
R&C-DM effectively use constraints to provide insight into and a trigger for specific post-syntactic operations:

“In order to capture the pandialectal fact that certain combinations of participant clitics are targets of Impoverishment, we propose that Participant Dissimilation rules are triggered by the following markedness constraint:

**Syntagmatic Participant Markedness**

An auxiliary M-word cannot contain two clitics $C_{l_1}$ and $C_{l_2}$ such that $C_{l_1}$ is specified as [+participant, $\Phi$] and $C_{l_2}$ is specified as [+participant, $\Psi$]”

[Arregi & Nevins 2012:214, emphasis mine]

**Optimality-Theoretic Distributed Morphology (OT-DM)**

a. **Only constraints, no rules**: Post-syntactic operations are decomposed into a series of constraints which apply in parallel

b. All aspects of DM are maintained, except rule-based seriality

c. Other than OT-DM, another name you could call it is: (Modular) Item-Based Realizational Non-Lexicalist Syntax-Driven Phonology-Free Optimality-Theoretical Morphology [(M)IBRNLSDPFOTM]

### 1.2 The substance of spell-out

Broadly, the mapping of syntactic structure to a phonological representation

Its purpose can be understood to ‘externalize’ an internal linguistic construction for communicative intent (at least on the PF side of things)

[Why it doesn’t map directly to motor planning and articulation is a separate question…]

**Y-Model of grammar (or ‘T-model’)**


**Morpho-syntactic module** maps to **morpho-phonological module** at spell-out
Input-output components of spell-out [Rolle 2018]
a. /S/ is the input - the ‘syntactic image’
b. \Ƨ\ is the output - the ‘phonological image’

Morpho-syntactic module:

a. Primitives taken from the feature lexicon, bundles of morphosyntactic features
   (‘SynSem features’ in Embick 2015:34) [Narrow Lexicon - Marantz 1997:204; List A - Harley & Noyer
   1999; List I - Harley 2014; List of Syntactic Atoms - Bobaljik 2017]
b. Syntactic structure built up cyclically via Merge, proceeds bottom-up/inside-out

Morpho-phonological module:

a. Ample evidence for cyclicity (or at least cyclic effects), catalogued in detail in
   Inkelas (2014:189-241)
   Hyman 2017; a good, recent discussion piece in Kastner 2018, a.o.]
   ['Obligatory inheritance’ of a previous cycle, i.e. that ‘later evaluations [are forced] to inherit the results of earlier ones’
   Steriade 2012:4]

An inside-out characterization of cyclicity is the most-common position across many
subfields, frameworks, modules, and phenomena
[Carstairs 1987; Bobaljik 2000; Carstairs-McCarthy 2001; Embick 2010:42; Bermúdez-Otero 2011; a.o.]

Spell-out primarily involves the ‘actuation of phonology’

<table>
<thead>
<tr>
<th>Spell-out operation</th>
<th>Provides</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Vocabulary insertion</td>
<td>Phonological substance (primitives)</td>
</tr>
<tr>
<td></td>
<td>[phonemes, tonemes, autosegments, etc.]</td>
</tr>
<tr>
<td>b. Linearization</td>
<td>Phonological precedence</td>
</tr>
<tr>
<td></td>
<td>[basic morph order]</td>
</tr>
<tr>
<td>c. Prosodification</td>
<td>Phonological constituency</td>
</tr>
<tr>
<td></td>
<td>[metrical structure, prosodic words, prosodic phrases, etc.]</td>
</tr>
<tr>
<td>d. Hierarchy exchange</td>
<td>Scope of phonological operations</td>
</tr>
<tr>
<td></td>
<td>[scope/order of the application of phonological rules]</td>
</tr>
</tbody>
</table>

Vocabulary items (i.e. the morphs associating form to meaning) are inserted via
vocabulary insertion (taken from Vocabulary), in the curly bracketed objects { } – each
labelled for reference {VI}, i.e. {DOG} [Articulated VI structure in Sande & Jenks 2017, Rolle 2018]

Interface literature ripe with numerous, less-phonological spell-out operations

a. Bundle manipulation – e.g. ‘fusion’, ‘fission’, insertion/deletion of
   morphosyntactic features (e.g. via ‘dissociated node insertion’, ‘enrichment’,
b. Syntax-like operations such as DM’s ‘lowering’ (movement of X⁰ down to its
   closest head it c-commands), or its counterpart ‘raising’
c. **Economy conditions** (e.g. multiple copy resolution, deletion-under-identity, e.g. suspended affixation) [Booij 1985, Kabak 2007, Merchant 2012, Guseva & Weisser 2018]

Not to mention where intonation/prosodic correlates of information structure fit in…

### 1.3 Morphology-in-parallel hypothesis (MIPH)

Post-syntactic operations apply in parallel in a constraint-based architecture

a. One interaction of operations which apply simultaneously to ‘actuate’ phonology

b. This does not preclude the possibility of multiple cycles of spell-out (i.e. ‘phases’)

Spell-out (and by extension morphology) itself is not a module

a. Cf. Paradigm Functional Morphology (PFM) where ‘morphology is an autonomous system’ [Bonami & Stump forthcoming]

### Morphology-in-parallel hypothesis (MIPH)

The substance of spell-out are a set of post-syntactic ‘operations’ which map a syntactic image / S / to an optimal phonological image \( \Lambda \), applying in parallel within an OT architecture (involving morphological CON, EVAL, GEN, etc.)

<table>
<thead>
<tr>
<th>I: / S / : Syntactic image</th>
<th>SPELL-OUT CONSTRAINT SET (MORPHCON)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LINEARIZATION (Family)</td>
</tr>
<tr>
<td></td>
<td>PROSODIFICATION (Family)</td>
</tr>
<tr>
<td></td>
<td>VOCABULARY INSERTION (Family)</td>
</tr>
<tr>
<td></td>
<td>HIERARCHY EXCHANGE (Family)</td>
</tr>
<tr>
<td></td>
<td>BUNDLE MANIPULATION (Family)</td>
</tr>
<tr>
<td></td>
<td>ECONOMY (Family)</td>
</tr>
<tr>
<td></td>
<td>MORPHOLOGICAL MARKEDNESS</td>
</tr>
<tr>
<td>O₁:  ( \Lambda_1 )</td>
<td>Phonological image candidates</td>
</tr>
<tr>
<td>O₂:  ( \Lambda_2 )</td>
<td></td>
</tr>
<tr>
<td>O₃:  ( \Lambda_3 )</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>

**An aside on OT-Syntax:**

I have no definitive opinion or stake at this point as to whether the syntactic module itself has an OT(-like) architecture [Grimshaw 1997a, 1997b, 2013, Legendre et al. 2001, Bresnan 2001, Broekhuis & Vogel 2013, Legendre et al. 2016; see recent argumentation and background in Murphy 2019 exploring cross-modular parallelism]
Statements like “…happen after spell-out”, or “…happen before spell-out” are therefore replaced by “…happen at spell-out” (or at least the more neutral “…during spell-out”)

**Challenge:** Regardless of assessing OT-DM’s intellectual merits, how to make it practical…

---

**2  WHY AN OT-DM FRAMEWORK?**

**2.1  Stronger commitment to a modular conception of grammar – or… Understanding the ‘translator’s office’ in ‘Modular no man’s land’**

**Modularity** – a major focus of Scheer’s (2011, and monumental) *A guide to morphosyntax-phonology interface theories*


a. “Modularity is one of the deepest layers of generative thinking…: in the 50s, Noam Chomsky participated in the development of the general computational paradigm (Turing - von Neumann, see § 603) that underlies much modern science and grew into the standard paradigm of how the mind works (Cognitive Science). …[T]he modern formulation of modularity is due to Fodor (1983). Language takes a prominent place in Fodor's book, which has grown out of a class co-taught with Chomsky.” [Scheer 2011:24]

b. “The modular perspective holds that grammatical activity – as other cognitive faculties – is organised in terms of a number of ontologically distinct, non-teleological and specialised computational systems: the modules. Modules are domain specific and encapsulated (§ 610). That is, they are devoted to a specific task, which they carry out using a specific vocabulary. Since they are ontologically distinct and speak different languages (of the mind), they are unable not understand, or even parse, what is going on in other modules.” [Scheer 2011:347]

---

**Two key principles of modularity** [After Scheer 2011:523-527, citing Segal 1996:145, a.o.]

a. Domain specificity with ‘specified vocabulary’ (i.e. different primitives)

b. Information and operations are encapsulated (i.e. modules are autonomous)

[“[T]he output is produced in complete disregard of any module-external information such as high-level expectations, beliefs (coming from the central system), memory, inference and attention or results of other modules” Scheer 2011:524]

---

**The simplest conception (which I take to be the default / null hypothesis) is that there are two modules at this juncture of grammar: syntax and phonology**

a. Spell-out itself is not a module, but rather a mapping between two modules, i.e. the ‘translator’s office’ within ‘modular no man’s land’ [Scheer p. 351-352]
Scheer (p. 622) attempts to make sense of Minimalism/DM discussion of “PF”:

Scheer discussing ‘PF movement’ in particular:

“...there is trouble with computation B...: computation B would have to access the morpho-syntactic labels of the tree, the tree geometrics and phonological vocabulary at the same time. Also, the tree labels would be the projection of nothing: on standard assumptions hierarchical structure is a projection of terminal elements. In a PF movement tree, however, phonological terminals would cohabit with morpho-syntactic structure and labels: this does not make any sense. Computation B is thus a modular alien.” [Scheer 2011:622, emphasis mine]

Concludes that “DM thus turns out to be a strong modularity offender” [p. 624]

In short, an intermediate representation at spell-out would require a mixed representation which is half-phonological information, half-syntactic information - this violates modularity
Cf. Embick 2015 Vocabulary insertion stages

a. “A standard assumption in Distributed Morphology is that Vocabulary Insertion applies from the inside out. This means that Vocabulary Insertion applies first to the most deeply embedded structural position in a complex head and proceeds outwards, producing what is sometimes referred to as cyclic insertion.”

b. “On the assumption that the Root has a phonological form underlyingly,

c. Vocabulary Insertion applies first at the v node, inserting -ize

d. after this, Vocabulary Insertion applies at the T[+past] node, and inserts –ed”

OT-DM circumvents this issue by making spell-out (and to a large extent, morphology itself) a mapping between modules, with no potential intermediate stages (at spell-out)

Another response it taken by Arregi & Nevins (2012:4), which circumvents this problem in a different way

a. Serial modular architecture w/r/t Basque auxiliaries

b. Rather than directly map syntax to phonology (module-to-module), there are a number of sub-modules between

[Cf. also Idsardi & Raimy’s 2013 four modules: (1) narrow syntax, (2) morphosyntax, (3) morphophonology, and (4) phonology]
2.2 Morphological conspiracies

Conspiracy: where rules with dissimilar inputs, outputs, and/or environments result in surface forms which all converge on or avoid a specific structure

[Kisseberth 1970, 2011; Prince & Smolensky 2004 [1993]; Kager 1999: Sec. 2.1.1.2; McCarthy 2002: Sec.3.1.4.3; 2008: 1-12; Bermúdez-Otero & Börjars 2006: 720; Wolf 2008, 2013; Murphy 2019; a.o.]

See Appendix 3

3 THE CRITICAL ISSUE: WHAT ARE THE DIFFERENT PREDICTIONS?

Predictions of an OT-DM framework

a. Simultaneous Insertion

Commitment 1 – Within a spell-out domain, all morphemes are replaced by vocabulary items simultaneously

Prediction 1 - Outward-looking phonologically conditioned allomorphy (PCA) should in principle be allowed and empirically attested

b. Opacity Restrictions

Commitment 2 – Within a spell-out domain, all morphological operations take place simultaneously in parallel

Prediction 2 - Opacity is an artefact of cyclicity, and thus should be limited to (i) the syntactic module, (ii) the phonological module, or (iii) inter-cyclic spell-out domains (e.g. phases)

There should be no opacity between morphological operations which take place during a given instance of spell-out

c. Syntax Insensitivity

Commitment 3 – Post-spell-out, there is no sensitivity to any aspect of the syntax, e.g. syntactic features, labels, positions (e.g. spec vs. comp), constituents (i.e. trees), relations (e.g. c-command), operational histories (e.g. moved elements)

[This follows Module Encapsulation, as above]

Prediction 3 – No aspect of phonology (its primitives and operations) is sensitive to syntactic information, only to that which is ‘translated’ at spell-out

[This should hold for later modules, too – e.g. a Phonetics module cannot refer to syntactic information]

3.1 Prediction 1 - Outward-looking phonologically conditioned allomorphy (PCA)

A growing (but still small) body of literature devoted to the subject, and the jury is out… but more on ‘no’ than ‘yes’ side (and definitely on the ‘no’ side typologically-speaking)

English *a* vs. *an* – inward sensitive to phonological condition (i.e. *C* vs. *V* initial)

a. **English** (inward-sensitive)  
   
   `a` cat  
   `an` upstanding cat  
   `an` ocelot  
   `a` terrible ocelot

b. **Martian** (outward-sensitive)  
   
   `one at` /wan/ `at`  
   `two cats` /u/ `cat-s`  
   `three cats` /θi/ `cat-s`  
   `four ats` /fo/ `at-s`

Syllable-counting allomorphy exists - e.g. as found throughout Panoan, Uralic, a.o. - but it is always only **inward-sensitive** [e.g. Embick’s 2010:166ff criticism – nothing which looks **outward-sensitive**]

What to look for: cases where one cannot resolve inner allomorphy until something about an outer morph becomes activated/visible at spell-out

### 3.2 Tonal allomorphy in Cilungu  *Rolle & Bickmore in progress*

What has been left virtually unexplored is examining directionality effects in PCA using tonal exponence, i.e. the realization of a grammatical category either totally or partially via tone/tonemes


Interaction between the exponents of **TAM** (*tense/aspect/mood*) [the target] and the **SM** (*subject marker*) [the trigger] within complex verbal structures

\[
\text{[V SM NEG TAM [MS OM [s [B ROOT DERIV ] TAM FV ] ] ]}
\]

( \(\text{[MS = macrostem ; [s = stem ; [B = base ; V =verb ; OM = object marker ] } \text{[See structure of the Bantu verb - Meeussen 1967]}

**Tonal contrasts**: Cilungu has a basic H vs. Ø tonal contrast, used both lexically and grammatically (with L by default)

**Expressing TAM**: TAM’s are exponed through a unique combination of:

a. 0, 1, or 2 prefixes
b. 0 or 1 suffix
c. The shape of the final vowel (-a/-e)
d. A unique grammatical tone pattern which appears on the verbal stem [‘Melodic Highs’]

**Grammatical tone patterns**

a. Ø  
   No grammatical tone  
   \(\text{[s τ τ τ τ ]}\)
b. \(\text{H}_{\text{FIN}}\)  
   H tone docks to the final TBU of the stem  
   \(\text{[s τ τ τ τ ]}\)
c. \(\text{H}_{2-\text{FIN}}\)  
   H tone docks to the 2nd to final TBUs of stem  
   \(\text{[s τ τ τ τ ]}\)
d. \(\text{H}_{2}\)  
   H tone docks to the 2nd TBU of the stem  
   \(\text{[s τ τ τ τ ]}\)
The road or the door to exponence?

Nicholas Rolle

TAM grammatical tone - minimal pairs [Bickmore 2014:42,45,48]

a. Past Inceptive: aa-…-a-Ø
   /yá-aa-sukilil-Ø/  [yá-á-súkílíl-à] ← Unbounded spreading
   ‘and then they started to accompany’

b. /yá-aa-sukilil-Ø Choola/
   [yá-á-súkìlìl-à Chòòlà]  cf.
   ‘and then they started to accompany Chola’  ↵  Binary H tone spreading (general)

c. Recent Perfect: á-…-a-Haunted
   /yá-á-sukilil-a-Haunted/  [yá-á-súkìlìl-à]
   ‘they have just accompanied’

d. Remote Perfect: á-…-a-2-FIN
   /yá-á-sukilil-a-2-FIN/  [yá-á-sùkílíl-à]
   ‘they have already accompanied’

Tense/aspect exponed through several sub-exponents [Bickmore 2007, 2014]

<table>
<thead>
<tr>
<th>TAM</th>
<th>Exponence</th>
<th>TAM</th>
<th>Exponence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistive Potential</td>
<td>nga-aa-…-a-Ø</td>
<td>Far Past</td>
<td>a-…-il-e-2-FIN</td>
</tr>
<tr>
<td>Past Inceptive</td>
<td>aa-…-a-Ø</td>
<td>Far Past</td>
<td>a-…-ang-a-2-FIN</td>
</tr>
<tr>
<td>Contrastive Habitual</td>
<td>ma-áaa-…-a-Ø</td>
<td>Remote Perfect</td>
<td>a-…-a-2-FIN</td>
</tr>
<tr>
<td>Future Continuative</td>
<td>ka-áaa-…-a-Ø</td>
<td>Narrative Past</td>
<td>…-a-2-FIN</td>
</tr>
<tr>
<td>Future Progressive</td>
<td>la-áaa-…-a-Ø</td>
<td>Remote Future</td>
<td>la-…-a-2-FIN</td>
</tr>
<tr>
<td>Hortative</td>
<td>áa-…-a-Ø</td>
<td>Potential</td>
<td>ngá-…-a-2-FIN</td>
</tr>
<tr>
<td>Immediate Future</td>
<td>már-…-a-Ø</td>
<td>Recent Perfect</td>
<td>á-…-a-2-FIN</td>
</tr>
<tr>
<td>Habitual</td>
<td>káa-…-a-Ø</td>
<td>Yesterday Past</td>
<td>á-…-ang-a-2-FIN</td>
</tr>
<tr>
<td>Present Progressive</td>
<td>kù-…-a-Ø</td>
<td>Progressive</td>
<td></td>
</tr>
<tr>
<td>Persitve</td>
<td>có-li-…-a-Ø</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“The first important thing to be noted is that the various TAMs … do not seem to have anything in common semantically. Thus, it does not seem possible to assign the MH any consistent meaning that it contributes the form.” [Bickmore 2007:254]

I take these floating grammatical tones to therefore be co-exponents of TAMs

Subject markers appear before verbs – i.e. the blue morphs above [Bickmore 2014:45]

Subject Markers

<table>
<thead>
<tr>
<th>Subject Markers</th>
<th>1SG</th>
<th>2SG</th>
<th>3SG</th>
<th>CL2</th>
<th>1PL</th>
<th>2PL</th>
<th>3PL</th>
<th>CL3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>…</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ñ-</td>
<td>ú-</td>
<td>u- / V</td>
<td>; a- / C</td>
<td>tú-</td>
<td>mű-</td>
<td>yá-</td>
<td>gu-</td>
<td>i-</td>
<td>lí-</td>
<td>yá-</td>
<td>cí-</td>
<td>ví-</td>
<td>i-</td>
<td>zí-</td>
<td></td>
</tr>
</tbody>
</table>
b. All SMs except three bear a high tone underlyingly

c. Those which do not consist of 3SG u-/a-, class 4 i-, and class 9 i-

d. These three markers do not form a morpho-syntactically natural class

[60] In the majority of TAMs, the tonal value of the subject marker does not affect the TAM’s associated grammatical tone

a. However, in three TAMs, high tone SMs condition one pattern while low tone SMs another: the *Yesterday Past*, the *Recent Past*, and the *Perfect*

[61] **Outward-looking tone-conditioned PCA (?)**:


[63] A minimal pair with *Yesterday Past*

a. High-toned \( u \)- 2SG conditions a grammatical tone \( \text{FIN} \) at the right edge

b. Non-high-toned \( u \)- 3SG does not

[64] **Yesterday Past**: \( \text{á-} \ldots \text{-il-e-FIN} \)  

[Bickmore 2007:8]

a. /ú-á-mu-fük-il-e-FIN/ \( \rightarrow \) [w-áá-mú-fük-ilé]  
‘you (sg) harvested for him/her (yesterday)’

b. /u-á-mu-fük-il-e-Ø/ \( \rightarrow \) [w-àà-mú-fük-ilél]  
‘he/she harvested for him/her (yesterday)’

c. /ú-á-mu-fük-il-e-FIN/ \( \rightarrow \) [w-áá-mú-fük-ilél]  
‘you (sg) turned up hem for him/her (yesterday)’

d. /u-á-mu-fük-il-e-Ø/ \( \rightarrow \) [w-àà-mú-fük-ilél]  
‘he/she turned up hem for him/her (yesterday)’

[Ø might be better understood as non-default L; ask me]

[65] **Note on tone**: There are independent tonal rules involving binary H tone spreading, downstep, and contour formation in these examples, which do not affect our analysis, but…

[66] **Please Stop me when you need to!**
Parallel facts are seen for non-human noun-class markers
[Bickmore 2007:246; first set from manuscript version only]

### Yesterday Past (YP): á-...-il-e-[H]_{FIN}  vs  YP + Passive –u ‘it/they was/were buried’

<table>
<thead>
<tr>
<th>Class</th>
<th>‘it/they washed’</th>
<th>‘it/they was/were buried’</th>
</tr>
</thead>
<tbody>
<tr>
<td>C3</td>
<td>/gú-á-ful-il-e-[H]_{FIN}/</td>
<td>/gú-á-ziiik-il-u-e-[H]_{FIN}/</td>
</tr>
<tr>
<td>C4</td>
<td>/-á-ful-il-e-Ø/</td>
<td>/-á-ziiik-il-u-e-Ø/</td>
</tr>
<tr>
<td>C5</td>
<td>/li-á-ful-il-e-[H]_{FIN}/</td>
<td>/li-á-ziiik-il-u-e-[H]_{FIN}/</td>
</tr>
<tr>
<td>C6</td>
<td>/yá-á-ful-il-e-[H]_{FIN}/</td>
<td>/yá-á-ziiik-il-u-e-[H]_{FIN}/</td>
</tr>
<tr>
<td>C7</td>
<td>/ci-á-ful-il-e-[H]_{FIN}/</td>
<td>/ci-á-ziiik-il-u-e-[H]_{FIN}/</td>
</tr>
<tr>
<td>C8</td>
<td>/vi-á-ful-il-e-[H]_{FIN}/</td>
<td>/vi-á-ziiik-il-u-e-[H]_{FIN}/</td>
</tr>
<tr>
<td>C9</td>
<td>/i-á-ful-il-e-Ø/</td>
<td>/i-á-ziiik-il-u-e-Ø/</td>
</tr>
<tr>
<td>C10</td>
<td>/zi-á-ful-il-e-[H]_{FIN}/</td>
<td>/zi-á-ziiik-il-u-e-[H]_{FIN}/</td>
</tr>
<tr>
<td>C11</td>
<td>/lú-á-ful-il-e-[H]_{FIN}/</td>
<td>/lú-á-ziiik-il-u-e-[H]_{FIN}/</td>
</tr>
<tr>
<td>C12</td>
<td>/ká-á-ful-il-e-[H]_{FIN}/</td>
<td>/ká-á-ziiik-il-u-e-[H]_{FIN}/</td>
</tr>
<tr>
<td>C13</td>
<td>/tú-á-ful-il-e-[H]_{FIN}/</td>
<td>/tú-á-ziiik-il-u-e-[H]_{FIN}/</td>
</tr>
<tr>
<td>C14</td>
<td>/gú-á-ful-il-e-[H]_{FIN}/</td>
<td>/gú-á-ziiik-il-u-e-[H]_{FIN}/</td>
</tr>
<tr>
<td>C15</td>
<td>/kú-á-ful-il-e-[H]_{FIN}/</td>
<td>/kú-á-ziiik-il-u-e-[H]_{FIN}/</td>
</tr>
</tbody>
</table>

### Other exceptional TAMs: Trigger of allomorphy is H vs. Ø tone, but outcome different

### Allomorphy:

- **a.** [YESTERDAY PAST] $\leftrightarrow$ á-...-il-e-[H]_{FIN} / if outer SM H
  - á-...-il-e-Ø / if outer SM ¬H
- **b.** [RECENT PAST] $\leftrightarrow$ á-cí...-il-e-[H]_{FIN} / if outer SM H
  - á-cí...-il-e-[H]_{2} / if outer SM ¬H
- **c.** [PERFECT] $\leftrightarrow$ -il-e-[H]_{2} / if outer SM H
  - -il-e-[H]_{2} / if outer SM ¬H

### Recent Past: á-cí...-il-e-[H]_{FIN}  [Bickmore 2014:49, 2007:262]

- **a.** H-toned SM /tú-á-cí-sópolol-il-e-[H]_{FIN}/ [tw-áá-cí-sópolw-ììlè]
  - ‘we recently untied’
- **b.** Non-H-toned SM /u-á-cí-sópolol-il-e-[H]_{2}/ [w-áá-cí-sópolw-ììlè]
  - ‘he/she recently untied’
- **c.** H-toned SM /tú-á-cí-mu-ziiik-il-e-[H]_{FIN}/ [tw-áá-cí-mú-ziis-ilè]
  - ‘we recently buried for him/her’
- **d.** Non-H-toned SM /u-á-cí-mu-sukíl-il-e-[H]_{2}/ [w-áá-cí-mú-sùkíl-ilè]
  - ‘he/she recently accompanied him/her’
Perfect: \[\ldots-il-e-\text{FIN}\]  

- a. /tú-fúz-il-e-\text{FIN}/ \[\Rightarrow [tú-fúz-ilé]\] ‘we have washed’
- b. /a-ful-il-e-\text{FIN}/ \[\Rightarrow [á-fúz-ilé]\] ‘he/she has washed’
- c. /tú-mú-zíik-il-e-\text{FIN}/ \[\Rightarrow [tú-mú-zíik-ilé]\] ‘we have buried him/her’
- d. /a-súkíl-il-e-\text{FIN}/ \[\Rightarrow [á-súkíl-ilé]\] ‘he/she has accompanied’

Obligatory note from the Larry Hyman (p.c.): “The Law of Initials and Finals”

“Yes, this is a pattern that Bantu tonologists have been aware of at least since Meeussen. I remember it coming up at the CALL meeting in 1972 (!) in Leiden at a time when we could all sit around one conference table! The general theory is that these derive from structures where the subject was repeated at the end of the verb, as you might expect from a relative clause or sometimes negatives (as per Makua, Nzadi etc.). François Nsuka talks about this in his dissertation on relative clauses. This may be only one source, but by “insubordination” à la Nick Evans the relative structure can become a main clause. I found it in Kirimi.”

In synchronic Cilungu, we cannot attribute this to general tonology
- a. Bickmore (2007, 2014, 2019) provides numerous contexts which all illustrate the exceptional interaction between SM tone and these TAMS: i.e. not spurious
- b. I.e. no active rule (i.e. a synchronically active Law of Initials and Finals) in language which deletes H at end of word when no H at beginning of word
- c. E.g. the tone of the SM has no effect on the co-varying grammatical tone with other similar TAMS

Far Past: \[a-\ldots-il-e-\text{FIN}\]  

- a. H /ú-a-mu-fuk-il-e-\text{FIN}/ \[\Rightarrow [w-áá-mú-fúk-ilé]\] ‘you (sg) harvested for him/her (yesterday)’
- b. ¬H /ú-a-mu-fuk-il-e-\text{FIN}/ \[\Rightarrow [w-àà-mú-fúk-ilé]\] ‘he/she harvested for him/her (yesterday)’

Remote perfect: \[a-\ldots-a-\text{FIN}\]  

- a. H /tú-a-zíik-a-\text{FIN}/ \[\Rightarrow [tw-áá-zíik-á]\] ‘we have already buried’
- b. ¬H /u-a-zíik-a-\text{FIN}/ \[\Rightarrow [w-àà-zíik-á]\] ‘he/she has already buried’

A final question: What are some alterative explanations for the clear typological rarity of outward-looking PCA?
- a. Few plausible diachronic pathways? [Hayes 2018 – Recent discussion on appealing to diachrony vs. to restrictiveness in curtailing model overgeneration]
- b. Not enough bigram frequency? [Ryan 2010]
REFERENCES

On my website, next to link for this handout: www.nicholasrolle.com/output

APPENDICES

5.1 Appendix 1: Core tenets of DM

Distributedness: ‘Morphology’ (slash morphological components) are ‘distributed’, e.g. primitives exist in three separate lists: the feature lexicon, the vocabulary, and the encyclopedia

Module Order: Syntax precedes and feeds morphology and not vice versa (i.e. there is no linguistic pre-syntactic module)

Cf. Kiparsky 2017 ‘Lexicalist Morphology’ (LM) - “Since the auxiliary complex is formed as a word in the morphology, it enters the syntax as a single functional head”

Module Order: Syntax precedes and feeds morphology and not vice versa (i.e. there is no linguistic pre-syntactic module)

Cf. Kiparsky 2017 ‘Lexicalist Morphology’ (LM) - “Since the auxiliary complex is formed as a word in the morphology, it enters the syntax as a single functional head”

[80] Uniform Concatenation: Morphologically complex words are formed via the same operations (i.e. MERGE) concatenating words in clauses

[e.g. syntax-all-the-way-down – Marantz 2000, 2001, Bobaljik 2017, a.o.]

[81] Feature Realization: Vocabulary Items realize feature bundles with phonological information (Late Insertion in DM terminology)

Cf. this Realizational model contrasts with an Incremental model, in which the morphemes themselves introduce relevant syntactic/semantic features [Stump 2001]

[82] Phonology-Free: Syntax/semantics lack access to phonological features

“nodes consist entirely of morphosyntactic/semantic features and lack phonological features” (H&M 1993:121)

[earlier Zwicky & Pullum 1986a,b]

[83] Internal Complexity: Internally complex words are the concatenation of morphosyntactic feature bundles


[84] Bundle Manipulation: The output of feature bundles from syntax can be manipulated by later, ‘morphological’ operations

[85] Input-Output Mapping: post-syntactic operations apply serially, formalized as ordered rules e.g. Embick 2015:217 - “I will draw on an example in which Fission is applied before Vocabulary Insertion” (emphasis mine), made most explicit in Arregi & Nevins (2012)

5.2 Appendix 2: Cophonology theory

Cophonology Theory - morphological constructions and lexical classes are associated with distinct, fully general grammars, e.g. to resolve vowel hiatus, one construction may trigger epenthesis while another deletion, as dictated by the sub-grammar

Cophonology cyclicity

\[
\text{CoP-Suffix}_3 \longrightarrow \text{CoP-Suffix}_2 \longrightarrow \text{CoP-Suffix}_1 \rightarrow \text{LEXROOT} \rightarrow \text{SUFFIX}_1 \rightarrow \text{SUFFIX}_2 \rightarrow \text{SUFFIX}_3
\]

Morphological structure of \([ \text{LEXROOT} \text{-SUFFIX}_1 \text{-SUFFIX}_2 \text{-SUFFIX}_3]\)

5.3 Appendix 3: Conspiracies and motivations for operations

Conspiracy: where rules with dissimilar inputs, outputs, and/or environments result in surface forms which all converge on or avoid a specific structure

[Kisseberth 1970, 2011; Prince & Smolensky 2004 [1993]; Kager 1999: Sec. 2.1.1.2; McCarthy 2002: Sec.3.1.4.3, 2008: 1-12;

Conspiracy to avoid bare verbs in Tiwa

[Several other conspiracies in Trommer 2001a, Rolle 2019, Murphy 2019, Foley to appear, a.o.]

a. In nearly all contexts, the verb appears with an overt suffix
b. One exception is with auxiliary verb constructions where an auxiliary selects a bare verb, in violation of a morphological constraint *BARE-V

Tiwa employs two repairs in free variation:

a. **Rebracketing**: an otherwise independent verb and auxiliary form a single complex phonological word, with the verb cliticizing to the right-adjacent auxiliary
   
   [Evidence: in V+Aux complexes, certain word medial consonants undergo intervocalic voicing]

b. **Dislocating**: a morpho-syntactically higher FOCUS head which canonically attaches to the right edge of the language attaches instead to the verb (Dawson’s ‘Focus Drift’)
   
   [Evidence: semantic argumentation that the verb is not focused]

<table>
<thead>
<tr>
<th>Language</th>
<th>Constraint</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiwa [lax]</td>
<td>*BARE-VERB</td>
<td><strong>Rebracketing</strong>: Verb and auxiliary form one word [Informally, the verb ‘cliticizes’ to the auxiliary]</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Dislocating</strong>: Focus dislocates altruistically [Informally, focus ‘drifts’ onto the verb]</td>
</tr>
<tr>
<td>[Tibeto-Burman: NE India – Dawson 2017]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**The road or the door to exponent?**

Tiwa repairs for constraint *BARE-V*

a. **Rebracking (‘verb cliticization’)**

V Aux Foc → (V=Aux=Foc)

(ὁ lî=thái-do=sê )
lî= thái-do =sê

go AUX-IPFV =FOC

‘he is still going’

b. **Dislocating (‘Focus Drift’)**

V Aux Foc → (V=Foc) (Aux)

(ὁ lî=ṣê ) (◁ thái-do )
lî= =ṣê thái-do

go =FOC AUX-IPFV

‘he is still going’

Similar conspiracies form catalysts for model modification within R&C-DM

a. “One of the most pervasive restrictions found throughout Basque auxiliaries is a kind of second position requirement on the auxiliary root itself, which we dub **Noninitiality**. This word-internal constraint demands that the auxiliary root have a terminal to its left, a result that can be achieved in three separate ways: one, as a consequence of the **linearization** process itself, if it should linearize a clitic (say, corresponding to the absolutive argument) to the left of the root; second, through the **insertion of an epenthetic** morpheme with no correspondent in the syntax, whose purpose is specifically to satisfy this Noninitiality requirement, and finally, through **Metathesis** operations, which may reorder the sequence that results from the Linearization procedure.” [Arregi & Nevins 2012:10, emphasis mine]

**The duplication problem** [See Kiparsky 2017 for historical context]

If we wish to formally incorporate markedness within grammar – in other words, directly encode the motivations for the operations – then constraints are our best bet, and if we allow for constraints, then we no longer need rules

5.4 Appendix 4: Prediction 2 – Transparency and Opacity

Kiparsky (2017) criticizes Arregi & Nevins’ (2012) treatment of Basque auxiliaries as critically under-demonstrating opacity across sub-modules/post-syntactic operations, to which Arregi & Nevins (2017) respond by recognizing but qualifying and complicating this claim of a ‘lack of opacity’ by arguing for another case of opacity

One recurrent operation which shows opacity effects involves **morph(eme) displacement**, i.e. a morph in an unexpected linear position

a. **Is dislocation different? If so, why?**

b. Working hypothesis: such dislocation then happens within phonology - it does not happen at spell-out
Nicholas Rolle

The road or the door to exponence?

---

[97] **Turoyo** [tru] [Neo-Aramaic - Kalin 2018, emphasis mine]

“phonological displacement of an affix (e.g., infixation) **counterbleeds** morphological operations but feeds/bleeds phonological operations. While some of the Turoyo findings simply reaffirm previously-established findings (see especially Paster 2006, 2009), a novel argument comes from showing that phonologically conditioned allomorphy persists across a linearly-intervening (but not structurally-intervening) affix.”

[98] **Meadow Mari** [mhr] [Uralic - Guseva & Weisser 2018]

Explicitly reject parallelism in their DM account of suspended affixation citing D-Metathesis **counterfeeding** Suspended affixation


“-lla displacement **counterbleeds** ni- insertion”

[100] **Caquinte** [cot] [Arawak - Rolle & O’Hagan in press]

Second position clitics are not satisfied at spell-out, i.e. they **vacuously** lower even when they have an appropriate host in the input

[101] Under OT-DM, which subcategorization requirements are satisfied at spell-out, and which are satisfied within the phonological module?

a. More ‘traditional’ phonological aspects which are subcategorized are satisfied at spell-out  
   [Makonde (Bantu) prosodic idiosyncrasies satisfied at spell-out - Rolle & Hyman in press]

b. Phonologically Conditioned allomorphy (PCA) – sensitive to underlying representations, not output, e.g. Turkish –I vs. –sI  
   [Paster 2006:98-100]
5.5 Appendix 5

Mapping of the syntactic image /S/ to a phonological image \( \text{S} \) [Rolle 2018]

Abridged:
### 5.6 Appendix 6: Sample of complex condensed tableau - Degema /V $D_{\sigma}$ V/ input type

[Rolle 2019]

<table>
<thead>
<tr>
<th>Input: ${\text{asp} , \text{asp^0} , ([\text{V} , V_1 , \text{asp}] , [\text{DP} , [\text{V} , V_2 , \text{asp}^0 , \text{V}]]])}</th>
<th>\text{Constraint stratum (CS) 1}</th>
<th>\text{CS 2}</th>
<th>\text{CS 3}</th>
</tr>
</thead>
<tbody>
<tr>
<td>\text{V=WF}_\text{MW} (\text{AGRSBJ})</td>
<td>\text{V=WF}_\text{MW} (\text{ASP})</td>
<td>\text{V1} &gt; \text{V2}</td>
<td>\text{MW} = \text{PRWD}</td>
</tr>
<tr>
<td>1</td>
<td>\text{D}</td>
<td>\text{V_1/V_2/asp}</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>\text{2}</td>
<td>\text{1}</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>3</td>
<td>\text{1/1}</td>
<td>\text{V_1/V_2/asp}</td>
<td>11</td>
</tr>
<tr>
<td>10</td>
<td>\text{Cand 4-9}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>11</td>
<td>\text{V_1/V_2/asp}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>12-21</td>
<td>\text{Cand 4-9}</td>
<td>1</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>22</td>
<td>\text{V_1/V_2/asp}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>23</td>
<td>\text{V_1/V_2/asp}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>24-25</td>
<td>\text{Cand 4-9}</td>
<td>1</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>26</td>
<td>\text{V_1/V_2/asp}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>27-61</td>
<td>\text{Cand 4-9}</td>
<td>1</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>62</td>
<td>\text{V_1/V_2/asp}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>63</td>
<td>\text{V_1/V_2/asp}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>64-75</td>
<td>\text{Cand 4-9}</td>
<td>1</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>76</td>
<td>\text{V_1/V_2/asp}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>77</td>
<td>\text{V_1/V_2/asp}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>78-100</td>
<td>\text{Cand 4-9}</td>
<td>1</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>101</td>
<td>\text{V_1/V_2/asp}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>102</td>
<td>\text{V_1/V_2/asp}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>103-213</td>
<td>\text{Cand 4-9}</td>
<td>1</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
<tr>
<td>214</td>
<td>\text{V_1/V_2/asp}</td>
<td>2</td>
<td>\text{V_1/V_2/asp}</td>
</tr>
</tbody>
</table>

(1) Dimensions along which output candidates were generated

- **IncD**: Did the verb and the pronominal object form one MWd or two?
  - i.e. $V_1/V_2$ vs. $V_1/V_2$
- **IncV**: In SVCs, did the verbs form one MWd or two?
  - i.e. $V_1/V_2$ vs. $V_1/V_2$
- **IncAsp**: Did the aspect marker and the verb form one MWd or two?
  - i.e. $V_1/V_2$ vs. $V_1/V_2$
- **LinAsp**: What is the linear position of the aspect marker?
  - i.e. $V_1/V_2$ vs. $V_1/V_2$
- **SbjAgr**: Did the verb appear with subject agreement in the same MWd?
  - i.e. $V_1/V_2$ vs. $V_1/V_2$
- **AspAgr**: Did the verb appear with aspect marking in the same MWd?
  - i.e. $V_1/V_2$ vs. $V_1/V_2$
- **Label**: Does the label of the MWd reflect a prosodically strong morpheme within it?
  - i.e. $V_1/V_2$ vs. $V_1/V_2$