Concatenation occurs one morpheme at a time:
Infixation in Choctaw

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Introduction

- There are several proposals on the ‘size’ of the chunks that the phonology deals with. For example:
  - Lexical Phonology & Morphology (Kiparsky 1982): phonology happens with **each morpheme.** Only 2 cycles (lexical and postlexical)
  - Phase-based morphology: phonological rules limited by **syntactic phases** (Adger 2007 check, else Chomsky 2000)
  - Optimality theory: **global?** (McCarthy & prince, 2001; Wolf, 2008)
  - **Prosodic** constituents (Selkirk, 1978 and following work)
- Choctaw (Muskogean) has a lot of morphology and phonology: perfect testing ground for questions about visibility and rule ordering.
- This is a very long-standing and contested debate (see Chomsky et al. 1956, Pesetsky 1979, Kiparsky 1982, Halle & Vergnaud 1987, Kiparsky 2000 Chomsky 2008, Newell, 2015 and many many others)

Roadmap

1. Theoretical background
2. We need spellout by derivational step
    a. Most Choctaw aspect markers infix from the right
    b. Tense suffixes vary in number of syllables, but don't affect infixation location
3. The steps proceed hierarchically
    a. Choctaw transitivity contrast is marked by suffixes
    b. Different suffix shape results in only intransitive verbs exhibiting iambic lengthening
    c. One aspect marker ("g-grade") infixes from the left and removes the context for iambic lengthening
    d. But we still see lengthening
4. Conclusion

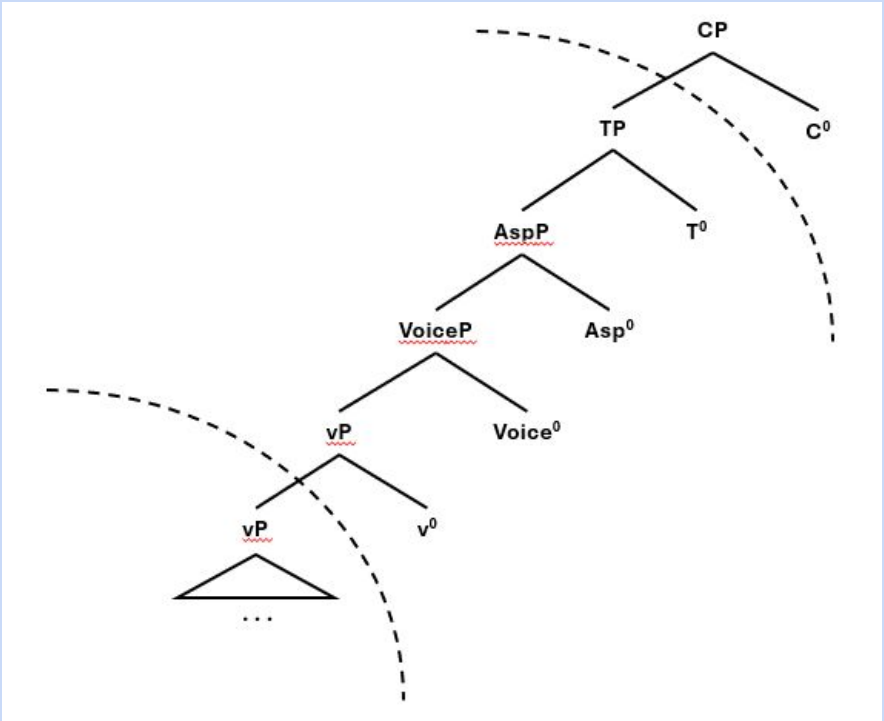
Section 1. Background

Phonological spellout

- Analysis is couched in Minimalism (Chomsky 2000) and Distributed Morphology (Halle & Marantz 1993)
- Translation from syntactic structure to phonological string
- What's syntactic structure?
  - roots
  - features
  - hierarchical relationships

Spellout domains

(1)



Steps of spellout

- 1. Replacing the content of each syntactic terminal with phonological content
  - We'll be representing this step as Vocabulary Insertion (VI) rules
- 2. Linearization of inserted content
  - Lose the hierarchical structure, now flat
  - The sequence is determined by locational specification of each morpheme
- 3. Phonology
  - Purely phonological derivation: information about hierarchy, synsem content not accessible
  - Ordered rules or constraint-based computation

Mechanics of DM morphophonology

- Syntactic structure of a phase is build up, one Merge (and Agree) operation at a time
- A phase is spelled out phonologically as a coherent element with limited access to adjacent phases
- Like the syntactic assembly, Vocabulary Insertion occurs one operation at a time, going upwards
    - We know this because of allomorphy patterns described by Bobaljik (2000)
    - Upward-conditioned allomorphy is only determined by features/root, while downward-conditioned allomorphy is only determined by vocabulary items

What about Linearization and Phonology?

- Do these occur:
  - Globally?
  - Clausally?
  - For the entire phase at once?
  - By prosodic constituent?
  - One item at a time?

In this talk we argue that **the entire phonological derivation/spellout occurs one item at a time rather than all at once within a phase.**

Section 2. Input to phonological derivation

Choctaw tense and aspect marking

- Several aspect morphemes appear as infixed material, inserted **after the penultimate vowel**

- *pi.sa* ‘see’	*mo.ma*	‘be all’	(neutral/no aspect)
- *pi**<n>**.sa* ‘look’	*mó**<m>**.ma(t)*	‘still’	(durative/progressive)
- *pi**<h>**.sa* ‘notice’			(resultative)
- *pí**<y.yii>**.sa* ‘see’	*mó**<y.yoo>**.ma*	‘all (emph.)’	(terminative/perfective)
- *pi.**<hin>**.sa* ‘look (rep.)’			(repetitive/iterative)
- *pi**<i>**.sa* ‘see’			(L-grade)

- Three tense markers: the past tense markers are syllables, the generic tense is only a consonant
  - *pi*$_2$*.sa**h***$_1$ ‘see’ (generic)
  - *pi*$_3$*.saa*$_2$*.**tok***$_1$ ‘saw’ (past)
  - *pi*$_3$*.sat*$_2$*.**took***$_1$ ‘saw a long time ago’ (distant past)

A problem for concurrent derivation of an entire phase

- The past tense suffixes (*-tok* ‘past’, *-ttook* ‘distant past’) add a syllable to the verb
- But the location of the aspect marker doesn’t change between tenses:

(2) (a) generic tense

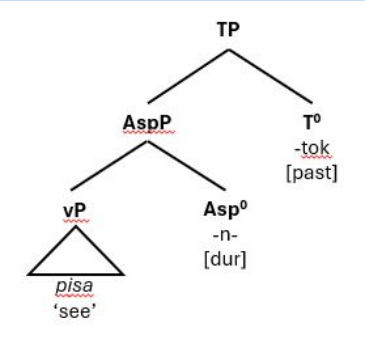
pi.sah	*pi**n**.sah*	
pisa -h	pisa -n-	-h
see -tns	see -dur-	-tns

(b) past tense

pi.saa.tok	*pi**n**.sa.tok / *pisa**n**tok*	
pisa -tok	pisa -n-	-tok
see -past	see -dur-	-past

Outcome of the two hypotheses

(3) (a) **Input structure**



(b) **VI rules**

√SEE ⇔ pisa
Asp[dur] ⇔ n / V_C(C)V#
T[past] ⇔ tok / _#

(*c) (((pisa) -n-) -tok)
/pisa+n+tok/
*[pi.sa**n.**tok]

(d) (((pisa) -n-) -tok)
((/pisa+n/) -tok)
([pinsa]) -tok)
/pinsa+tok/
[pi**n.**sa.tok]

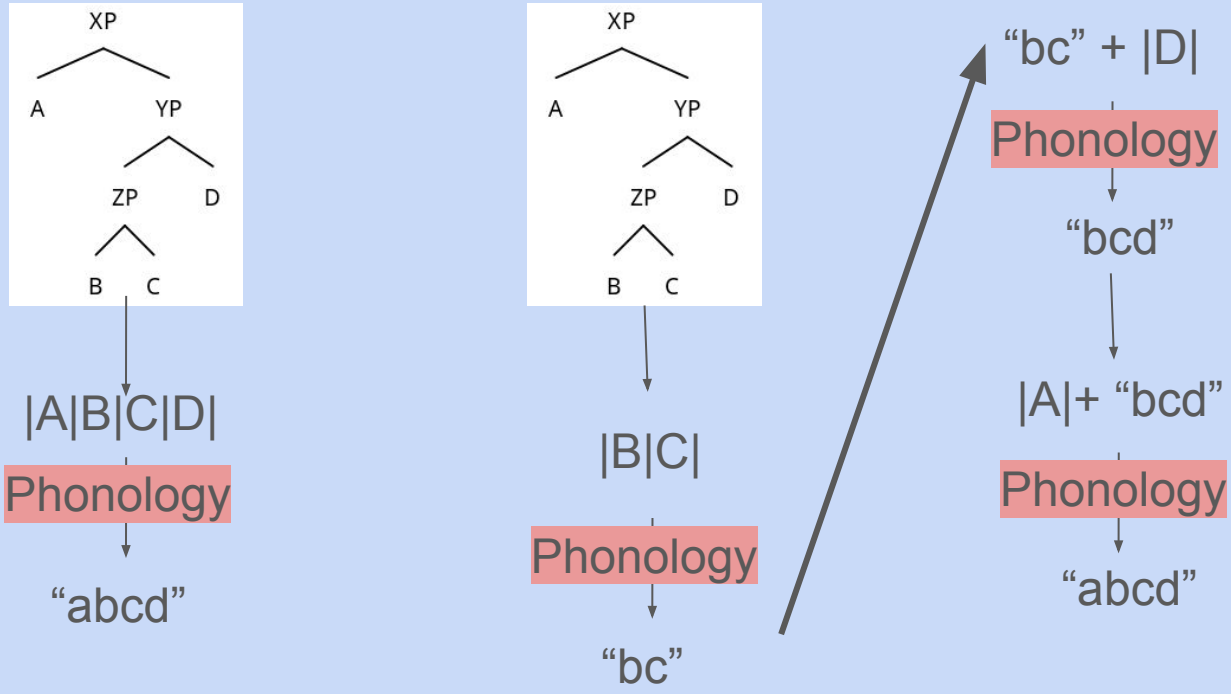
Section 3. The order of concatenation

The order of concatenation

- In the previous section we saw that the phonological derivation occurs one morpheme at a time, but in which order?
  - (a) Linear order: left-to-right or right-to-left
  - (b) Hierarchical order: moving up the syntactic tree
- We can adjudicate between these two hypotheses by examining forms of an aspectual infix in Choctaw called the “g-grade” (Broadwell, 2006).

We argue for the second hypothesis: **that phonological spellout out moves upward hierarchically, inserting a VI, linearizing it to the base string, and computing the phonological form, all at once** before moving up to the next terminal

(4) The two hypotheses

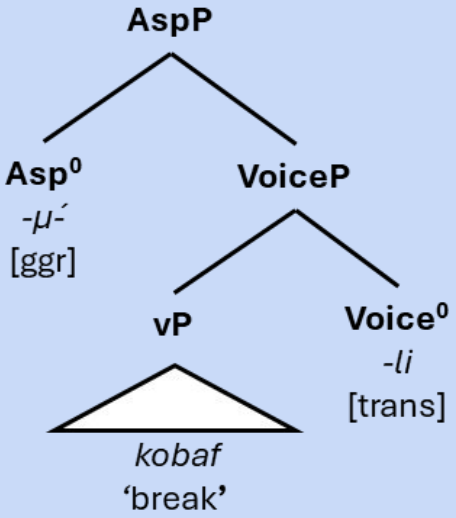


The g-grade: infixing from the **left** instead of the right

- Semantics: “finally VB-ed” for active verbs, “too VB(ey)” for attributive verbs

(5) Some example g-grade forms (from Nicklas, 1974, and Ulrich, 1994:326)

	base	g-grade	
(a)	**ko.b**aa.fa	**kób.b**aa.fa	‘to break’
(b)	**ta.l**ak.chi	**tál.l**ak.chi	‘to be tied’
(c)	**o.**na	**óo.**na	‘to arrive’



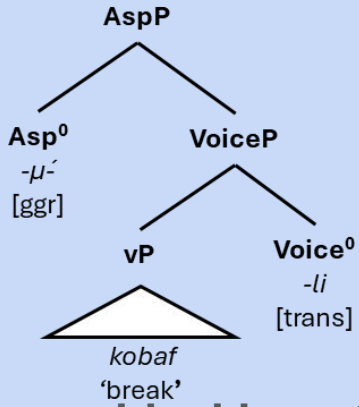
(6) VI rule: Asp[delayed] ⇔ μ́ / #μ_

Relevant phonology for “g-grade” formation

- Iambic lengthening:
  - underlying sequences of light syllables- **(C)V**- are parsed into iambs via vowel lengthening
  - /**(C)V.CV.**C…/ -> [**(C)V.CVV.**C…]
- Transitivity marking morphology (Tyler, 2020):
  - Voice[-N] ⇔ a / _#
  - Voice[+N] ⇔ li / _#
- Many verb stems/roots are CVCVC shape
  - Intransitive *-a* will create an environment for iambic lengthening:
    - **CVCVC** + /a/ -> **CV.CV.**Ca -> **CV.CVV.**Ca
  - But transitive *-li* will not create an environment for iambic lengthening:
    - **CVCVC** + /li/ -> **CV.CVC.**li -> **CV.CVC.**li, ***CV.CVVC.**li
  - So for stems of this shape, the transitivity suffix will condition whether or not rhythmic lengthening appears

Derivation of the transitive *kóbbaffi* finally break’

(7) Input: (a) -μ́- + kobaf + -li (b)



(8) **(a) Linear hypothesis:** **(b) Hierarchical hypothesis:**

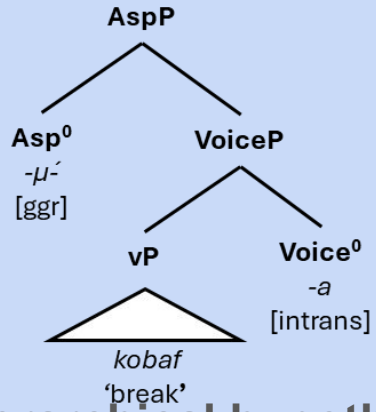
Step 1. μ́ + ko.baf -> kób.baf ko.baf + li -> ko.baf.fi

Step 2. kób.baf + li -> kób.baf.fi μ́ + ko.baf.fi -> kób.baf.fi

Order doesn’t matter for the transitive form.

Derivation of the intransitive *kóbba:fa* ‘finally break’

(9) Input: (a) -μ́- + kobaf + -a (b)



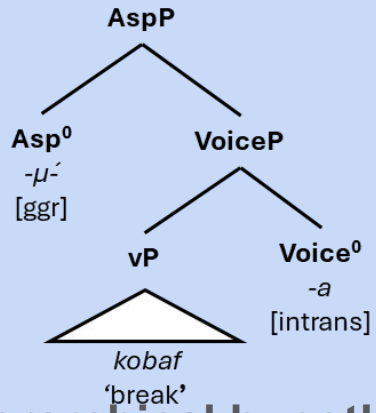
(10)

	(a) Linear hypothesis:	**(b) Hierarchical hypothesis:**
Step 1.	μ́ + ko.baf -> **kób.ba**f	ko.baf + a -> **ko.ba**.fa -> **ko.baa**.fa
Step 2.	kób.baf + a -> *kób.ba.fa	μ́ + ko.ba:.fa -> kób.baa.fa

Order *does* matter for the *in*transitive form.

Derivation of the intransitive *kóbba:fa* ‘finally break’

(9) Input: (a) -μ́- + kobaf + -a (b)



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Step 1.	μ́ + ko.baf -> **kób.ba**f	ko.baf + a -> **ko.ba**.fa -> **ko.baa**.fa
Step 2.	kób.baf + a -> *kób.ba.fa	μ́ + ko.ba:.fa -> kób.baa.fa

Order *does* matter for the *in*transitive form.

Linear concatenation generates the incorrect output

- If we concatenate the g-grade infix first, the first syllable is heavy.

  Step 1. μ́ + kobaf -> **kób.ba**f

- When we add the intransitive *-a*, the first two syllables are CVC.CV rather than CV.CV, so we don't get iambic lengthening.

  Step 2. **kób.ba**f + a -> *kób.ba.fa

- The form with iambic lengthening must be the input to infixation

Takeaway from g-grade derivation:

- Order of operations:
  - 1: Voice/transitivity suffix
  - 2: Iambic lengthening
  - 3: Aspect infix
- This respects the hierarchical structure, *not* linear order.
- If the stem+Voice is determined *before* the stem+Asp, even when the linear order is Asp+stem+Voice, then the derivation must occur in order of the morpho-syntactic hierarchy (specifically bottom to top)
  - Linear order isn't important

Section 5. Conclusion

Conclusions:

- Choctaw morphology and phonology allows us to derive crucial orderings:
  - Durative *-n-* must be inserted before past *-tok*
    - **Even though** Tense and Aspect are in the same phase
  - (1) Voice/transitivity suffix, (2) iambic lengthening, (3) (L-aligned) aspect infixes
    - Morphology, phonology, morphology, phonology
    - Sensitive to hierarchical order, NOT linear L->R
- Immediately, this looks most compatible with Lexical Phonology and Morphology (Kiparsky 1982)
- But it doesn't have to be: open to both prosodic boundary (see work on Match Theory, Selkirk 2009) and 'phase'-based interpretations of the interface (see Samuels, 2010), so long as chunks are sufficiently small.

Appendices

Appendix A. Iambic lengthening is sensitive to absolutive prefixes

(12) An example adapted from Broadwell (2006:22)

sasa:laha:tok

sa-	salaha	-tok
1s.abs-	be.slow	-pst

‘I am slow’

- /salaha/ doesn’t get parsed as [sala:ha] before the *sa-* prefix is added
- This remains true even for verbs with transitivity suffixes (*-a*/*-li* from before)

Appendix A (cont.)

- To get ***sa-sa:****laha:tok* instead of **sa-**_**sala:**_*hatok,* iambic lengthening must apply *after* the absolutive prefix is concatenated, but before aspect markers like the g-grade.
- Order:
  - Concatenate transitivity (VoiceP)
  - Concatenate absolutive clitics (vP/ApplP)
  - Iambic lengthening
  - Concatenate aspect (AspP)
  - Concatenate tense (TP)

Appendix B. More examples of g-grade derivations (Ulrich, 1986:173-208)

(13) (a) páttoolilih

μ́- pato -li -li -h

ggr- touch -trans -1s.erg -tns

‘I finally touched (it).’

(b) káppassah

μ́- kapassa -h

ggr- be.cold -tns

‘It’s too cold.’

(c) ánnooli

μ́- ano -li

ggr- tell -trans

‘finally tell’