Khoekhoegowab Tone Sandhi:
Prosodic structure and extended projections

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Khoekhoegowab / Khoekhoe[1] has contrastive tone, but:

▶ the full range of contrasts is only possible in certain prosodic positions.
▶ Elsewhere, sandhi (melodic substitution) applies.

Sandhi gives us a test for some kind of prosodic constituency.

This talk is mostly about how tense marking interacts with that constituency.

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[1](Khoe-Kwadi, 200*k* speakers, Namibia. Unless otherwise noted, all data is from original fieldwork in the Windhoek area.)

The position of tense (/ aspect / polarity) marking is highly variable across morphosyntactic contexts:

(1) |Gôab ge   mai-e huni hâ.
     boy DECL pap   stir PERF
     "The boy has stirred the pap."   Postverbal

(2) |Gôab ge   mai-e go   huni.
     boy DECL pap   PST stir
     "The boy stirred the pap."   Preverbal

(3) Mî ta ge ra [|gôab go   mai-e huni] -sa.
     I am saying   boy PST pap stir   -NOM
     "I am saying that the boy stirred the pap."   2nd position

Tense marking & sandhi

I'll show that the position of tense marking crucially affects sandhi on the verb.

- ▶ In matrix clauses (and some embedded ones), a verb will undergo sandhi exactly when preceded by its tense marker.
- ▶ This is true even when the verb and its tense marker are non-contiguous:

(4)   Aob ge   [mai-e go huni] tsi [‖gan-e am.]
      man DECL   pap PST stir and   meat grill
      "The man stirred the pap and grilled the meat."

- ▶ I'll argue that there is pressure against separating roots from their extended projection. (López, 2009)

In isolation, Khoekhoe lexical vocabulary has a 6-way tonal contrast — four level tones & two contours (Brugman, 2009)

Tone		Example		
SH	Superhigh	/kai/	'big'	▶
H	High	/aob/	'man'	▶
L	Low	/‖ari/	'yesterday'	▶
SL	Superlow	/gomas/	'cow'	▶
H-SH	High-rising	/huni/	'stir'	▶
SL-L	Low-rising	/nesi/	'now'	▶

Tone sandhi

However, words only rarely surface with their 'citation' tone:

- ▶ For example, within a DP only the leftmost word takes citation tone.
- ▶ All other words undergo sandhi.

(5) a. súű́ku
         pots
     b. |ápa̋ sùùku
         red   pots
     c. !nání̋ |àpa sùùku
         six   red pots
     d. ‖náa̋ !nàni |àpa sùùku
         those six   red   pots

(Brugman, 2009)

Sandhi is an opaque melodic substitution process which maps each melody to an (apparently arbitrary) other melody:

Citation	Sandhi
SL-L	SL-L
SL H	L-SL
L H-SH	L
SH	H

Where does sandhi apply?

For convenience, I'll call the domain of sandhi a phonological phrase (φ).

- ▶ Sandhi applies to all but the leftmost word in a φ.
- ▶ DPs, PPs, & AdvPs all get their own φ.
- ▶ i.e. only the leftmost item in each of those XPs will keep citation form.

VPs, however, are more complicated.

Khoekhoe packages tense, aspect, and polarity information into a set of (mostly fusional) particles.

	IPA	Gloss
go	[ko]	recent past
ni	[ni]	future
ta	[ta]	negative non-finite
tama	[tama]	non-future negative
hâ	[hã:]	perfect
...		

These particles fall into two classes:

▶ Postverbal particles appear immediately after the verb:

    (6)   Khoeb ge   oms |kha oa   tama.
            man   DECL home to   return NEG.NF
            "The man didn't return home."   ▶

▶ Preverbal ones encliticize to something in the middlefield
(typically the immediately-preverbal element).

    (7)   Khoeb ge   oms |kha go oa.
            man   DECL home to   PST return
            "The man returned home."   ▶

There's reason to believe that (6) & (7) have the same syntactic
structure. (See Kusmer 2019 for details.)

Sandhi on verbs

If sandhi applies to non-XP-initial words, we might predict that verbal sandhi depends on the presence of an object or adverb.

(8) a. (O V) — sandhi on verb
     b. (V) — no sandhi on verb

This isn't what happens, but previous descriptions disagree on what does:

▶ Haacke (1999) says that when a tense-marker immediately precedes the verb, the [T V] unit forms a sandhi domain.
→ The verb undergoes sandhi when immediately preceded by T.
▶ Brugman (2009) says that verbs in matrix clauses always undergo sandhi.
→ Only embedded clause verbs retain citation.

A prosodic production experiment:

- ▶ Pairs of sentences with PREVERBAL and POSTVERBAL tense marking.
- ▶ 4 native speakers, reading from slides.
- ▶ Two repetitions of each item; 288 total tokens per speaker.

All verbs were chosen from the two tonal classes that show the maximum perceptual distinctness under sandhi:

1. High-Rising → Low
2. High → Low-Falling

MATRIX:

(9) Khoeb ge oms |kha oa tama.
     man DECL home to return NEG.NF
     "The man didn't return home."

QUESTION:

(10) ǁNa tarasa tae-e am tama?
      that woman what grill NEG.NF
      "What didn't that woman grill?"

COORDINATION:

(11) Aob ge   mai-e huni tsi ǁgan-e am tama.
      man DECL pap   stir and meat grill NEG.NF
      "The man didn't stir the pap or grill the meat."

Syntactic frames — embedded

QUOTATIVE:

(12)   Mî ta ge ra [arib ge |hôasa mû tama   ] -ti.
        I am saying dog DECL cat   see NEG.NF] C
        "I am saying that the dog didn't see the cat."

NOMINALIZED:

(13)   Mî ta ge ra [Dandagob oms |kha oa   tama   ] -sa.
        I am saying D.   home to return NEG.NF -NOM
        "I am saying that Dandago didn't return home."

RELATIVE:

(14)   [Oms |kha oa   tama   ] khoeb ge.
         home to return NEG.NF man   DECL
        "It's the man who returned home."

TextGrids were generated using forced alignment (McAuliffe et al., 2017).

▶ Alignment of the verb was then adjusted by hand.
▶ Verbs were extracted in isolation, to blind transcribers to experimental manipulation.
▶ 4 non-Khoekhoe-speaking transcribers each made a binary classification (high or low) for each token.
▶ Inter-transcriber reliability: Fleiss' Kappa = 0.77 ('substantial agreement')

Analysis

After some exploratory analysis, a logistic regression was used to assess the likelihood of transcribing a low tone (i.e. sandhi):

- ▶ `Transcription ~ Frame * Position`
- ▶ Custom contrast coding used to compare:
    - ▶ {MATRIX, QUES., COORD., QUOT.} vs. {NOM., REL.}
    - ▶ MATRIX vs. each other 'matrix-like' frame
    - ▶ NOM. vs. REL.

The following coefficients were found to be significant:

	Estimate	z value	Pr(>|z|)	
NOM vs. REL[2]	2.8	2.7	0.00601	**
POSITION	3.2	11	< 2e-16	***
MATRIX-LIKE * POSITION	3.9	5.5	2.86e-08	***

▶ Most notable: MATRIX-LIKE * POSITION.
▶ In matrix-like clauses, the verb undergoes sandhi when preceded by tense-marking.
▶ In embedded clauses, the verb never undergoes sandhi.

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[2]This is confounded by downdrift.

It's worth looking more carefully at the VP-coordination condition:

(15)　a.　Aob　ge　　[mai-e huni] tsi　[‖gan-e am] tama.
　　　　 man DECL　pap　stir　and　meat　grill　NEG.NF
　　　　　　　　　　　　　　　　　　　　　　　▶

　　　b.　Aob ge　　[mai-e huni] tsi　[‖gan-e go　am.]
　　　　　 man DECL　pap　stir　and　meat　PST　grill
　　　　　　　　　　　　　　　　　　　　　　　▶

　　　c.　Aob ge　　[mai-e go　huni] tsi　[‖gan-e am.]
　　　　　 man DECL　pap　PST　stir　and　meat　grill
　　　　　 "The man did(n't) stir the pap and grill the meat."　　▶

Takeaway:

▶ Preverbal tense-marking correlates with sandhi *even at a distance*.

▶ Postverbal tense-marking correlates sandhi-resistance *even at a distance*.

I would like to maintain the generalization that sandhi-resistance is associated with the left edge of a φ.

- ▶ If this is true, then postverbal tense marking conditions a syntax-prosody mismatch.
- ▶ In this context, the verb resists sandhi.
- ▶ But there is no constituent with the verb at its left edge:
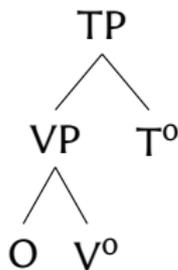
(16)　a.　　　　　　　　　　　　　　b.
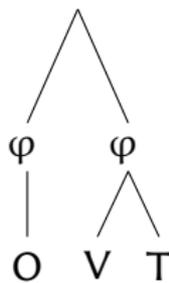
We might imagine that a constraint like EQUALSISTERS (Myrberg, 2013) would prefer promotion of the verb:

(17)

	EQUALSISTERS
a. (((O) V) T)	**
b. ☞ (((O) (V)) (T))	

But whatever drives this deviation from the syntax is defused when tense marking precedes the verb, even at a distance:

(18)

	??	EqualSisters
a. ☞ T ... ((O) V)		**
b. T ... ((O) (V))	*	

Haacke's original intuition was right: It seems like the verb phrases together with tense marking.

▶ We need some constraint that specifically targets V & T.

I propose to borrow an intuition from López (2009): Extended Projections (Grimshaw, 1991) must phrase together.

(19)   EXTENDEDPROJECTION: A root must not be separated
       from its Extended Projection by a phonological phrase
       boundary.

▶ When tense is postverbal, this will prefer to phrase the verb
   together with what follows it (placing it at the left edge).

(20)

		EXTPROJ	EQSIS
a.	(((O) V) T)	*	**
b. ☞	((O) (V T))		

► When tense is preverbal, this will prefer to phrase the verb together with what precedes it (keeping it away from the left edge.)

(21)

	EXTPROJ	EQSIS
a. T ... ((O) V)	*	*
b. ☞ (T .. (O) V)		

Embedded clauses

But recall: in (most) embedded clauses the verb always resists sandhi.

▶ Embedded clauses differ from matrix ones in another respect: Preverbal tense marking goes in second position. (22)

▶ Only one embedded clause type behaves like matrix clauses, and it has a second-position clause-type marker.

(22)   Mî ta ge ra [|gôab go mai-e huni] -sa.
        I am saying boy PST pap stir   -NOM
        "I am saying that the boy stirred the pap."

(23)   Mî ta ge ra [arib ge |hôasa mû tama   ] -ti.
        I am saying dog DECL cat   see NEG.NF] C
        "I am saying that the dog didn't see the cat."

Perhaps, in the absence of a clause-type marker, head-movement breaks the EP relationship.

Conclusion

Khoekhoe prosodic phrasing interacts with morphosyntax in complex ways.

▶ In most clauses, verbs phrase together with tense marking, wherever it is located.

▶ In some embedded clauses, verbs always phrase on their own.

I've suggested that prosody needs to be sensitive to Extended Projections in order to account for this.

▶ This involves allowing the prosody to see featural relationships between heads (i.e. not just constituency).

▶ We might see this as related to ARGUMENT-φ (Clemens, 2016). Perhaps prosody can see more than we think it can?

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