A GESTURAL ACCOUNT OF MINOR SYLLABLES: EVIDENCE FROM KHMER

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Minor Syllables and Khmer
Minor syllables

- First part of a “sesquisyllable”
  - Reduced segment inventory
  - Reduced syllable shape
  - No tone or stress

- [rə.'bɨŋ] ‘gourd’ Bunong (Butler, in progress)
- [θə.jè] ‘saliva’ Burmese (Green 2005)
- [kə.'bal] ‘head’ Khmer (Huffman 1972)
Khmer

- **Monosyllables (CVC)**
  - [mʌt] ‘dash away’ មឹត

- **Disyllables and longer**
  - [mʌt.pot] ‘stretch one’s back’ មឹតពត់

- **Sesquisyllables**
  - [mteh]/[məteh] ‘pepper’ ម្មេស
Khmer clusters

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Huffman (1972)
What is minor syllable [ə]?

- Excrecent/phonetic
  - “bnick” → [bənɪk]

- Epenthetic/phonological
  - “chipotle”: [tʃɪ.pɒtɪ] → [tʃɪ.pɒt.əl]

- Agnostic view
  - “Intrusive schwa”
Gestures and schwa
Speech is composed of coordinated dynamical gestures (Browman and Goldstein 1986, 1989, 1992; Saltzman and Kelso 1987; inter alia)

Gestures are articulatory movements toward targets of the vocal tract

Gestures can overlap or underlap
Gestures cont.

- Gestures can be described in terms of their parts

- Gestures can be formalized as constraints
  - OCP: Overlapping identical gestures are prohibited (Gafos 2002)
Appropriateness of the model

- Many gesturally-based studies on initial consonant clusters
  - French (Kühnert et al. 2006)
  - Georgian (Goldstein et al. 2007)
  - Italian (Hermes et al. 2008)
- Tashylhiyt Berber (Ridouane and Fougeron 2011)
  - EPG data to show that intrusive schwa in Berber does not have its own timing slot, suggesting it is not phonological
Goals

- To understand the nature of minor syllables by asking whether sesquisyllables are monosyllables with excrescent schwas or disyllables with epenthetic schwas.

- To use a gestural model of speech to interpret the results.
Experiment

Set-up and expectations
Experiment

- **Participants**
  - 18 Khmer speakers, ages 18 – 44 ($\mu = 27$), recorded in Phnom Penh

- **Stimuli**
  - CCVC/CəCVC: 20
  - C∧(C).CVC: 4
  - C∧C: 13
  - Read in frame sentence: [nijij _____ mdɔŋ tiət]
  - 3 repetitions; only 2\textsuperscript{nd} was analyzed
Possible outcomes

- Schwa underlap: (voiced)
- Non-schwa underlap: (voiceless)
- No underlap:
Experiment

Results and analyses
Underlap distributions

- Of 358 tokens, 62% have underlap
  - 100% of voiceless underlap have voiceless C1
  - 80% of voiced underlap have voiced C1 (93% of omit [pr])

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Underlap distributions cont.

- Of 358 tokens, 38% do not have underlap
  - 89% of no underlap have affricate or fricative C1

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Durational distributions

- Is schwa underlap different than non-schwa underlap?

- Is there a durational difference between consonant sequences in C@CVC and CǝCVC words?
Two sources of variation

- Schwa underlap and non-schwa underlap occur in nearly mutually exclusive environments.
- Those environments (i.e. voiceless obstruents vs. voiced sonorants) have inherent durational differences.
- A direct comparison across word forms (C@CVC vs. CǝCVC) is not possible.
- 😞 Form = Total Duration + C1 type + C2 type + ε
Comparison with residuals

- Total duration = C1 type + C2 type + ε
- Underlap = C1 type + C2 type + ε

- Underlap type does not correlate with total duration or underlap duration.
- Underlap duration does correlate with total duration (p < 0.0001).

- This suggests that underlap type does not affect the duration of the CC sequence.
Sonority patterns

- Underlap types combined
- Data sorted according to natural classes:
  - Obstruent or Sonorant
- Sequences that differ in sonority are longer than sequences that match in sonority.

OS, SO > SS, OO
Total durations by sonority type

$p < 0.0001$
Syllable types

\[ \begin{align*}
\text{pn, pŋ, tŋ, cŋ} \\
\text{mt, lb, lk} \\
\text{> } \\
\text{mn, lm, mŋ} \\
\text{pc, pk, ck, cb}
\end{align*} \]

- Are these actually different?
Comparison with disyllables

- **Total duration:**
  - Eg. [mʌt.'pot] > [məteh]
  - OO, OS, SO: $p < 0.0001$

- **Underlap duration:**
  - Eg. [mʌt.'pot] > [məteh]
  - OO, OS: $p < 0.0001$
  - SO: $p = 0.3899$
Inverse relationships

- No correlation between underlap duration and C1 or C2 duration for any of the sonority pairs
- Obstruent-Sonorant clusters:

  \[
  C1: R^2 = 0.17 \\
  C2: R^2 = 0.09
  \]
Discussion
Conclusions, extensions and implications
Summary

- Schwa appears in a predictable context
- No durational difference between
  - voiced (schwa) underlap and voiceless (non-schwa) underlap
  - sequences with underlap and sequences without underlap (perhaps due to frication noise)
- Significant durational difference between
  - word initial consonant sequences in “sesquisyllables” and unstressed syllables in disyllabic words
Conclusions

- Khmer “sesquisyllables” are monosyllables with (i) gestural spreading and (ii) sufficient voicing conditions to create the percept of [ə].
- Conceptualizing units as dynamically timed gestures instead of segments
  - can explain why schwa appears where it does
  - equates schwa underlap with non-schwa underlap
Extendions

- Proto-Vietic > Middle Vietnamese
  - Sesquisyllables > monosyllables
    - bə.laj > blaj > plaj  ‘fruit’

Matisoff (2003)
Implications

- Understanding “sesquisyllabicity” in terms of gestures
  - provides an explanation (not just a description) of language change than can be formalized in terms of constraints
  - sets the sesquisyllable within a broader class of similar phenomena

- Further consideration of the interaction of underlap and sonority is needed
Thank you

Extra Slides
Schwa distribution

- Of 358 CCVC tokens…
- Underlap: 222 (62%)
  - Without schwa: 99 (45%)
    - C1 voiceless: 100%
  - With schwa: 123 (55%)
    - C1 voiced: 80%
    - Excluding [pr]: 93%
- No underlap: 136 (38%)
  - C1 fricative or affricate: 108 (89%)
C1 durations

- C1s are shorter in CC sequences than as onsets in CVC monosyllables; $\Delta S > \Delta O$