A Gestural Deconstruction of the Minor Syllable

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Mainland Southeast Asian Languages:
The State of the Art in 2012

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Outline

• Defining the Minor Syllable
  – Definitions
  – Criteria
• Brief introduction to gestural framework
• Experiments
  – Khmer
  – Bunong
• Conclusions
  – We should re-evaluate the notions of sesquisyllable and minor syllable
The Sesquisyllable

• Characteristic of Southeast Asian languages (Diffloth and Zide 1992, Enfield 2005, inter alia.)

• Matisoff (1973, 86):
  “Proto-[Austro-Asiatic] had what one might call a ‘sesquisyllabic’ structure, with morphemes that were ‘a syllable and a half’ in length. That is, the prevocalic consonant was often preceded by a ‘pre-initial’ consonant... It is perhaps no accident that these ‘halfway tonal’ [Mon-Khmer] languages also have a syllabic structure intermediate between the truly monosyllabic [Sino-Tibetan] and truly polysyllabic [Austronesian] types.”
Defining the Minor Syllable
The Minor Syllable

- Khmer (Henderson 1952, 150)
  “Disyllables of this type are intermediate structurally between the extended monosyllable and the full, or major disyllable.”
  - Extended Monosyllables
    \[\text{[pʰdek]}\] ‘to put to bed’
  - Minor Disyllables
    \[\text{[sɔm.naɪm]}\] ‘humidity’
  - Major Disyllables
    \[\text{[kait.laiŋ]}\] ‘to grow’
• Michaud (2012, 2)

The minor syllable consists of “a simple consonant... plus an optional nucleus, V: either a vowel, or a sonorant (nasal or liquid) serving as nucleus. In the Austroasiatic domain, the most frequently encountered situation is one in which there can be no vowel contrast in the presyllable: the nucleus consists simply in a schwa, a noncontrastive, optional vowel.”
• Diffloth and Zide (1992)

Final-syllable stress and lack of suffixation converge to make the major syllable the “richest and most stable part of the word” (3). The minor syllable has a poor consonant inventory as well as a “vocalism”, which reduces to a single possible vowel, i.e. [ə], in most cases.
• Brunelle and Pittayaporn (2012, 5)
  “While many authors take sesquisyllables to be any disyllabic word with a reduced number of contrasts in initial syllables (Larish 1999; Thurgood 1999), others take the more restrictive position that the syllabicity of the minor syllable is carried by a neutral vowel or a syllabic consonant (Diffloth 1976: 232; Svantesson 1983: 27)”
Examples of Minor Syllables

• [ɾə.biŋ] ‘gourd’ Bunong (Butler, in progress)

• [ti.jɔ̃k] ‘to point’ Jahai (Burenhult 2001)

• [təɾ.pah] ‘to slap each other’ Pacoh (Watson 1964)

• [m̩.ləm] ‘one’ Stieng (Haupers 1969)
Variability

/ljung/ Turung (Morey 2005)

[ljung] ‘finger’
[ləjung] ‘finger’
[lijung] ‘finger’
A Scale of Syllabicity
Thomas (1992)
Type 1

• “Predictable open transition between consonants” (206)

• Two options:
  – The optional schwa may be omitted when a nasal coda acts as the nucleus in its place (Northern Khmer, Thomas 1992; Kuay, Preecha 1988; Halang, Cooper and Cooper 1966)
  – The type of transition – aspirated, schwa or Ø – is predictable from the consonants in the minor syllable (Stieng, Haupers 1969; Central Khmer, Jacob 1968, etc.)
Type 2

- Meaning contrast between CəC- and CC- forms
- Chrau: [plaj] ‘fruit’ with [pəlaj] ‘unfortunately’
- May have a small range of vowels in the minor syllable, usually limited to [i, ə, u]. The quality of the vowel is always conditioned by the environment.

  E.g. In Chrau, the vowel is realized as [ə] unless in the presence of a palatal or labial consonant, in which case it is realized as [i] or [u], respectively.

  • [pədar] ‘send’
  • [sidac] ‘king’
  • [ruwəh] ‘elephant’
Type 3
• Minor syllable vowel is NOT predictable from environment
• Minor syllable has a reduced inventory

  – Pacoh (Watson 1971)
    [tinol] ‘a post’
    [papi] ‘converse’
    [kuchet] ‘die’

  – Kuay (Preecha 1988)
    [kilɛk] ‘a tree’
    [kəthiim] ‘garlic’
    [sulin] ‘Surin’
Type 4

- “Nearly full vowel contrasts in a weakly stressed minor syllable” (p.209)
- But all of the examples provided have only a small set of these word types
  - Northeastern Thai (Preecha 1988), Kuay (Preecha 1988), Halang (Cooper and Cooper 1966), etc.
- Kensiw/Kensiu contrasts these “minor” syllables with “pre-syllables” (Bishop 1996)
Criteria:
What Doesn’t Work
Stress v. Tone

• Stress: Cua (Maier 1969)
  
  [ka.ˈlaat]  ‘hunk of meat’
  [ta.ˈrʌk]  ‘unison call’

• Tone: Thai (Bennett 1994)
  
  [la.mút]  ‘sp. fruit’
  [sa.nùk]  ‘fun’
Shape of the Minor Syllable

• No codas: Burmese (Green 2005)
  \[ tɕə.bó \] from \[ tɕáN + pó \] ‘bed-bug’
  \[ ŋə.l̥a \] from \[ ŋiʔ + l̥a \] ‘two months’

• Codas: So (Migliazza 2003)
  \[ baŋ.pɛc \] ‘to work sorcery’
  \[ sam.loʊŋ \] ‘slipknot’
Allowable Vowels

- Schwa
- Responses to vowel harmony
- Small set of peripheral vowels

Chrau has each of these (Thomas 1971)

- [pədər] ‘send’
- [sidac] ‘king’
- [ruwēh] ‘elephant’
Number of Minor Syllables

• One: Moken (Pittayaporn 2005)
  
  [pʰə.laː]  ‘husked rice’
  [ka.bu.t]  ‘cloud’

• Multiple: Palaung (Shorto 1960)
  
  [rə.kər.taʔ]  ‘loom’
  [kə.rə.thaiŋ]  ‘chair’
Criteria:
What Might Work
3 Properties of Sesquisyllables

• Final prominence
  – Despite claims to the contrary
    (Bennett 1994 on Chinese)

• Reduction of non-final syllables

• Weight restrictions
  – Heavy final syllables, light non-final syllables
Preliminary Conclusion

• Sesquisyllables are (a subtype of) iambs
• Addressed in Pittayaporn (2005) wrt Moken
  – Presyllables: weak initial syllable with a schwa vowel
  – Minor syllable: weak initial syllable with a reduced set of non-schwa vowels

• Conflated into a single category because of a lack of phonological evidence that they should be treated separately.
Implications and Questions

• If sesquisyllables are iambic, they are by definition disyllabic.
• What do we make of Type 1 sesquisyllables?
• What can phonetics tell us about the phonological structure of sesquisyllables?
Gestures

• 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 and Minor Syllables

• Can provide insight as to the phonological reality (or lack thereof) of minor syllable vowel

• Has gesture (phonological)
  – Underlying
  – Epenthetic
    “chipotle”: [tʃi.potɬ] → [tʃi.pot.le]

• No gesture (phonetic)
  – Excrescent
    “bnick” → [bənɪk]
Experiments:
Khmer and Bunong
Overview

• Acoustic investigation of 2 Mon-Khmer languages claimed to have sesquisyllables
• Measured minor syllable vowel durations and formants
• Interpreted results in light of articulation

• Results:
  – Minor syllables in Khmer are not syllables.
  – Minor syllables in Bunong are syllables.
Khmer
Sesquisyllables in Khmer

As we saw before:

“Disyllables of this type are intermediate structurally between the extended monosyllable and the full, or major disyllable” (Henderson 1952, 150)

– Extended Monosyllables
  
  \[\text{ph\text{h}dek}\] \text{‘to put to bed’}

– Minor Disyllables
  
  \[\text{som.na\text{i}m}\] \text{‘humidity}

– Major Disyllables
  
  \[\text{kait.lai\text{n}\text{h}}\] \text{‘to grow’}
Type 1 Sesquisyllables

[mteh]  ‘pepper’  ឈឺឈឺ
[mə'teh]

[ptʃoap]  ‘attach’  បាន
[pə'tʃoap]
Khmer Clusters

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□[ə] □[ə̥] □Ø

Huffman (1972)
Possible Results I
Possible Results II

<table>
<thead>
<tr>
<th>s</th>
<th>k</th>
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</table>

- **Gestures**
- **Voicing**

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Method

• Participants
  – 18 Khmer speakers, ages 18 – 44 (μ = 27), recorded in Phnom Penh

• Stimuli
  – CCVC/CəCVC: 20
  – C∧(C).CVC: 4
  – C∧C: 13
  – Read in frame sentence: [nijij _____ m职业道德 tiət]
  – 3 repetitions
Khmer Distributional Results
Distributional Results I

- 716 CCVC/CəCVC/Cə̥CVC tokens (reps 2 and 3)
  - 442 tokens (62%) have underlap
  - 274 tokens (38%) do not have underlap
Distributional Results II

• Of the tokens with underlap
  – 123 (55%) have voiced underlap
  – 99 (45%) have voiceless underlap
Clusters with non-sibilant C1s

• C1 is voiced ([m] or [l])
  – Underlap in 93% of tokens
  – Underlap is voiced 100% of the time

• C1 is voiceless ([p] or [t])
  – Underlap in 95% of tokens
  – Underlap is voiceless 99% of the time

• Note exception of [pr]
Khmer Duration Results
Non-sibilant C1s

• Is there a difference in duration between [ə] and [œ]?

• Linear regression of underlap type ([ə] vs. [œ]) after factoring out differences in C1 and C2 type via an analysis of residuals show:
  – No correlation between underlap type and total duration
  – No correlation between underlap type and underlap duration

• Durations of [ə] and [œ] are not significantly different.
Sibilant C1s

• Whether a cluster “has” underlap or does not have underlap is not correlated with the duration of the cluster ($\rho = 0.1263$).

• Suggests that clusters with sibilant C1s may have underlap although not visible on a spectrogram.

• If underlap is present, center of gravity measurements should be different between \textit{tʃCVC} and \textit{tʃVC}.
Sibilant C1s

- Slope of the decrease in intensity for [tʃ] as C1 in a cluster is significantly different than for [tʃ] as a simplex onset, suggesting that underlap may be present. This is not the case for [s].
Underlap vs. Unstressed Syllables

• Comparison of underlap durations with vowel durations in unstressed syllables

• [mteh]/*məteh* ‘pepper’ ប្រយោគ
• [mat.'pɔt] ‘stretch one’s back’ ប្រមាណតា

• Highly significant difference in duration ($p < 0.0001$)
Khmer Formant Results
Formant Results

• Comparison of F1 and F2 for $C_1^{[alveolar]}-C_2^{[velar]}$ pairs between “minor syllable” [$\emptyset$], as well as unstressed and stressed [$\Lambda$].

• F1 is lower for [$\emptyset$] than [$\Lambda$].

• F2 is higher for [$\emptyset$] than [$\Lambda$].

• These results are consistent with an interpretation under which [$\Lambda$] has an associated tongue gesture and [$\emptyset$] does not.
Vowel Plots

C1 – labial

+ [ə] CəCVC
○ [ʌ] CʌC.CVC, CʌC

C1 – alveolar
Khmer Conclusions

• Type 1 “minor syllable” nuclei are qualitatively and quantitatively different than other schwa vowels in Khmer.

• Results suggest they do not have an associated tongue gesture but are instead transition states between consonant gestures.

• They should not be considered minor syllables.
Bunong
Bunong

- Mon-Khmer family
- Also Phnong or Mnong
- Spoken in Cambodia and Vietnam
- About 52,000 speakers worldwide
- Previous work
## Word Types

<table>
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<tr>
<th>Monosyllables</th>
<th>Sesquisyllables</th>
<th>Disyllables</th>
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<td>/rə.la:w/</td>
<td>/ko.raɲ/</td>
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<tr>
<td>‘forest’</td>
<td>‘more than’</td>
<td>‘lord’</td>
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<td>/plaj/</td>
<td>/lə.hat/</td>
<td>/ko.mak/</td>
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<td>‘fruit’</td>
<td>‘tightly fitting’</td>
<td>‘knee’</td>
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<td>/cuaj/</td>
<td>/təm.təl/</td>
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<td>‘offend’</td>
<td>‘to fight’</td>
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<td>‘uncle’</td>
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Minor Syllables vs. Complex Onsets

Phaen et al. (2012)

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<td>k</td>
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<td>r</td>
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any consonant, except liquids or glides

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<thead>
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<th>palatal</th>
<th>velar</th>
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<td>t</td>
<td>c</td>
<td>k</td>
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<td>c^h</td>
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Questions

• How do minor syllables in Bunong compare to
  – underlap
    • Does Bunong have underlap?
  – major syllables

• How do Bunong minor syllables compare to
  Type 1 minor syllables in Khmer?
Predictions

a) CVC
b) CCVC
c-
   1) CCVC
   2) CəCVC
Method

• Participants
  – 12 Bunong speakers, ages 22 – 36 (μ = 28), recorded in Mondulkiri Province

• Stimuli
  – Complex onset monosyllable CCVC: 7
  – Sesquisyllable CǝCVC: 12
  – Simplex onset monosyllable CʌC: 21
  – Read in frame sentence: [lah nau ____]
  – 3 repetitions
Results:
Minor Syllables vs. Underlap
Underlap Distribution

- 45 – 48 tokens per box
- Top = Percent of tokens with underlap
- Bottom = Percent of underlap tokens that are voiced

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Underlap Duration

• Consonant sequences fall into three groups
  – Pre-nasalized stops ([mp], [nt])
  – Cr voiced transition sequences
  – Cl voiceless transition sequences

• Following same methodology from Khmer experiment, results show that [ə] and [ə̥] are not significantly different in length.
C1 sibilants

- Clusters with C1 sibilants have voiced underlap in 80% of cases, likely due to C2 [r].
- Unlike Khmer [tʃ], additional underlap is not present ($p = 0.1205$).
Duration Results

• Duration for minor syllable schwa is significantly longer than underlap duration ($p < 0.0001$).
Formant Results

• F1 values are significantly lower for underlap than for minor syllable schwa ($p < 0.0001$).
• F2 values are not significantly different ($p = 0.954$)

![Graph showing F1 vs F2 values for Underlap, Minor, and Syllable Schwa]
Results:
Minor Syllables vs. Major Syllables
Duration Results

• Not surprisingly, minor syllable vowels – which are always unstressed – are significantly shorter than major syllable vowels, which are always stressed ($p < 0.0001$).
Formant Results I

• Because it has been claimed that minor syllable vowels are underlingly /a/ but are phonetically reduced to [ə], the minor syllable vowel is compared here to both underlying /a/ and /ʌ/ in monosyllables.

• F2 is not significantly different.

• F1 is highest for [a], then [ʌ], then [ə]. All differences are significant ($p < 0.0001$)
Formant Results II

- /ə/
- /ʌ/
- /a/
Bunong Conclusions

• Minor syllables in Bunong are qualitatively and quantitatively different from underlap.
• They are also qualitatively and quantitatively different than underlying stressed vowels.
• These results suggest Bunong minor syllable nuclei are phonological (and have an associated tongue gesture) but reduced due to lack of prominence.
General Conclusions
• Minor syllables in Khmer and Bunong are not the same thing.
• Sesquisyllables in Khmer can be reclassified as monosyllables.
• Sesquisyllables in Bunong can be reclassified as disyllables, in particular iambs.
• If we take the presence of a gesture with a target in the vocal tract to be the basis of the phonological reality of a sound, we can empirically distinguish between Type 1 sesquisyllables and other types.

• More phonological evidence is needed to determine if we should make a distinction between Types 2 – 4.
Main Conclusion

• The terms *sesquisyllable* and *minor syllable*
  – Conflate different phonological entities into one
  – Are unnecessary in that they refer to phonological units that can be described by phonological notions that are more widely accepted

• More work is needed to flesh out what sesquisyllables really are in each language purported to have them.
Thank you!
References I

References II