A Gestural Deconstruction of the Minor Syllable

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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

  [pʰdek] 'to put to bed'

  – Minor Disyllables

  [sɔm.naɨm] 'humidity

  – Major Disyllables

  [kaɨt.laɨŋ] '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

- [rə.bɨŋ] ‘gourd’
  Bunong (Butler, in progress)
- [ti.jɔ̃k] ‘to point’
  Jahai (Burenhult 2001)
- [tər.pah] ‘to slap each other’
  Pacoh (Watson 1964)
- [m̩.ləm] ‘one’
  Stieng (Haupers 1969)

Variability

/ljung/ Turung (Morey 2005)

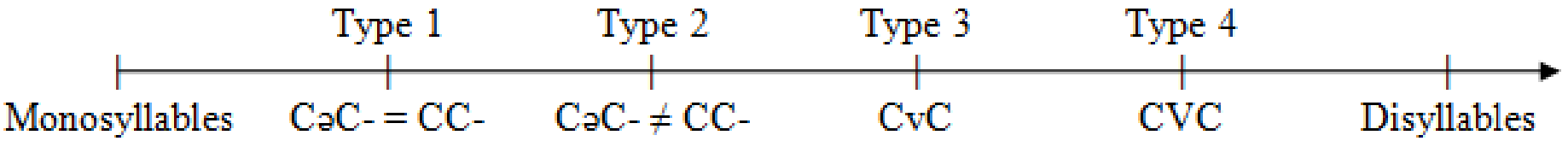
[ljung] ‘finger’

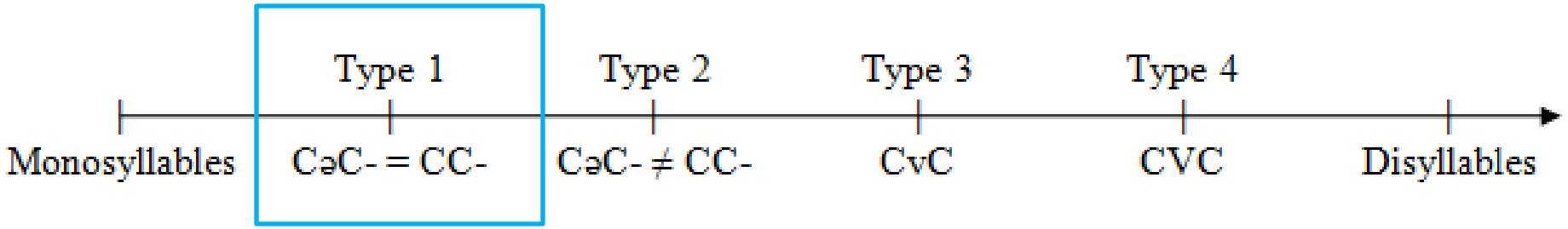
[ləjung] ‘finger’

[lijung] ‘finger’

A Scale of Syllabicity

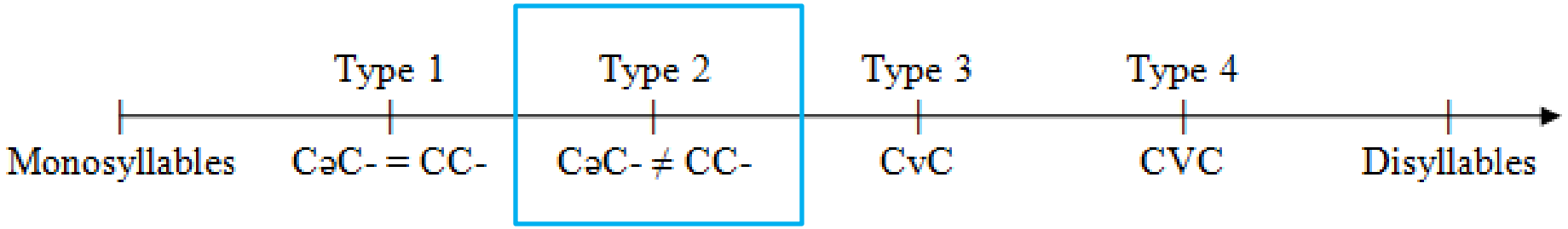
Thomas (1992)


Type 1
Type 2
Type 3
Type 4
Monosyllables
CəC- = CC-
CəC- ≠ CC-
CvC
CVC
Disyllables



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.)

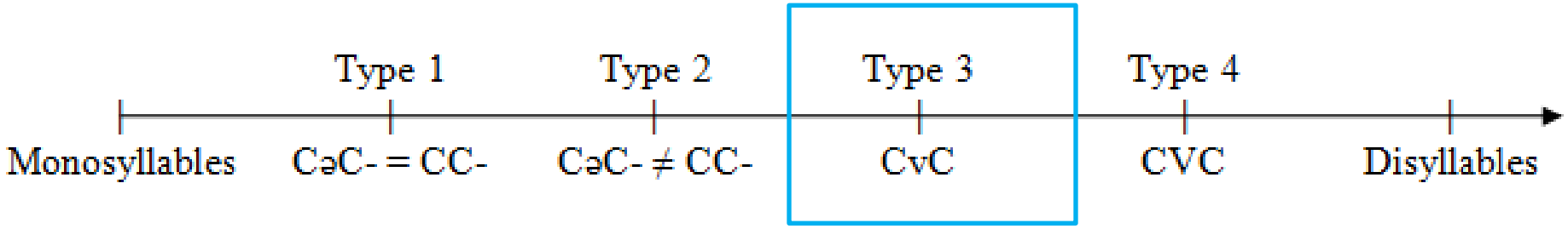


Type 2

- 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’
  - [ruwɛh] ‘elephant’



Type 3

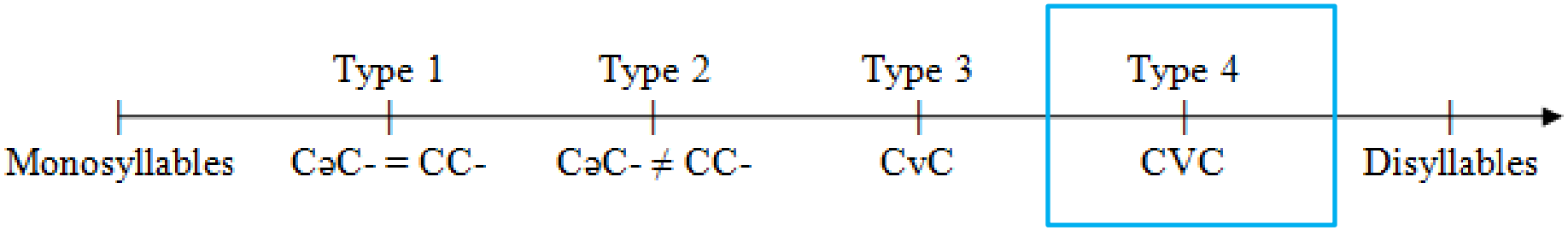
- Minor syllable vowel is NOT predictable from environment
- Minor syllable has a reduced inventory

  – 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’

  [n̥ə.la̰] from [n̥iʔ + la̰] ‘two months’

- Codas: So (Migliazza 2003)

  [baŋ.pɛ̰c] ‘to work sorcery’

  [sam.loːŋ] ‘slipknot’

Allowable Vowels

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

- Chrau has each of these (Thomas 1971)

[pədar]	‘send’
[sidac]	‘king’
[ruwɛh]	‘elephant’

Number of Minor Syllables

- One: Moken (Pittayaporn 2005)

  [phə.laː] ‘husked rice’

  [ka.but] ‘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

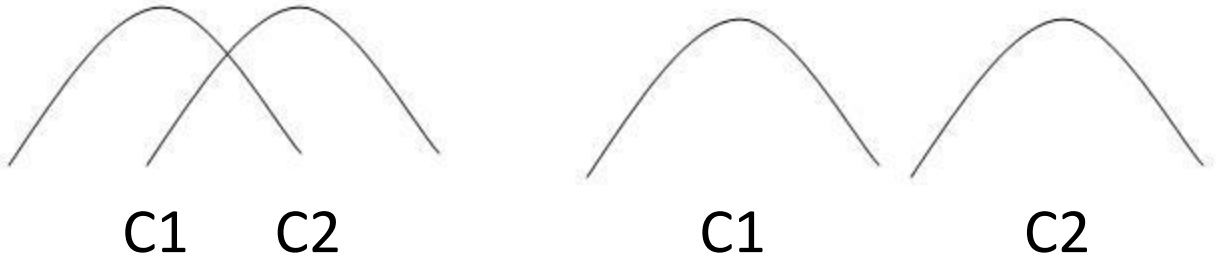
- Conflated into a single category because of a lack of phonological evidence that they should be treated separately.

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

[pʰdek] 'to put to bed'

– Minor Disyllables

[sɔm.naɨm] 'humidity

– Major Disyllables

[kaɨt.laɨŋ] 'to grow'

Type 1 Sesquisyllables

[mteh]	‘pepper’	ស្ម៉ះ
[mə'teh]		
[pt͡ʃoap]	‘attach’	ភ្ជាប់
[pə̤'t͡ʃoap]		

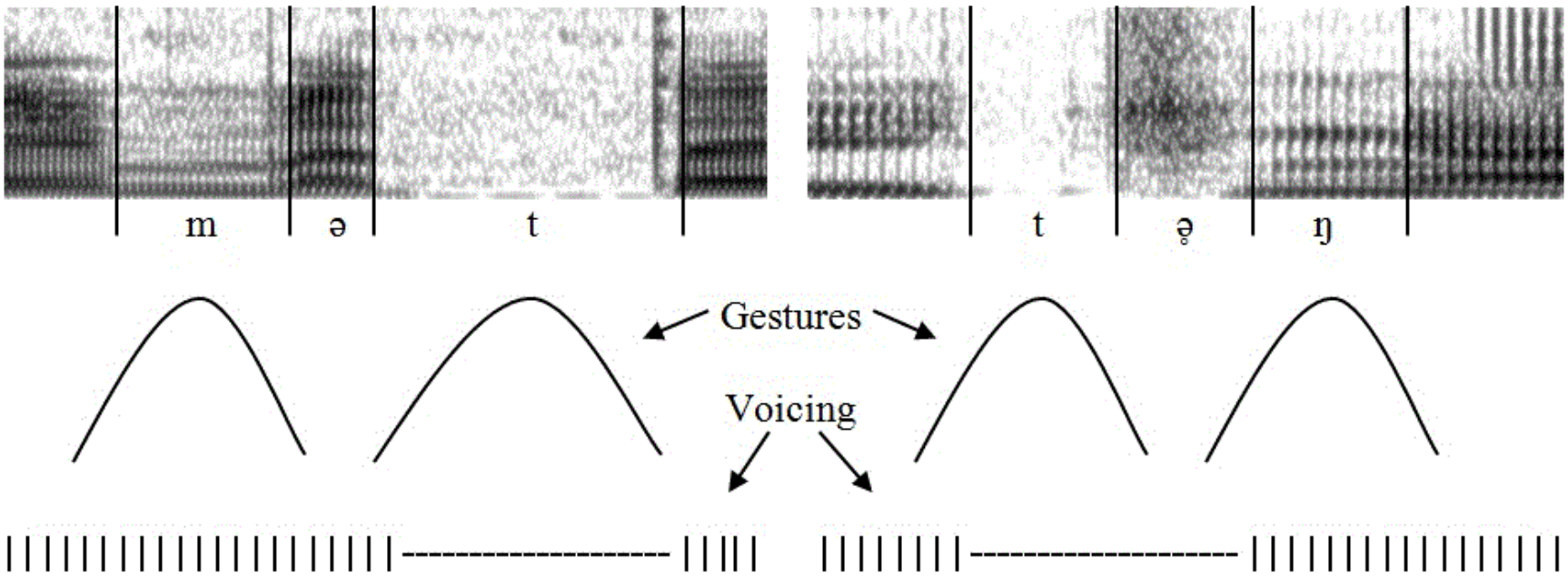
Khmer Clusters

C1 \ C2	s	h	r	l	p	t	tʃ	k	m	n	ɲ	ŋ	ʔ	b	d
p	ps	ph	pr	pl		pt	ptʃ	pk		pn	pɲ	pŋ	pʔ		pd
t		th	tr	tl	tp			tk	tm	tn		tŋ	tʔ	tb	
tʃ		tʃh	tʃr	tʃl	tʃp			tʃk	tʃm	tʃn		tʃŋ	tʃʔ	tʃb	tʃd
k	ks	kh	kr	kl	kp	kt	ktʃ		km	kn	kɲ	kŋ			
s			sr	sl	sp	st		sk	sm	sn	sɲ	sŋ	sʔ	sb	sd
m	ms	mh	mr	ml		mt	mtʃ			mn	mɲ		mʔ		
l		lh			lp			lk	lm			lŋ	lʔ	lb	

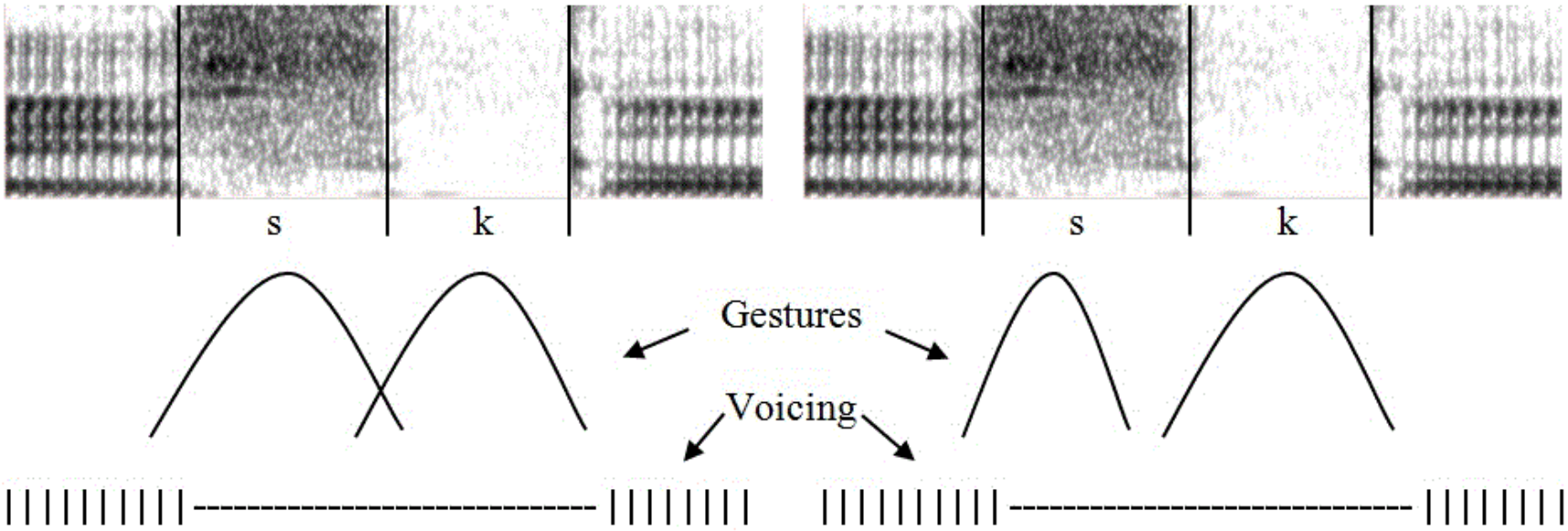
□[ə] ▩[ə̯] ■Ø

Huffman (1972)

Possible Results I



Possible Results II



Method

- Participants
  - 18 Khmer speakers, ages 18 – 44 (μ = 27), recorded in Phnom Penh
- Stimuli
  - CCVC/CəCVC: 20
  - CʌC(C).CVC: 4
  - CʌC: 13
  - Read in frame sentence: [nijij _____ mdɔŋ tiət]
  - 3 repetitions

Khmer Distributional Results

Distributional Results I

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

C1 \ C2	s	h	r	l	p	t	tʃ	k	m	n	ɲ	ŋ	ʔ	b	d
p	ps	ph	100	pl		pt	92	100		94	pɲ	94	pʔ		pd
t		th	tr	tl	tp			tk	tm	tn		94	tʔ	tb	
tʃ		6	tʃr	tʃl	tʃp			6	tʃm	tʃn		31	tʃʔ	56	tʃd
k	ks	kh	kr	kl	kp	kt	ktʃ		km	kn	kɲ	kŋ			
s			sr	sl	sp	0		0	6	sn	sɲ	0	sʔ	sb	sd
m	ms	mh	mr	ml		77	mtʃ			86	mɲ		mʔ		
l		lh			lp			97	97			97	lʔ	100	

Distributional Results II

- Of the tokens with underlap
  - 123 (55%) have voiced underlap
  - 99 (45%) have voiceless underlap

C1 \ C2	s	h	r	l	p	t	tʃ	k	m	n	ɲ	ŋ	ʔ	b	d
p	ps	ph	100	pl		pt	0	0		3	pɲ	0	pʔ		pd
t		th	tr	tl	tp			tk	tm	tn		0	tʔ	tb	
tʃ		0	tʃr	tʃl	tʃp			0	tʃm	tʃn		0	tʃʔ	75	tʃd
k	ks	kh	kr	kl	kp	kt	ktʃ		km	kn	kɲ	kŋ			
s			sr	sl	sp				0	sn	sɲ		sʔ	sb	sd
m	ms	mh	mr	ml		100	mtʃ			100	mɲ		mʔ		
l		lh			lp			100	100			100	lʔ	100	

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

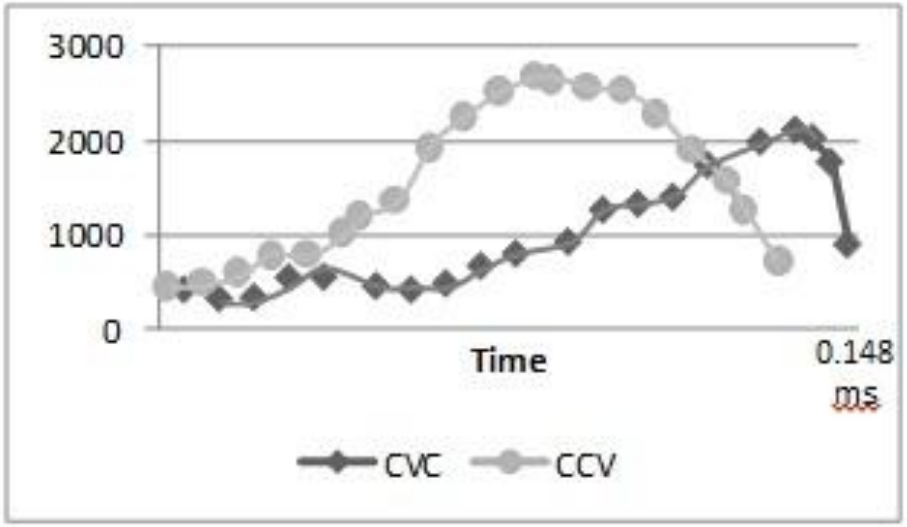
- Is there a difference in duration between [ə] and [ə̰]?
- Linear regression of underlap type ([ə] vs. [ə̰]) after factoring out differences in C1 and C2 type via an analysis of residuals show:
  - No correlation between underlap type and total duration
  - No correlation between underlap type and underlap duration
- Durations of [ə] and [ə̰] are not significantly different.

Sibilant C1s

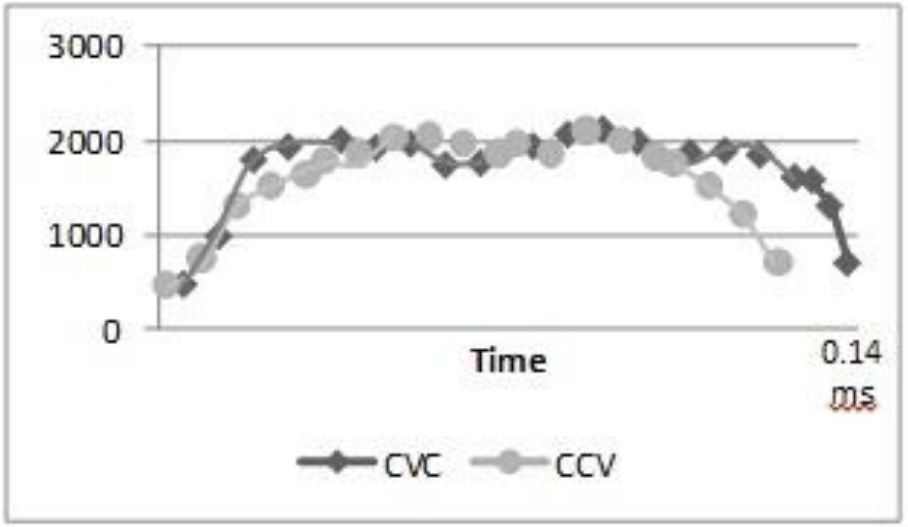
- Whether a cluster “has” underlap or does not have underlap is not correlated with the duration of the cluster (p = 0.1263).
- Suggests that clusters with sibilant C1s may have underlap although not visible on a spectrogram.
- If underlap is present, center of gravity measurements should be different between t͡ʃCVC and t͡ʃVC.

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].



[tʃ]



[s]

Underlap vs. Unstressed Syllables

- Comparison of underlap durations with vowel durations in unstressed syllables

- [mteh]/[mə̲teh] ‘pepper’ ម្ទេស
- [mʌ̲t.ˈpot] ‘stretch one’s back’ មឹតពត់

- Highly significant difference in duration ($p < 0.0001$)

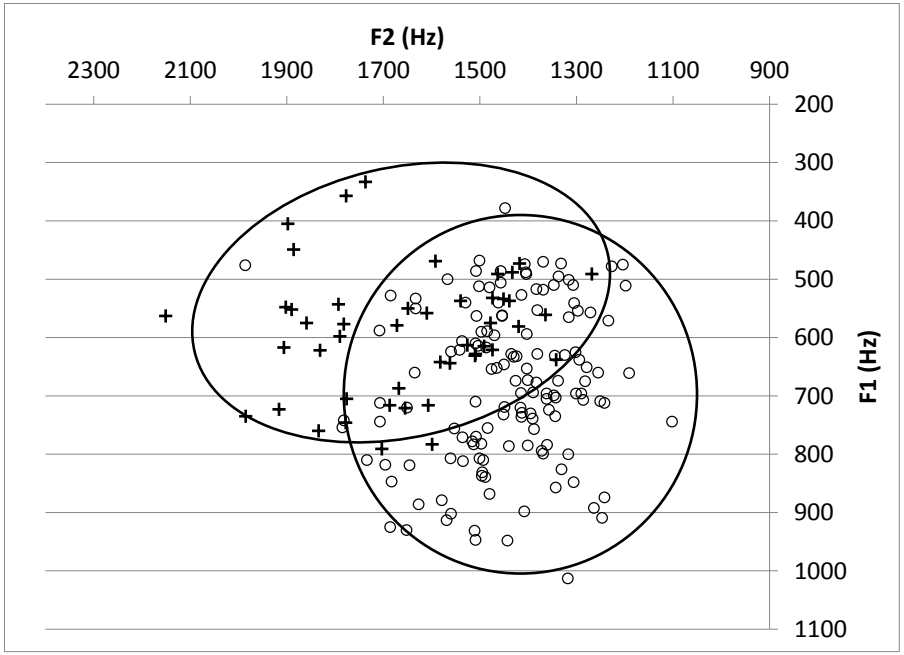
Khmer Formant Results

Formant Results

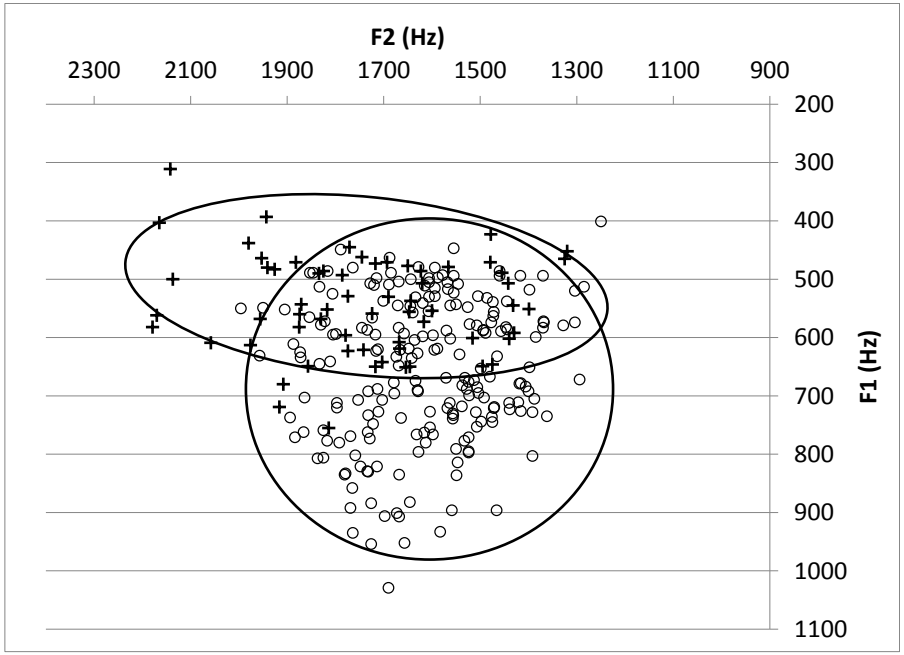
- Comparison of F1 and F2 for $C1_{[alveolar]}$-$C2_{[velar]}$ pairs between "minor syllable" [ə], as well as unstressed and stressed [ʌ].
- F1 is lower for [ə] than [ʌ].
- F2 is higher for [ə] than [ʌ].

- These results are consistent with an interpretation under which [ʌ] has an associated tongue gesture and [ə] does not.

Vowel Plots



C1 – labial



C1 – alveolar

+ [ə] CəCVC

○ [ʌ] CʌC.CVC, CʌC

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

Bequette (2008), Phaen et al. (2012), Phillips (1973 *inter alia*), Vogel and Filippi (2006)

Word Types

Monosyllables

/bri:/	‘forest’
/plaj/	‘fruit’
/cuaj/	‘offend’
/khʌt/	‘die’
/kuʔ/	‘sit’
/koːɲ/	‘uncle’

Sesquisyllables

/rə.la:w/	‘more than’
/lə.hat/	‘tightly fitting’
/təm.tɔl/	‘to fight’
/kə.tojç/	‘hatchet’
/m.lam/	CLASSIFIER

Disyllables

/ko.raɲ/	‘lord’
/ko.mak/	‘knee’

Minor Syllables vs. Complex Onsets

C_1C_2VC	
C1	C2
any consonant	r l w j

$C_1ə.C_2VC$		
C1	v	C2
p p^h c^h k r l	ə	any consonant, except liquids or glides

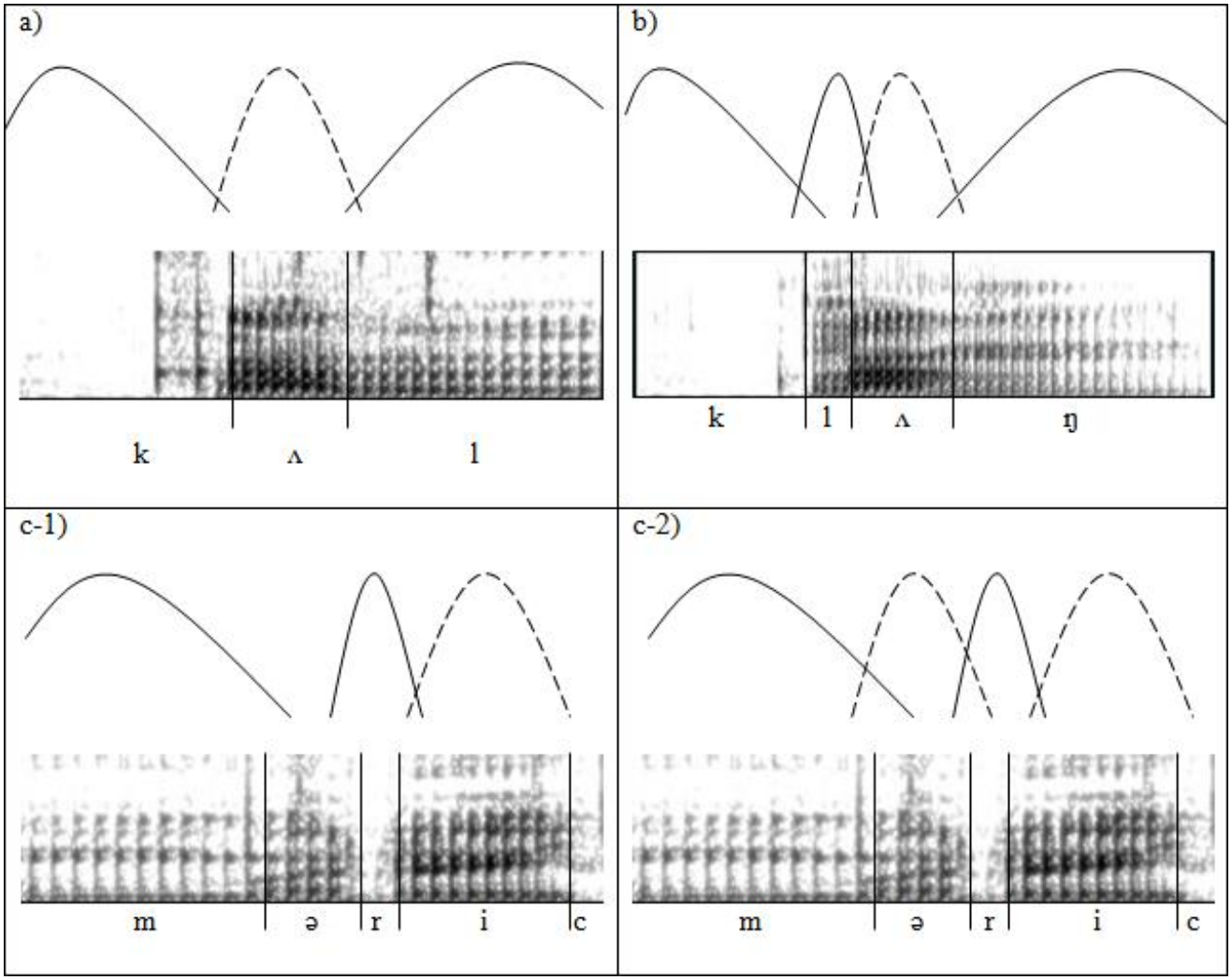
	labial	alveolar	palatal	velar	glottal
unaspirated plosive	p	t	c	k	ʔ
aspirated plosive	p^h	t^h	c^h	k^h	
pre-nasalized plosive	^{m}b	^{n}d	^{ɲ}ɟ	^{ŋ}g	
implosive	ɓ	ɗ			
nasal	m	n	ɲ	ŋ	
tap		ɾ			
fricative		s			h
approximant	w	l	j		

Phaen et al. (2012)

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 CəCVC: 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

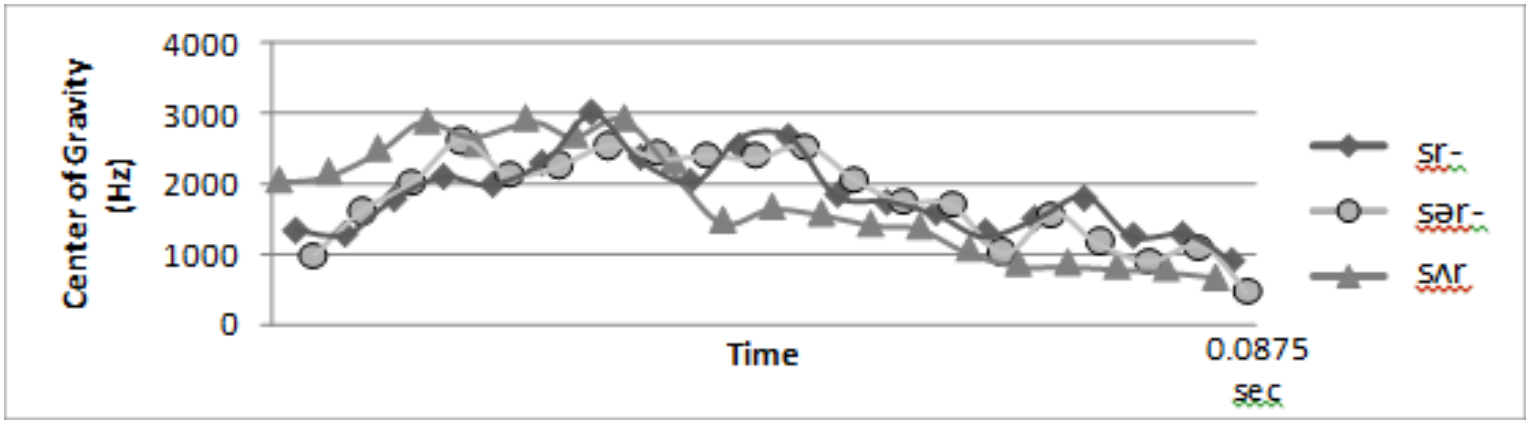
C1 \ C2	p	t	r	l
k				98 0
s			80 100	
m	0 X		89 100	
n		6 100		
ŋ			98 100	13 0

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.

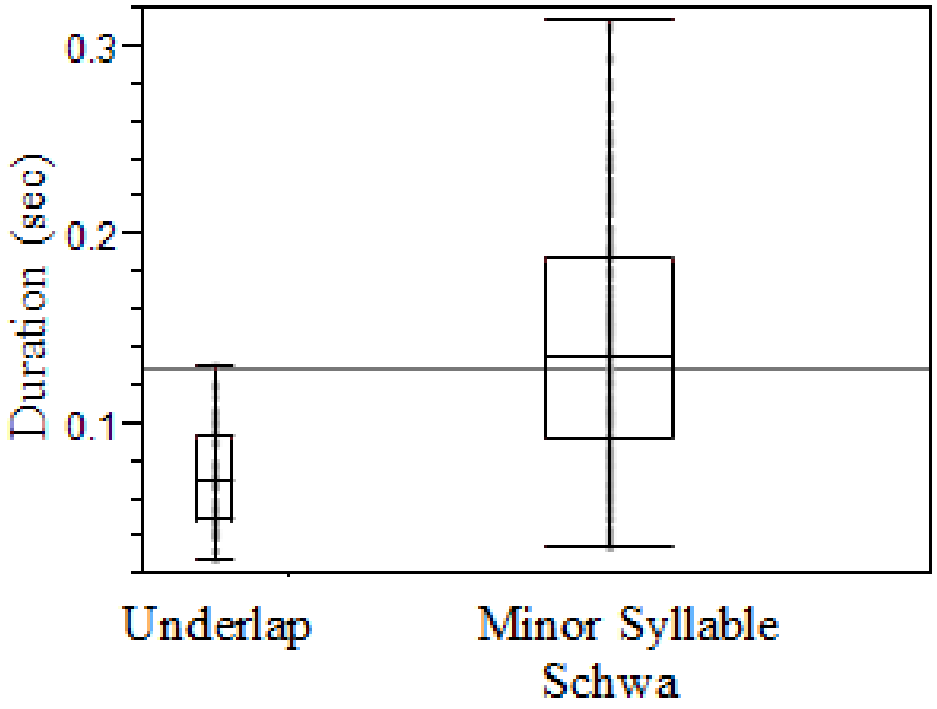
C1 sibilants

- 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).



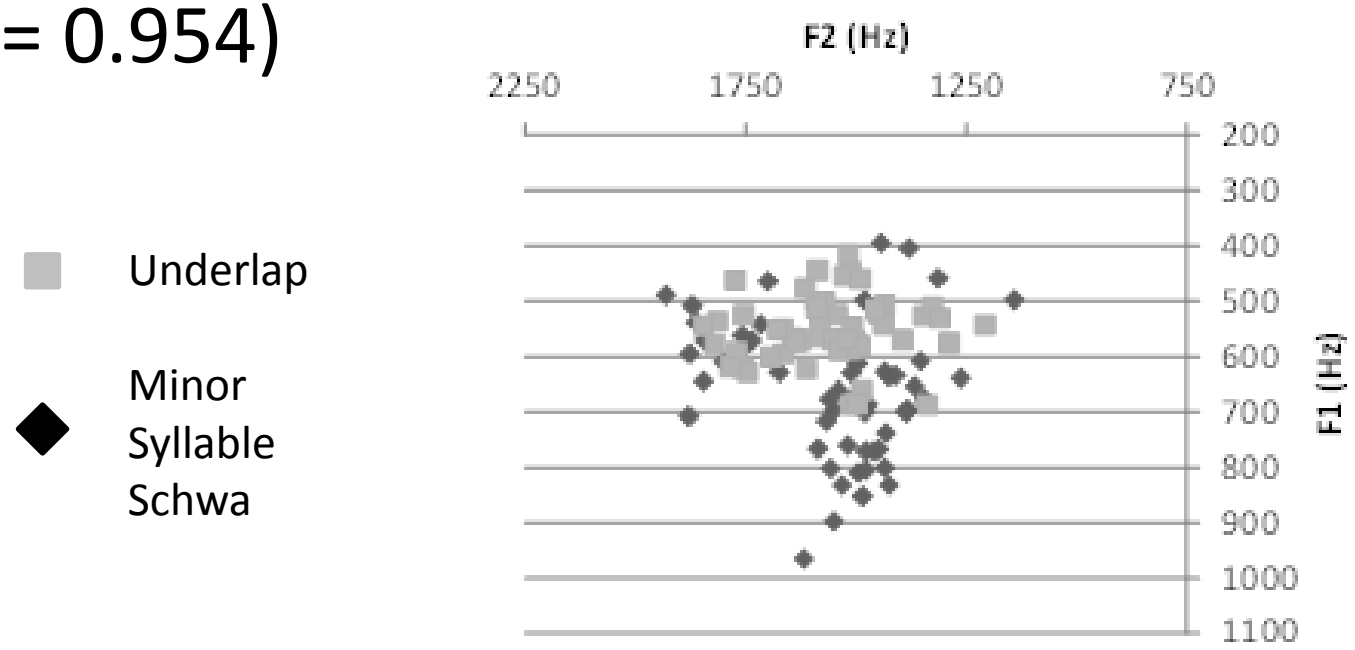
Duration Results

- 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 ($p = 0.954$)



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

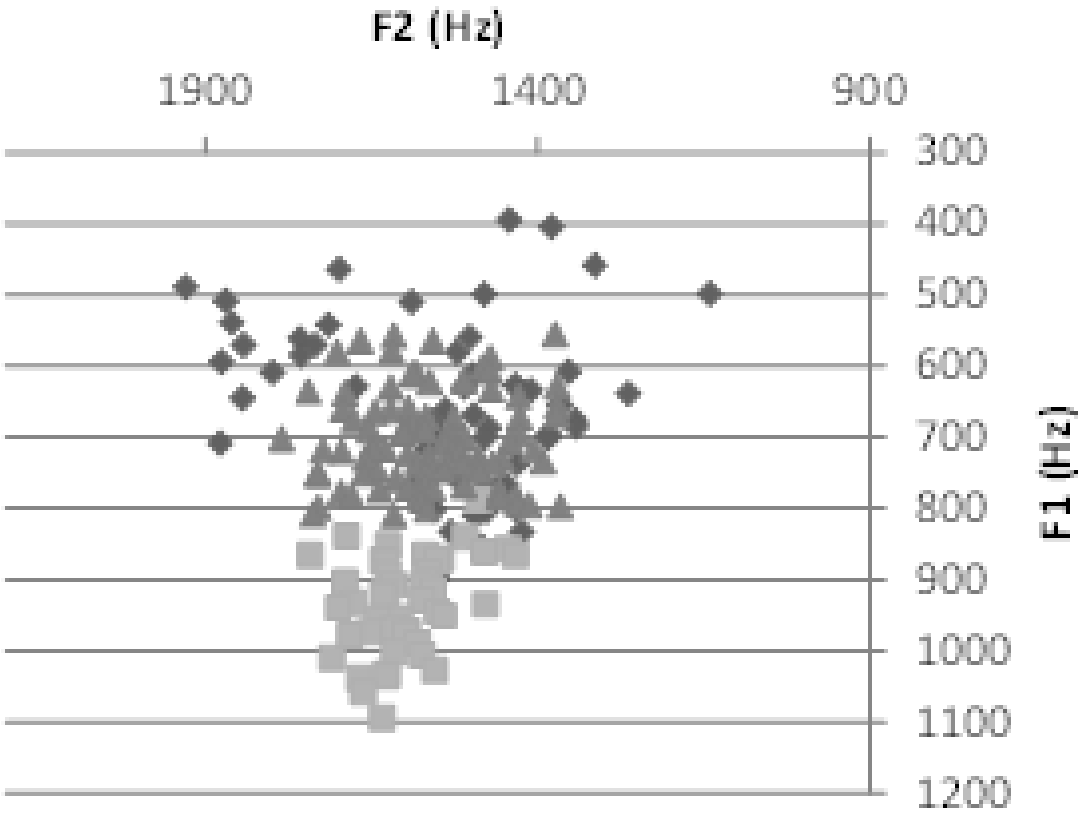
- Because it has been claimed that minor syllable vowels are underlyingly /a/ but are phonetically reduced to [ə], the minor syllable vowel is compared here to both underlying /a/ and /ʌ/ in monosyllables.
- F2 is not significantly different.
- F1 is highest for [a], then [ʌ], then [ə]. All differences 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!

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