Phonology at the Interface of Morphology and Phonetics: On the Distinct Synchronic Origins of Creaky Vowels in Two Mon-Khmer Languages

Introduction:

1. Phonological systems function to optimize the acoustic salience of their contrastive values.

   The optimal phonology is that which results in the salient encoding of its contrasts: **acoustic transparency**.

   In situations where contrasts run the risk of neutralizing, phasing rules manipulate gestural timing relationships in order to ensure the perceptual salience of these values.


   There are exceptions to this generalization (Steriade 1993): Chong.

3. Chong creaky vowels are not associated with a laryngeal constriction. Their creakiness is derived from a lexically laryngealized tautosyllabic coda stop—the laryngeal constriction precedes the oral closure.

   \[
   \begin{align*}
   SL \text{ (supralaryngeal):} & \quad \text{coronal stop:} \quad \begin{array}{c}
   \text{low vowel:} \quad \begin{array}{c}
   \text{constriction:}
   \end{array}
   \end{array} \\
   L \text{ (laryngeal):} & \quad \begin{array}{c}
   a \\
   \bar{a} \\
   t
   \end{array}
   \end{align*}
   \]

   Sedang creaky vowels are true creaky vowels: the laryngeal constriction is nuclear in affiliation:

   \[
   \begin{align*}
   SL: & \quad \text{coronal stop:} \quad \begin{array}{c}
   \text{low vowel:} \quad \begin{array}{c}
   \text{constriction:}
   \end{array}
   \end{array} \\
   L: & \quad \begin{array}{c}
   a \\
   \bar{a} \\
   t
   \end{array}
   \end{align*}
   \]

4. There are phonetic, phonotactic, and morphological reasons for the Chong and Sedang patterns.

Chong:

5. Chong is a Mon-Khmer language spoken by approximately 5500 people in Cambodia and Thailand (Huffman 1985, Thonkum 1987a,b).

6. Chong vowels may be phonetically creaky and/or breathy. Vowel creakiness is derived from laryngealized word-final stops. Breathiness is derived from a nuclear phonation contrast.
7. segment inventory:

<table>
<thead>
<tr>
<th>p</th>
<th>t</th>
<th>c</th>
<th>k</th>
<th>i</th>
<th>u</th>
<th>u</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>TH</td>
<td>CH</td>
<td>KH</td>
<td>E</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>B</td>
<td>D</td>
<td>N</td>
<td>I</td>
<td>J</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>N</td>
<td>η</td>
<td>η</td>
<td>S</td>
<td>L, R</td>
<td>J</td>
</tr>
</tbody>
</table>

8. Chong contains four "registers".

R(egister) 1: clear voice, high pitch, higher F1
R2: clear-creaky voice, high-falling pitch, higher F1
R3: breathy voice, lower pitch, lower F1
R4: breathy-creaky voice, low-falling pitch, lower F1

examples of Chong registers:

R1: chih¹ [chi] to dry in the sun
    pu¹ [puk] rotten smell
    sii¹ [sii] head louse
    pʰo?¹ [pʰo?] to dream

R2: kəsut² [kəsu³t] to come off
    tham² [tham] crab
    kəpʰaŋ² [kəpʰaŋ] scraps, chips
    suuc² [suuc] ant

R3: puut³ [pʊu⁴t] to speak
    kəlaa³ [kəlaa³] ear
    pəh³ [pəh] ashes
    kəcaai³ [kəcaai³] nine

R4: luuc⁴ [luuc] soft
    kəlaai⁴ [kəlaai⁴] loose
    cam⁴ [cam] bruised
    peet⁴ [peet] hips

9. Chong codas:

stops: p kəkæp¹ [kəkæp] to cut (with scissors)
       t pe³t [pe³t] plague
       c kənooc² [kənooc²] nipple
       k leek¹ [leek¹] chicken
nasals: m cum⁴ [cum] vine, climber
        n khiin² [khiin²] guard
        n (no examples given)
        n kəleŋ² [kəleŋ²] floor
glides: j luj⁴ [lu⁴j] earthworm
        w we² [we²] curved
laryngeals: ? rəko⁷¹ [rəko⁷¹] tips (of climbers and creepers)
            h pah³ [pah] dry
10. Generalizations regarding the distribution of Chong laryngeals:
   1) In creaky registers, creakiness always follows clear or breathy phonation.
   2) While /ʔ/ and /h/ codas may co-occur with the clear and breathy registers, /ʔ/ and /h/ codas may not co-occur with clear-creaky and breathy-creaky registers.

\[
\begin{align*}
[\text{Vʔ}] & \quad \text{but} & *[\text{VVʔ}] \\
[\text{Vʔ}] & \quad *[\text{VVʔ}] \\
[\text{Vh}] & \quad *[\text{VVh}] \\
[\text{Vh}] & \quad *[\text{VVh}]
\end{align*}
\]

3) Creaky registers co-occurring with sonorant codas are realized as laryngealization on the coda only, not on the vowel.

4) Creaky registers may only occur in closed syllables.

11. All of these generalizations may be accounted for if the laryngeal constriction is ordered to follow the nucleus. That is, the constriction is part of the coda, lexically coextensive with a coda supralaryngeal constriction, if one.

12. 1) In creaky registers, creakiness always follows clear or breathy phonation.

Creaky phonation follows breathy phonation because codas follow stops.

a. breathy vowel with laryngealized sonorant:

<table>
<thead>
<tr>
<th>SL:</th>
<th>low vowel:</th>
<th>coronal stop:</th>
<th>nasal:</th>
</tr>
</thead>
<tbody>
<tr>
<td>L:</td>
<td>abduction:</td>
<td></td>
<td>constricted</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\text{examples:} & \quad \text{cam}^4 & \quad [\text{cam}] & \quad \text{bruised} \\
\text{cOON}^4 & \quad [\text{cOON}] & \quad \text{we}
\end{align*}
\]

b. breathy vowel with laryngealized stop:

<table>
<thead>
<tr>
<th>SL:</th>
<th>low vowel:</th>
<th>coronal stop:</th>
</tr>
</thead>
<tbody>
<tr>
<td>L:</td>
<td>abduction:</td>
<td></td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\text{examples:} & \quad \text{luuc}^4 & \quad [\text{luuc}] & \quad \text{soft} \\
\text{lOOp}^4 & \quad [\text{lOOp}] & \quad \text{gadfly}
\end{align*}
\]

13. 2) While /ʔ/ and /h/ codas may co-occur with the clear and breathy registers, /ʔ/ and /h/ codas may not co-occur with clear-creaky and breathy-creaky registers.

Incompatible laryngeal states may not be simultaneous (Halle and Stevens 1971): */ʔ/, */h/, */V̥/.
14. 3) Creaky registers co-occurring with sonorant codas are realized as laryngealization on the coda only, not on the vowel itself.

Creaky registers co-occurring with sonorant codas realize their creakiness on the coda because the laryngeal constriction is lexically associated with this position.

Creaky registers co-occurring with stop codas realize their creakiness on the preceding vowel.

If laryngealization were phonetically coextensive with the oral occlusion, no acoustic energy would be present to encode this contrastive information. Therefore, the laryngeal gesture is sequenced to precede the stop closure, and acoustic transparency is achieved.
15. Creaky registers may occur only in closed syllables.

Creaky registers occur only in closed syllables because the laryngeal constriction is phonologically associated with coda position. When this gesture stands alone in coda position, it is phonetically realized as a post-vocalic glottal stop.

16. Glottalized coda stops in Chong are realized as pre-glottals in order to achieve acoustic transparency.

17. Morphological and phonotactic influences:
- Chong words are very short: most roots are monosyllabic.
- Bisyllabic roots possess [kə] or [rə] as the first syllable.
- Syllable structure is quite simple: C(C)V(C)

Laryngeally augmenting root-final consonants serves to expand the inventory of contrastive root types, albeit in a non-optimal fashion.

- Chong coda stops are unreleased, as is the norm for related Mon-Khmer and areal languages.
- Mon-Khmer languages are strictly non-suffixing (Nghia 1976).

In root-final position, a laryngeal gesture that is endangered by acoustic opacity must be sequenced to precede the opacity-inducing supralaryngeal gesture if it is to survive, despite the noted preference for realization on release.

As no lexical morphological complex involves material following the root, and as root-final stops are unreleased, there is no lexical environment in which contrastive information may be phonetically realized following the root. So contrastive laryngealization in root-final plosives is realized on its tautosyllabic, or, more to the point, tautomorphic vowel.

18. Chong formalized:

a morphological constraint prohibits suffixation, allowing only left-edge alignment.

**Chong morphological constraint:**

align affixes to the right of the root/stem

**Chong phonotactic constraint:**

<table>
<thead>
<tr>
<th></th>
<th>optimal:</th>
<th>sub-optimal:</th>
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<tbody>
<tr>
<td>codas released</td>
<td></td>
<td>codas unreleased</td>
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</table>

**Chong laryngealed stop phasing constraint:**

<table>
<thead>
<tr>
<th></th>
<th>optimal:</th>
<th>sub-optimal:</th>
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<tbody>
<tr>
<td>sequence constriction at stop release</td>
<td>sequence constriction to precede stop closure</td>
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19. **Sedang:**
Sedang is a Mon-Khmer language spoken by approximately 40,000 people in Vietnam (Grimes 1988, Smith 1968).

20. **segment inventory:**

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<tbody>
<tr>
<td>p</td>
<td>t</td>
<td>tʃ</td>
<td>k</td>
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<tr>
<td>b</td>
<td>d</td>
<td>dʒ</td>
<td>ɡ</td>
<td>ɛ/ɛ</td>
<td>o</td>
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<tr>
<td>s</td>
<td>ʃ</td>
<td>ɛ/æ</td>
<td>ɔ</td>
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<td>m</td>
<td>n</td>
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<td>l, r</td>
<td>j</td>
<td>w</td>
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h, ?

21. **syllable structure:** C(C/G)V(C)

22. **permissible codas:** p, t, k, m, n, ɲ, y, w, h, ?

23. **phonotactics:**

a. Sonorants, as well as the voiced stops, which are redundantly prenasalized, may be preglottalized. When voiced stops are preglottalized they lose their nasal component.

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<thead>
<tr>
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<tbody>
<tr>
<td>lo</td>
<td>to go out</td>
<td>?lo</td>
</tr>
<tr>
<td>mot</td>
<td>to enter</td>
<td>?mot</td>
</tr>
<tr>
<td>mbo</td>
<td>opening</td>
<td>?bok</td>
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b. Sonorants may be pre-aspirated.

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<tbody>
<tr>
<td>rei</td>
<td>root</td>
<td>hre</td>
</tr>
<tr>
<td>no</td>
<td>mango</td>
<td>hno</td>
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c. Voiceless stops may be post-aspirated

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<tbody>
<tr>
<td>kia</td>
<td>grave</td>
<td>khi</td>
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24. Vowels in Sedang may be either plain or creaky. (With nasalization cross-classifying, this results in four vowel classes.) Smith: "a laryngealized vowel is a vowel during which there is simultaneous voicing and trillization," and that "(i)n closed syllables, the trillization continues through the final consonant" (p.60).

25. Creaky vowels may be present in either open syllables, or syllables closed by sonorants (see (15)), and, most significantly, "final glottal stop contrasts with [vowel--D.S.] laryngealization in open syllables"(p.60).

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</thead>
<tbody>
<tr>
<td>plain:</td>
<td>creaked:</td>
<td>checked:</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ɑ</td>
<td>very</td>
<td>ɑ?</td>
<td>daughter's husband</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o</td>
<td>young sibling</td>
<td>o</td>
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<td>cha</td>
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<td>cha?</td>
<td>gate</td>
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26. Sedang formalized:

**phasing constraint:**

共识 optimal: realize the nuclear constriction simultaneously with the vowel

Sedang creaky vowels are optimally realized.

**Conclusion:**

2. --Creaked vowels in Chong and Sedang have distinct synchronic origins.

   --Sedang creaky vowels are true laryngealized segments.

   --Chong creaky vowels are derived from phonologically laryngealized coda stops.

   --Vowels possess sufficient acoustic energy to simultaneously encode supralaryngeal and laryngeal gestures; stops do not.

   --Stops must sequence contrastive laryngeal gestures in order for them to achieve acoustic transparency.

   --This phonetic realization is intimately bound to morphological and phonotactic structure. Chong is not a suffixing language. Unreleased root-final stops which possess contrastive laryngealization must realize this laryngeal feature on a tautomorphemic vowel, if it is to survive.

   --As Chong roots are short, all possible contrasts are best maintained.

   --Although stop releases are best suited to accommodate laryngeal contrasts, particular morphological constraints may make this optimal realization site unavailable.

   --In Chong, the tautosyllabic/tautomorphemic vowel bears the burden of acoustically encoding contrastive laryngeals in this environment.