

# International Workshop on Pharyngeals & Pharyngealisation

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- **The Phonology of Pharyngeals**

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- aim
  - survey some issues in the phonology of pharyngeals

- outline
- phonological definition of pharyngeal
- research foci
- representational issues
- two problems:
  - - phonetics-phonology mismatch
  - - development of pharyngeals
- areas for further research

# Phonological definition of pharyngeal

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- a member of the postvelar natural class
  - Bessel & Czaykowska-Higgins (1991)
  - articulatorily based (expected): 'produced with postvelar articulation'
  - solely vocal fold gesture excluded (Fant source-filter distinction – vocal fold gesture doesn't filter the signal; Debuccalisation, e.g., Kelantan Malay *ʔasaʔ*)
- postvelar subclasses
  - gutturals (McCarthy 1994)
  - emphatics/retracted consonants (long list of studies on Semitic, Salishan, Caucasian)
- pharyngeal classes illustrated
  - Postvelar – lax Vs conditioned by all postvelars in colloquial Arabic, e.g., *ʔulə*, *ǫura*
  - guttural – lowered imperfects in MSA, e.g., *faʔal*, *ǫahal*, *famaχ* (McCarthy 1994)
  - emphatics – emphasis/retraction spread, e.g. Arabic */tʔɛ:b/ tɑ:b*

## Research foci

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- phonological inventories, representation, distribution, postvelar harmony, first language acquisition, sociophonology, language disorders, historical development
- languages studied
  - from Afro-Asiatic, Austro-Asiatic, Austronesian, Eskimo-Aleut, Indo-European, Kartvelian, Khoisan, Macro-Ge, Na-Dene, North Caucasian, Niger-Congo, Nilo-Saharan, Salishan, Sin-Tibetan, and Wakashan families

# Representational issues

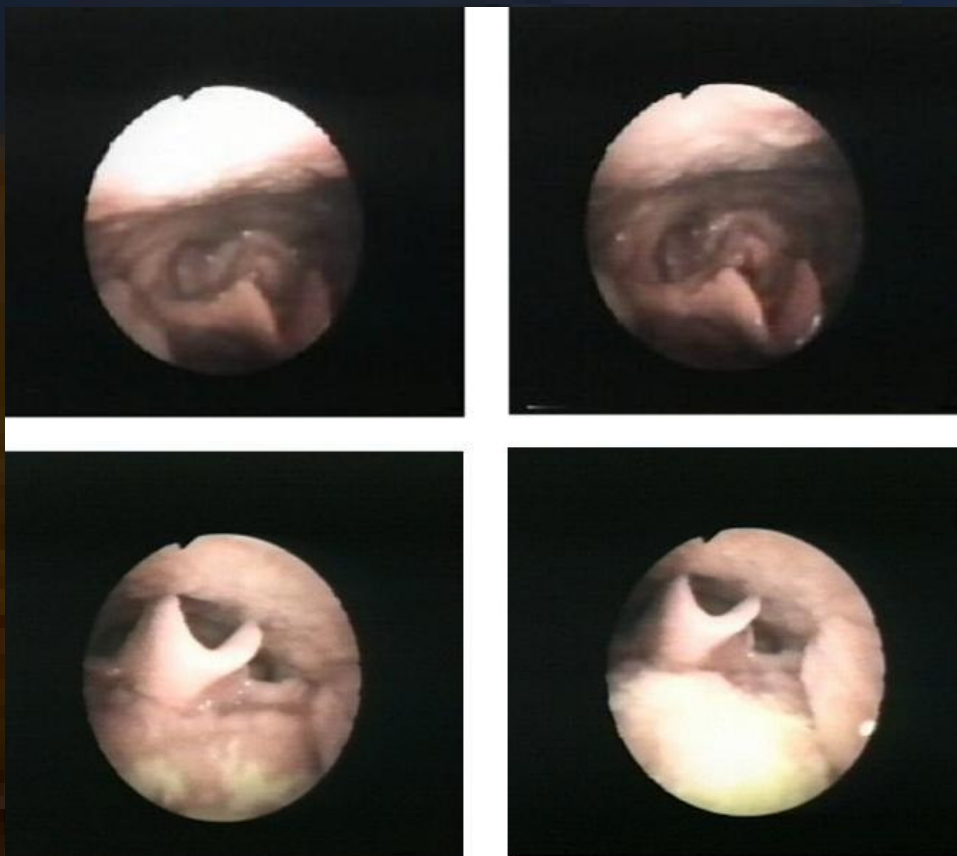
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- geometry, full specification or not
- Vaux (1994), McCarthy (1994)ff, Bin Muqbil (2005); Bellem (2007)
- representation of postvelars (Shahin 2002:2)
- (primary or secondary) [RTR]. Phonological specification for [RTR] implemented in the phonetics as aryepiglottic articulation (Carlson & Esling 2003)
- representation of gutturals
- primary [RTR] for pharyngeals and guttural laryngeals
- primary [DOR] and secondary [RTR] for uvulars (concomitant [DOR] and secondary [RTR] is representation of uvular articulation)
- representation of emphatics
- primary [LAB], [COR] or [DOR] and secondary [RTR] and secondary [DOR] (concomitant secondary [RTR] and secondary DOR is representation of uvularisation (i.e., secondary uvular articulation))

# Phonetics-phonology mismatch

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- **guttural laryngeals** (Shahin to appear a)
- **Phonetic basis for their patterning as gutturals, required by the Grounding Hypothesis (Archangeli & Pulleyblank 1994), a phonological puzzle addressed by several studies (e.g., Lindqvist-Gauffin 1969, Trigo 1991, McCarthy 1994, Nolan 1995, Zawaydeh 1999, Shahin 2002)**
- **McCarthy (1994), citing the findings of Klatt & Stevens (1969) and an assumption of Younes (1982), concluded guttural laryngeals have no postvelar articulation**
- **this conclusion premature because the Klatt & Stevens data are from guttural laryngeals in an irrelevant context, and Younes' assumption is based on data from non-guttural laryngeals**
- **Zawaydeh (1999) analysed tokens of laryngeals and found no postvelar articulation. But her tokens were produced by bilingual Arabic-English speaker in nonsense carrier forms, not in natural language tokens of real Arabic words. So we're uncertain they were the outputs of the regular phonology and phonetics of Arabic,**
- **and we still ask How are guttural laryngeals produced? Are they produced with the pharyngeal articulation shared by the other gutturals?**
- **Natural language tokens: laryngoscopic data gathered with John Esling at STR, Victoria, BC, Canada; native Arabic speaker, bilingual, adult male, Arabic word carrier forms. Hebrew data of Prof. Asher Laufer & Haskins Laboratories also examined.**



Maximum constriction of tokens of Arabic laryngeal and pharyngeal gutturals in Arabic words. From top left, clockwise:  
 ʔ h ħ ʕ.

- no aryepiglottic constriction and no retraction of tongue root or epiglottis for the laryngeals
- pharyngeals produced with extreme constriction of laryngeal sphincter, clamping down of the epilaryngeal tube, with epiglottis drawn downward by aryepiglottic folds, and with extreme retraction of epiglottis and tongue root toward rear pharyngeal wall
- stricture most extreme for ħ (found by Esling 1999 with cardinal productions)

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- **Arabic laryngeals pattern phonologically with other gutturals as members of the guttural natural class. Lack of phonetic basis for that patterning means laryngeal gutturals are, at least in Arabic, a case of phonetics-phonology mismatch. (Another case: Shank and Wilson 2000 on Nuuchahnulth ʕ.)**
  - **Grounding Hypothesis, proposed as constraint-like requirement by Archangeli & Pulleyblank (1994:172), requires featural relations be “rooted in the physical properties of the vocal track or speech signal”. Finding for Arabic indicates this requirement can be overridden by other phonological constraints:**
  - **patterning of guttural laryngeals as gutturals shows they are, at least lexically, specified for [RTR]**

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- **their [RTR] specification is lost because, at least in Arabic, the Grounding Hypothesis is dominated by the paradigmatic constraint RTR/SON ('A segment that is specified for [RTR] is specified for [Sonorant].')**
  - **Existence of RTR/SON is indicated by affinity of [RTR] with sonorants (Shahin 2002). Arabic laryngeals aren't sonorants. RTR/SON satisfied in Arabic by loss of [RTR] specification for the laryngeals.**
  - **having lost their [RTR] specification, Arabic laryngeals are implemented in the phonetics without aryepiglottic articulation, in violation of Grounding Hypothesis\***
  - **in Arabic at least, the puzzle of guttural laryngeals is an epiphenomenon of constraint interaction**
  - **This sort of constraint ranking account is anticipated for Arabic dialects in which emphatic Cs not produced with secondary uvularisation.**

\*Note that RTR/SON is itself grounded: laxness/raised  $F_1$  is more perceptible on sonorants than nonsonorants (Shahin 2002:98). This means that Grounding Hypothesis decomposes and is actually a constraint family consisting of at least (i) Grounding Hypothesis[NaturalClass] (violated by Arabic guttural laryngeals), and (ii) RTR/SON and other grounded feature cooccurrence constraints. Also note that Grounding Hypothesis[NaturalClass] is a constraint for which candidate outputs are assessed at the phonology-phonetics interface.

## Development of pharyngeals

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- uvular-to-pharyngeal shifts (Shahin to appear b)
- on Wakashan: Jakobson (1969), Carlson & Esling (2003)
- **St'át'imcets (Lillooet, Interior Salish) labialised voiced uvular gutturals are pharyngeal, not uvular**

a. <i>wəʕən</i>	‘to sort things out, to pick out the best (intr., tr.)’
b. <i>məʕəʕ</i>	‘(breaking) daylight’
c. <i>ləʕ<sup>w</sup>ən</i>	‘to hide’
d. <i>kíʕiʕ<sup>w</sup></i>	‘to be run down, withered; to have t.b.’

- Acoustic study

		context	carrier form with plain guttural	carrier form with labialised guttural
onset	1	#_ ə	<i>ʕəlʕəl</i> ‘strong, healthy, vigorous’	<i>ʕwəlp</i> ‘to burn’
	2	ə . _ ə	<i>wəʕən</i> ‘to sort out things, to pick out the best, intr., tr.’	<i>ləʕwən</i> ‘to hide something, intr., tr.’
	3	<i>i_ a</i> or <i>i_ á</i>	<i>kantíʕ’a</i> ‘to swallow (liquid) the wrong way, into one’s windpipe’	<i>tiʕ’wálk’am</i> ‘to untie a package, intr.’
coda	4	<i>i_ C.</i> or <i>i_ #</i>	<i>kantíʕ’íkana</i> ‘I swallowed something the wrong way’	<i>k’iʔiʕ’w</i> ‘to be run down, withered; to have t.b.’

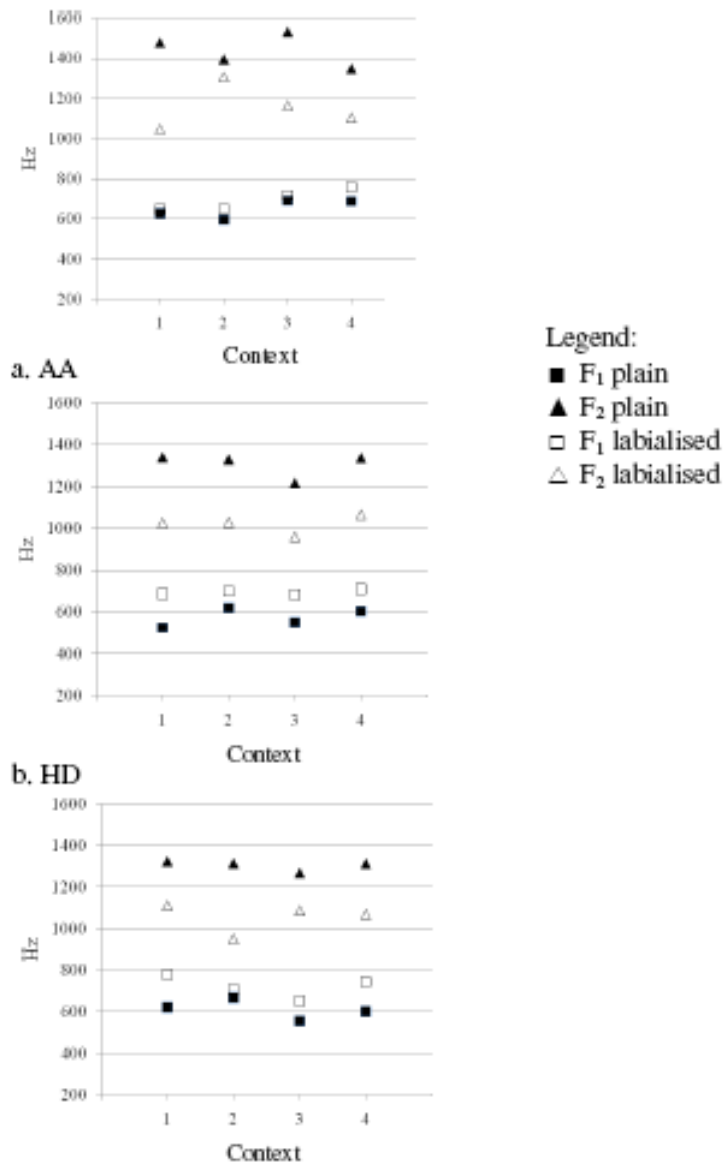
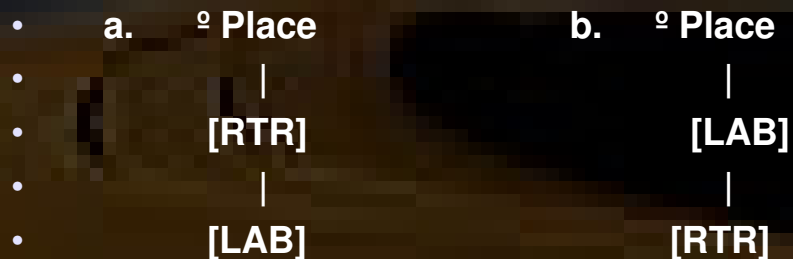


FIGURE 1. Mean F<sub>1</sub> and F<sub>2</sub> of Plain and Labialised Tokens of St'át'imcets Gutturals per Context for Speakers AA, HD, and LC

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- what 's driving the acquisition of phonologically pharyngeal place by the labialised gutturals?
  - can't be effect of highly ranked paradigmatic grounding constraint \*[dor]/[lab] ('If [dorsal], then not [labial].') (Archangeli and Pulleyblank 1994): labialised dorsals ( $k^{(ʷ)}$   $x^{w}$   $q^{(ʔ)}$   $\chi^{w}$ ) tolerated in the St'át'imcets surface consonantal inventory
  - can't be due to feature overload: overload, as with complex segments like  $q^{(ʔ)}$  and  $\chi^{w}$ , is tolerated

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- rather, a standard acoustic finding is that labialisation lowers  $F_2$
  - indicates that for St'át'imcets  $\zeta^w \zeta'^w$ , the lower  $F_2$  of their pharyngeal articulation enhances the lower  $F_2$  of their labialisation
  - enhancement: the enhancing feature helps to give “a well-defined and perceptually more reasonable acoustic correlate” of a distinctive property, since it yields “a modulation on the acoustic properties of the [distinguishing] feature” (Stevens and Keyser 1989:83, 86).
  - suggests the pharyngeal articulation of  $\zeta(\prime)^w$  is driven by the principle of Contrast in phonology (e.g., Flemming 2001): as pharyngeals, labialised  $\zeta^w \zeta'^w$  surface more distinct from their plain counterparts,  $\zeta \zeta'$ . Since uvular vs. pharyngeal distinction isn't lexical for St'át'imcets, pharyngeal realisation for the labialised gutturals is fine as it doesn't violate Contrast by creating any neutralisation.
  - Now we ask: What formal representational change have  $\zeta^w \zeta'^w$  undergone?

- relevant aspects of lexical representation of St'át'imcets  $\xi^w \xi'^w$ :

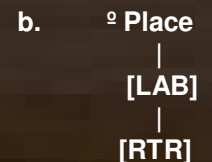
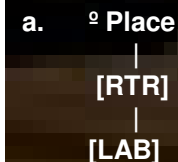


- it's clear that  $\xi^w \xi'^w$  have lost their primary place feature [DOR], since  $\xi^w \xi'^w$  have no dorsal component: they're pharyngeal. If they had a dorsal component, they'd be velar or uvular (or secondarily velarised or secondarily uvularised).
- Assume PRIM ('A segment must have primary articulation.'). A secondary articulation feature can be promoted to primary status (see Selkirk 1998) as in dialectal English *sawft* (\**sait*) 'salt', with deletion of [COR] and promotion of secondary [DOR] for the / (Chambers 1998).
- But are the  $\xi^w \xi'^w$  labialised pharyngeals (a), or pharyngealised labials (b)? Which secondary feature has been promoted to primary status?

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- a criterion by which to judge is based on the nature of secondary articulation: it's of looser stricture than the primary articulation (Ladefoged & Maddieson 1996)
  - no articulatory (e.g., MRI or ultrasound) data yet, from which to determine which, of the lip rounding and pharyngeal articulation, is tighter for St'át'imcets  $\zeta^w \zeta'^w$
  - distribution of features in this language, as shown by the language's retraction harmony, provides an answer
  - in St'át'imcets there's no secondary pharyngealisation for Cs without concomitant secondary uvularisation: the only consonants with secondary pharyngealisation are the retracted consonants  $\zeta \zeta' \zeta^w \zeta'^w \chi \chi^w$ , which are also secondarily uvularised. (Besides secondary [RTR], they also have secondary [DOR].)

- $\zeta^w \zeta'^w$  aren't retracted consonants because they don't trigger retraction harmony. Retraction harmony backs non-high vowels immediately preceding a retracted C. Relevant data below; (f–g) illustrate lack of triggering by gutturals:

a. $\text{ʔá}\zeta\text{ə}m$	'sick, ill'
b. $m\text{ə}q$	'to get stuffed, to eat too much'
c. $sqy\text{ə}\check{x}$	'drunk'
d. $m\text{ə}x\acute{a}z'$	'huckleberry'
e. $m\acute{a}q\text{a}ʔ$	'snow'
f. $c\acute{a}\zeta\text{ə}n$	'to rip, tear something, intr., tr.' ( $c\acute{a}\zeta\text{ə}n$ )
g. $m\text{ə}\zeta m\acute{a}\zeta$	'light, bright' ( $*m\text{ə}\zeta m\acute{a}\zeta$ )



- The  $\zeta^w \zeta'^w$ , then, aren't uvularised. Since uvularisation is a requirement of any St'át'imcets consonant which is pharyngealised, this means that  $\zeta^w \zeta'^w$  are labialised pharyngeals, with the representation in (a).

## Areas for further research

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- phonologisation
- Meyers (2002), Przeddzieke (2005)
- consonantal vs. vocalic nature of pharyngeal features
  - [RTR] essentially vocalic
  - gravitates to vowels, can have non-consonantal source (e.g., Akan ATR harmony)
  - secondary [RTR] + secondary [DOR] (the features of emphatics) aren't essentially vocalic; they gravitate (together) to a C or V
- Related predictions:
  - there are languages with [RTR] on Vs but not on Cs – true of 44% of languages in UPSID
  - if a language has [RTR] specified on Cs, it will have [RTR]-specified Vs, i.e., [RTR] (/pharyngealisation/laxing) harmony will occur in languages with underlying [RTR] Cs. To test this, we need the right data.
- several languages with [RTR] still unstudied  
for phonological inventories, representation, distribution, postvelar harmony, first language acquisition, sociophonology, language disorders, historical development etc

## Selected references

- Bellem, A. 2007. Towards a comparative typology of emphatics: across Semitic and into Arabic dialect phonology. PhD dissertation, SOAS, University of London.
- Bessell, N. & E. Czaykowska-Higgins. 1991. The phonetics and phonology of postvelar sounds in Moses-Columbia Salish (Nxa'amxcin). Paper presented at the Canadian Linguistics Association Conference, Queen's University (Kingston, Ontario, May 1991).
- Bin-Muqbil, M. 2006. Phonetic and phonological aspects of Arabic emphatics and gutturals. PhD dissertation, University of Wisconsin-Madison.
- Blevins, J. 2007. Evolutionary phonology: the emergence of sound patterns. Cambridge: Cambridge University Press.
- Carlson, B. F. & J. H. Esling. 2003. Phonetics and physiology of the historical shift of uvulars to pharyngeals in Nuuchahnulth (Nootka). *Journal of the International Phonetic Association* 33 (2):183-193.
- Esling, J. H. 1996. Pharyngeal consonants and the aryepiglottic sphincter. *Journal of the International Phonetic Association* 26:65-88.
- Flynn, D. & S. Fulop. 2005. Acoustic features in Athabaskan. Paper presented at the Annual Meeting of the Linguistic Society of America (Oakland, California, January 2005).
- Jacobsen, W. H. Jr. 1969. Origin of the Nootka pharyngeals. *International Journal of American Linguistics* 35, 125-153.
- Maddieson, I. 1984. *Patterns of sounds*. Cambridge: Cambridge University Press.
- McCarthy, J. J. 1994. The phonetics and phonology of Semitic pharyngeals". P. 191-234 in P. Keating (ed.), *Phonological Structure and Phonetic Form*. Cambridge: Cambridge University Press.
- Meyers, S. 2000. Boundary disputes: the distinction between phonetic and phonological sound patterns. P.254-72 in N. Burton-Roberts, P. Carr and G. Docherty (eds.), *Phonological knowledge: conceptual and empirical issues*. Oxford: Oxford University Press.
- Przedziecki, M. 2005. Vowel harmony and coarticulation in three dialects of Yoruba: phonetics determining phonology. PhD dissertation, Cornell University.
- Shahin, K. 2002. *Postvelar harmony*. Amsterdam & Philadelphia: Benjamins.
- Shahin, K. to appear a. A phonetic study of guttural laryngeals. In B. Heselwood & Z. Hassan (eds.), *Instrumental Studies in Arabic Linguistics*. Amsterdam & Philadelphia, Benjamins.
- Shahin, K. to appear b. Promotion of secondary place in St'át'imcets. In D. Beck & G. J. Rowicka (eds.), *A Festschrift for Thomas M. Hess*. University of Montana Occasional Papers in Linguistics.
- Watson, Janet C. E. (2002). *The phonology and morphology of Arabic*. Oxford: Oxford University Press.