Against phonetic realism as the source of root co-occurrence restrictions

AMP 2016, University of Southern California

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October 21st–23rd, 2016

Introduction

Two broad approaches to laryngeal co-occurrence restrictions:

- FEATURAL APPROACHES: co-occurrence restrictions refer to **abstract phonological features**.
  (e.g. Itô & Mester 1986, McCarthy 1989, Suzuki 1998, MacEachern 1999, Rose & Walker 2004, Mackenzie 2009, 2011, 2013, Hansson 2010, W. G. Bennett 2015, etc.)
- PHONETIC REALISM: co-occurrence restrictions refer to **language-specific phonetic properties**.
  (Gallagher 2010a,b, 2011, 2012, 2015; see also Flemming 2001, 2003, Steriade 2001, 2009, etc.)

Introduction

Laryngeal co-occurrence restrictions are widely attested within roots.

(e.g. Itô & Mester 1986, MacEachern 1999, Rose & Walker 2004, Hansson 2010, Gallagher 2010b, Rose 2011, W. G. Bennett 2015, etc.)

(1) **Chaha**: ejectives don't occur with plain voiceless stops in roots
(Rose & Walker 2004, Rose & King 2007, Gallagher 2010a)

a. [ji-kəft] 'he opens'
b. [ji-tʔəβkʔ] 'it is tight'
c. *[ji-kʔəft]
d. *[ji-kəftʔ]

Laryngeal co-occurrence restrictions in Kaqchikel roots

Kaqchikel has a phonemic contrast between plain voiceless and 'glottalized' plosives at corresponding places of articulation.

	Bilabial	Dental/ alveolar	Post-alveolar	Velar	Uvular	Glottal
Stop	p ɓ	t tʔ		k kʔ	q qʔ	ʔ
Affricate		t͡s t͡sʔ	t͡ʃ t͡ʃʔ			

(2) a. /koχ/ 'lion'
b. /kʔoχ/ 'mask'

(3) a. /w-aq/ 'my pig'
b. /w-aqʔ/ 'my tongue'

(Campbell 1977, Chacach Cutzal 1990, Cojtí Macario & Lopez 1990, García Matzar et al. 1999, Majzul et al. 2000, Brown et al. 2010, R. Bennett to appear, etc.)

Laryngeal co-occurrence restrictions in Kaqchikel roots

Multiple ejectives are not allowed in a /CVC/ root, unless they are identical (Edmonson 1988: 60-72, R. Bennett to appear, and references there)

$$\boxed{*/\mathrm{T}_1^{\text{ʔ}}\mathrm{VT}_2^{\text{ʔ}}/,\ 1 \neq 2}$$

(4)
a. /tʔotʔ/ 'snail'
b. /kʔekʔ/ 'stingy'
c. /qʔaqʔ/ 'fire'
d. /t͡ʃʔitʃʔ/ 'metal'

(5)
a. */qʔotʔ/
b. */kʔeqʔ/
c. */qʔat͡ʃʔ/
etc.

Plain stops are unrestricted.

Laryngeal co-occurrence restrictions in Kaqchikel roots

The labial implosive /ɓ/ and glottal stop /ʔ/ are exempt from this restriction, and freely combine with ejectives in /CVC/ roots.

(6) /ɓ/ exempt
a. /ɓət͡sʔ/ 'thread'
b. /kʔiɓ/ 'pacaya (fruit of the Chamaedorea palm)'
c. /-ɓiqʔ/ 'to swallow'

(7) /ʔ/ exempt
a. /t͡sʔiʔ/ 'dog'
b. /ikʔ/ 'moon' (surface [ʔikʔ])
c. /-qʔuʔ/ 'blanket'

Phonetic realism

Analytical problem: [CONSTRICTED GLOTTIS] alone does not pick out the correct natural classes for Kaqchikel.

- /Tʔ/ are [CG].
- /ɓ ʔ/ are [CG] too.

Phonetic realism

Phonetic realism: Root co-occurrence constraints are sensitive to specific dimensions of **auditory similarity** (Gallagher 2010b, 2011, 2012, 2015).

Phonetic realism

Auditory similiarity is expressed with **acoustically-defined phonological features**.

Features relevant for ejectives:

- Burst intensity: [LOUD BURST]
- Release duration: [LONG VOT]
- Phonation: [CREAK]

These are **redundant** features: not independently contrastive, but predictable phonetic properties of ejectives.

Phonetic realism

The acoustic properties of ejectives vary widely across languages.

- **Consequence**: the featural representation of ejectives must also vary across languages. (Gallagher 2010b: 38)
  - **Cochabamba Quechua**: /T$^{\text{ʔ}}$/ = [LOUD BURST, LONG VOT]
  - **Hausa**: /T$^{\text{ʔ}}$/ = [CREAK]

(Lindau 1984, Kingston 1984, 2005, Ladefoged & Maddieson 1996, Warner 1996, Clements & Osu 2002, Wright et al. 2002, Bird 2002, Fallon 2002, Ham 2004, Shosted 2009, Gallagher 2010b, Percival 2015, R. Bennett to appear, etc.)

Phonetic realism

Claim: laryngeal co-occurrence restrictions are stated over these redundant, language-specific auditory properties.

(Gallagher 2010a,b, 2011, 2012, 2015; Flemming 2001, 2003, 2004, 2005; Steriade 1999, 2001, 2009 etc.)

(8) OCP[LOUD BURST]:
Roots cannot contain two instances of a stop specified (redundantly) as [LOUD BURST]. (Gallagher 2011)

This is **phonetic realism**: Language-specific **phonetics determine** language-specific **phonotactic patterning**.

Phonetic realism

Prediction
Segment classes in laryngeal co-occurrence restrictions should correspond to phonetic classes defined by acoustic/auditory similarity.

Results

Phonetic realism: some auditory feature should be *unique* to ejectives (the restricted class).

Finding: *no* acoustic property is unique to ejectives.

- Burst intensity and VOT: /T/ ≈ /T$^{\text{ʔ}}$/
- Phonation: /b̥/ ≈ /T$^{\text{ʔ}}$/

(**Note**: our presentation is informal/visual, but all of our descriptive claims are backed-up by statistical clustering techniques and mixed-effects regressions.)

Results

Ejectives across languages:

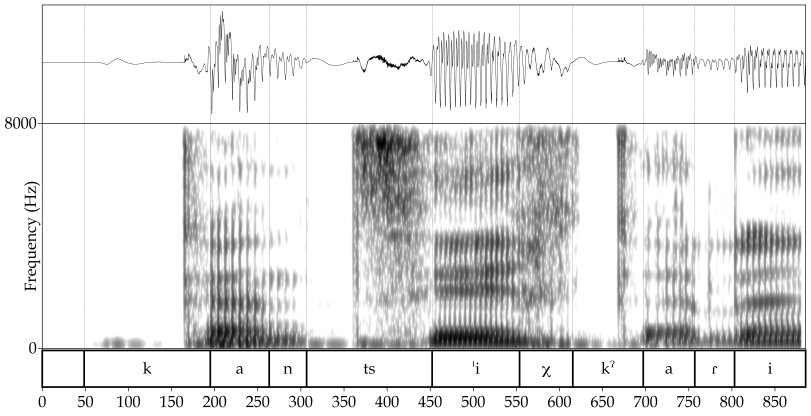
	Stiff	**Slack**
Burst intensity	Loud	Weak
Release duration	Long	Short
Phonation	Modal/tense	Creaky

(Lindau 1984, Kingston 1984, 2005, Wright et al. 2002, Shosted 2009, etc.)

Observation: ejectives appear to be SLACK in Kaqchikel.

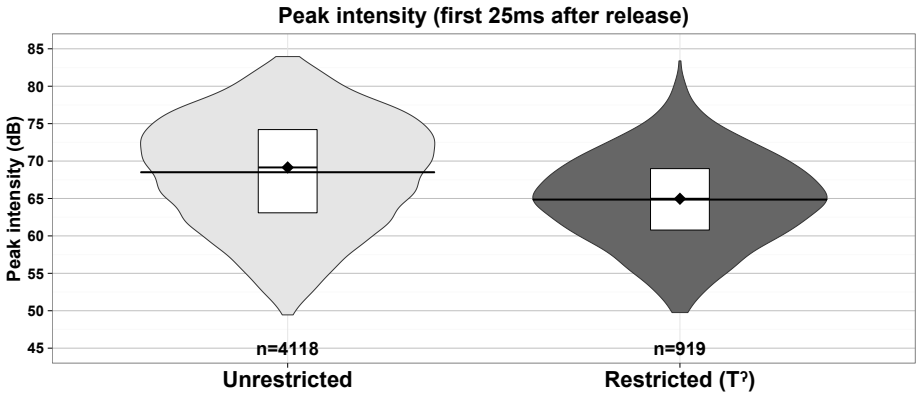
- Release properties (burst, VOT) much like plain counterparts.
- Creakiness distinguishes ejectives from plain counterparts.

Slack ejective [k$^{\text{ʔ}}$] in Kaqchikel



kan tzij k'a ri /kan t͡siχ kʔa ɾi/ '(but it was) truly like that' (SPEAKER 8)

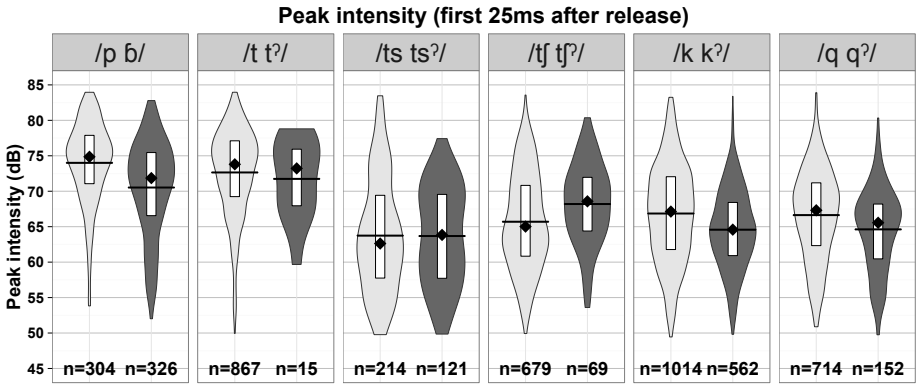
[LOUD BURST]



Peak intensity during burst (first 25ms of VOT interval)

(Blumstein & Stevens 1979, Stevens 2000: 455)

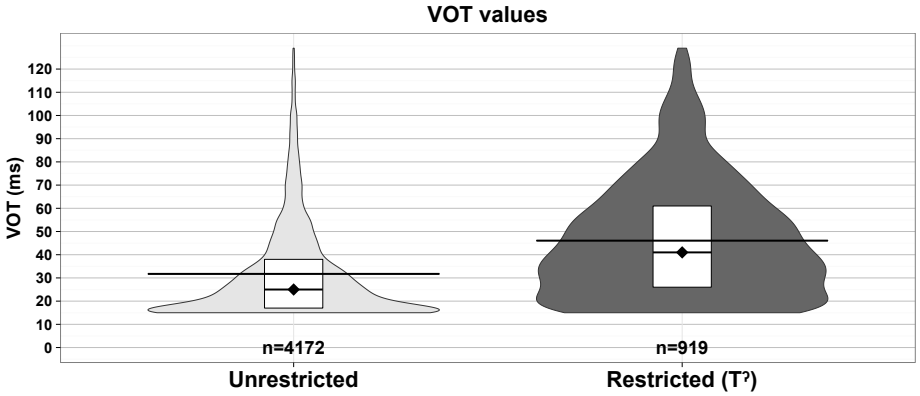
[LOUD BURST]



Peak intensity during burst (first 25ms of VOT interval)

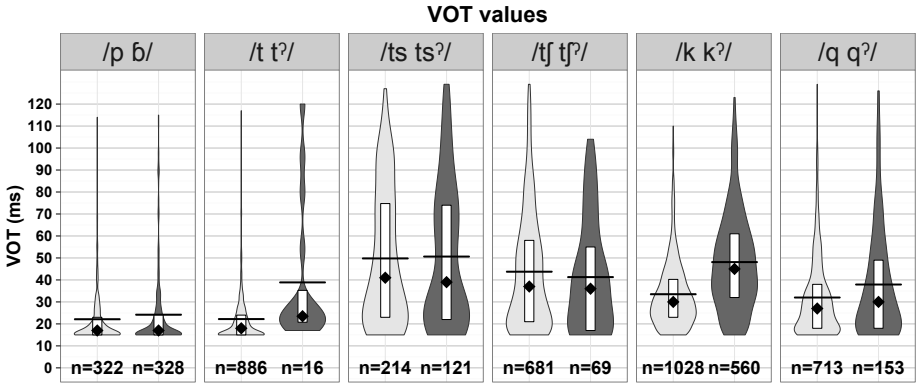
(Blumstein & Stevens 1979, Stevens 2000: 455)

[LONG VOT]



VOT (release noise) duration

[LONG VOT]



VOT (release noise) duration

[LONG VOT]

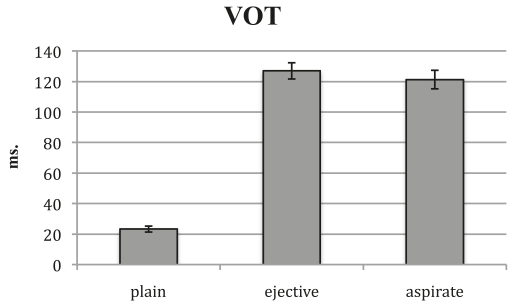
VOT does not reliably separate plain and ejective stops (except /k kˀ/).

[LONG VOT]

None of the Kaqchikel ejectives merit the label [LONG VOT].

(See also Keating 1984, Cho & Ladefoged 1999, Holt et al. 2004.)

- Mean VOTs for /T$^{\text{ʔ}}$/: 24-46ms

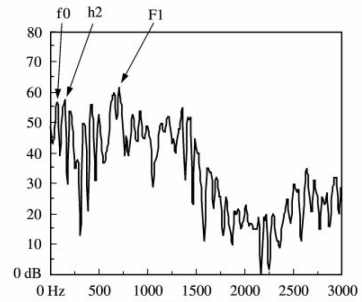


VOT values in Cochabamba Quechua (Gallagher 2011)

[CREAK]

A standard measure of voice quality is **H1-H2**:

- Relative amplitude of f0 (H1) and the second harmonic (H2).
- Low H1-H2 ≈ more creak.



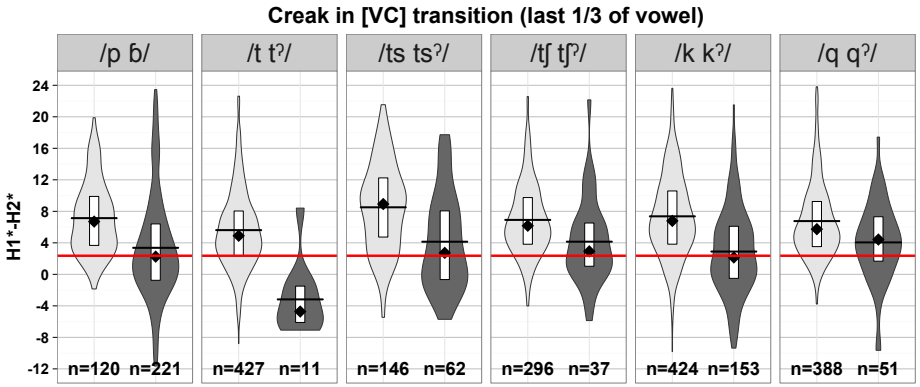
(Gordon & Ladefoged 2001; see also Gerratt & Kreiman 2001, DiCanio 2009, 2014, Garellek 2013, Keating et al. 2015, and references there)

[CREAK]

Phonation fails to distinguish /6/ from /T$^{\text{ʔ}}$/.

- *All* glottalized consonants induce creaky phonation on adjacent vowels.
- Plain stops do not induce creaky phonation.
- (n = 4267 distinct stop-adjacent vowels)

[CREAK]: VC transition



Creakiness (H1*-H2*) during last 1/3 of vowel in VC transition

Interim summary

The acoustic features [LOUD BURST, LONG VOT, CREAK] fail to define phonotactically appropriate natural classes.

- [LOUD BURST, LONG VOT]: /T/ ≈ /T$^{\text{ʔ}}$/ (neither qualify)
- [CREAK]: /ɓ/ ≈ /T$^{\text{ʔ}}$/

Conclusion: laryngeal co-occcurrence restrictions in Kaqchikel cannot be stated over auditorily-defined features.

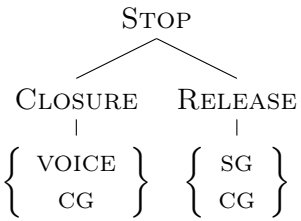
Formal analysis

Proposal: assume a different *representational status* for [CONSTRICTED GLOTTIS] in /T$^{\text{ʔ}}$/ vs. /ɓ ʔ/

Assumption: stops have sub-segmental phonological structure.

(Kingston 1984, 1990, Keating 1990, Steriade 1993, 1994, Gafos 2002, etc.)

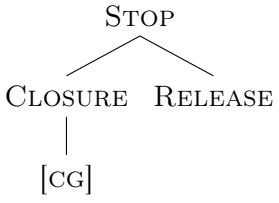
Formal analysis



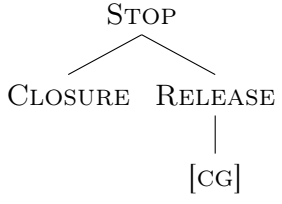
(after Keating 1990, Steriade 1993, 1994)

Formal analysis

Implosives and /ʔ/



Ejectives



(after Keating 1990, Steriade 1993, 1994)

The restriction, restated

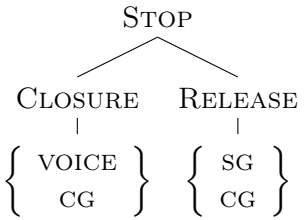
(9) $\text{OCP}[\text{CG-REL}]_{\text{ROOT}}$
Assign one violation for every /CVC/ root containing two instances of RELEASE-linked [CONSTRICTED GLOTTIS].

(NB: the permissibility of co-occurring identical ejectives requires further mechanisms; McCarthy 1979, 1989, Gallagher & Coon 2009, Gallagher 2010a, 2014, etc.)

Formal analysis

Predicted long-distance dissimilations:

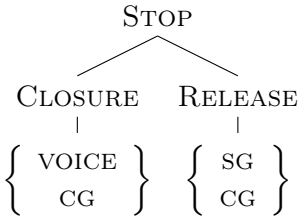
- $\text{OCP}[\text{VOI}]$: Voiced obstruents (✓, Japanese, Itô & Mester 1986)
- $\text{OCP}[\text{CG}]$: Ejectives, implosives and /ʔ/ (✓, Bolivian Aymara, Landerman 1994)
- $\text{OCP}[\text{SG}]$: Aspirated stops and /h ɦ/ (✓, Sanskrit, Grassmann 1863)



Formal analysis

Predicted long-distance dissimilations:

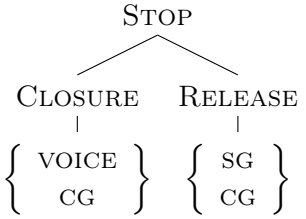
- $\text{OCP}[\text{CG-REL}]$: Ejectives, but not implosives or /ʔ/ (✓, Kaqchikel)
- $\text{OCP}[\text{SG-REL}]$: Aspirated stops, but not [h] (✓, Ofo, De Reuse 1981)
- $\text{OCP}[\mathbb{F}\text{-REL}]$: Ejectives, aspirated stops (✓, Quechua, Parker & Weber 1996)
- $\text{OCP}[\mathbb{F}\text{-CLO}]$: Voiced stops and implosives: (✓, Hausa, Parsons 1970)



Formal analysis

Unexpected long-distance dissimilations:

- Ejectives/aspirated stops and voiced stops (unattested)
- Aspirated stops and implosives (unattested)



(MacEachern 1997, 1999, Rose & Walker 2004, Hansson 2010, Gallagher 2010a,b, 2011, 2015, Mackenzie 2009, 2011, 2013, W. G. Bennett 2013, 2015)

Conclusion

With respect to root-level laryngeal co-occurrence restrictions in Mayan:

- Phonetic realism is too strict: phonotactic classes do not line up with acoustic classes in Kaqchikel (and probably other Mayan languages).
- A more promising tact: OCP constraints stated over abstract (but articulatorily-grounded) features in sub-segmental structure.

Conclusion

The distinction between ejectives and implosives is crucial for phonotactic patterning in Kaqchikel.

- The realization of the glottalized labial as implosive $/\mathrm{ɓ}/$ (rather than ejective $/\mathrm{p^{\prime}}/$) is predictable from its place of articulation.
- ∴ predictable, redundant, and non-contrastive properties must be phonologically 'active' for the purposes of phonotactic restrictions.

(E.g. Vaux 1996, Steriade 2001, Flemming 2003, Gallagher 2011; cf. Hall 2007, Dresher 2009, and others.)

References

References available on request.

Slide download

Slides available for download at
`http://tang-kevin.github.io/Files/Slides/Bennett_Tang_AMP.pdf`