Guttural Semi-Transparency

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1. What is Guttural Semi-Transparency?

Guttural transparency –laryngeals, pharyngeals and uvulars show transparency to vowel harmony, whereas other consonants do not.

Tigrinya: (Ethio-Semitic) – data from Berhane (1991); gutturals ħ ʕ h ʔ

(1)	a.	jɨ-gərrɨf	'whip-3MS.IMPF.A'	e.	yɨ-sɨ<u>ħ</u>ɨb	'pull-3MS.IMPF'
	b.	jɨ-rɨssɨʕ	'forget-3MS.IMPF.B'	f	yɨ-rɨss<u>uʕ</u>-u	'forget-3MP.IMPF.B'
	c.	jɨ-bɨddɨl-u	'hurt-3MP.IMPF.B'			
	d.	mɨ-bɨrɑx-om	'INF-bless-3MP'	g.	mɨ-gɨ<u>loh-om</u>	'INF-pull up-3MP'

But, gutturals can also lower /ə/ vowels to [a]

(2)	a.	gərəf-ə	'whip.PFV-3MS.PFV'	c.	<u>ʔa</u>sər-ə	'arrest.PFV-3MS.PFV'
	b.	gɨrəf	'whip.2MS!'	d.	bɨl<u>aʕ</u>	'eat.2MS!'

Guttural lowering combines with guttural transparency (3e-g. i):

(3)	a.	ʔɨsər	'arrest.2MS!'	e.	s<u>aħ</u>ab	'pull.2MS!
	b	gɨrəf	'whip.2MS!'	f	l<u>aʕ</u>ax	'send.2MS!'
	c.	gərəf-ə	'whip.PFV-3MS.PFV'	g.	l<u>aʔ</u>ax-ə	'send.PFV-3MS.PFV'
	d.	jɨ-gərrɨf	'3MS-whip.IMPF.A'	h.	jɨ-bəllɨʕ	'3MS-eat.IMPF.A'
				i.	j<u>a-ʔa</u>ssɨr	'3MS-arrest.IMPF.A'

- If gutturals trigger lowering, the vowel and consonant presumably share feature(s).
- If the guttural is intervocalic, it is not actually transparent, but *participates* in transguttural vowel harmony/copy (McCarthy 1994b, Padgett 1995).

The guttural "semi-transparency" phenomenon: The potential for gutturals to simultaneously allow transguttural harmony and influence the quality of the harmonizing vowels.

Goals of this talk:

1. Claim that gutturals are not skipped in vowel harmony, but participate
2. Relate permeability/participation of guttural consonants to their *articulation* (rather than lack of representational structure or markedness)
   a. gutturals allow transparency due to less interference with oral vowel articulation
   b. laryngeals can behave differently than pharyngeals and uvulars → block harmony less, lower vowels less
   c. quality of vowels participating in transguttural harmony may be restricted to those that participate in lowering/retraction or are most compatible with guttural articulations
3. Show that these observations are borne out by attested data
4. Develop a formal analysis that encodes participation of gutturals in harmony

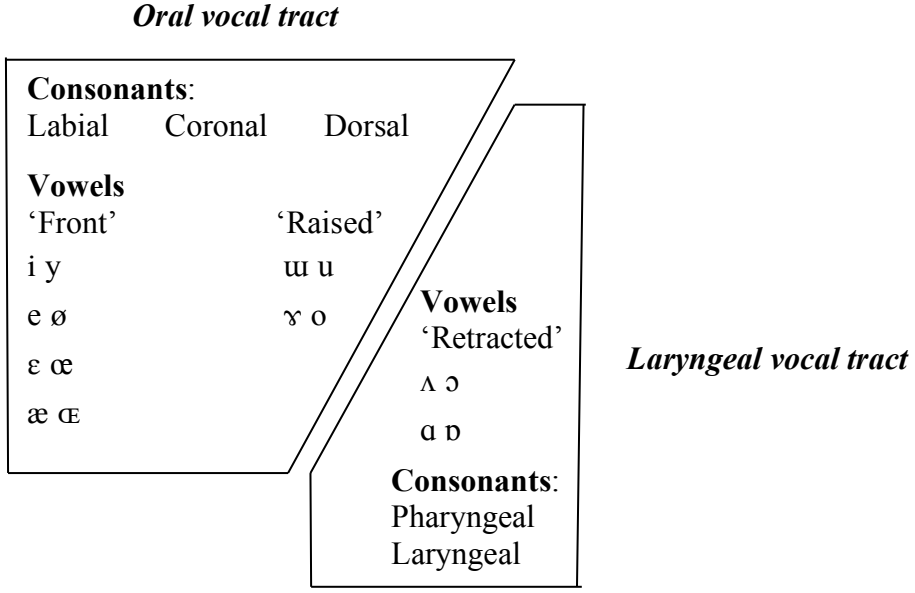
2. Articulation and classification

Transguttural harmony and vowel lowering/retraction in the vicinity of gutturals is related to articulation and phonological class behavior.

2.1 The laryngeal vocal tract

- Oral/laryngeal vocal tract model (Esling 2005):
  - Oral vocal tract: uvula and articulators anterior to it, including upper surface of the vocal tract, tongue, lips, and jaw.
  - Laryngeal vocal tract: where sounds with pharyngeal and glottal constriction are formed.

(4) Oral/laryngeal vocal tract model



- **Pharyngeal consonants** involve aryepiglottic constriction, which gives rise to lingual retraction (Esling 1996, Carlson & Esling 2003).
- **Laryngeal consonants** are formed in the laryngeal vocal tract.
  - Laryngeals do not necessarily involve epilaryngeal constriction, but it is potentially present, especially for [ʔ].
- **Uvular consonants** involve a lingual constriction in the oral vocal tract. They can be pharyngealized as a secondary narrowing.
  - Uvular fricatives are more retracted than stops (Moisik 2013, Sylak-Glassman 2014a).
- **Vowels in the laryngeal vocal tract** show lingual retraction as a function of laryngeal constriction – aryepiglottic folds form a constriction against epiglottis.

Retracted vowels and laryngeal/pharyngeal (and possibly uvular) consonants engage the laryngeal articulator, distinct from the remainder of the vocal tract.

2.2 Class behavior

Guttural class

- Consists of laryngeals, pharyngeals, and (some) uvulars, typically fricatives, based on phonological behavior (Hayward & Hayward 1989, McCarthy 1994a).
- While no single articulatory property is reliably present for all gutturals; they share potential for aryepiglottic constriction and resulting lingual retraction.
- Fits with patterns that show:
  - Retraction/lowering of vowels in vicinity of gutturals – interaction through control of laryngeal articulator.
  - Transguttural vowel assimilation – oral/laryngeal bifurcation is consistent with propensity for gutturals to permit simultaneous vocalic articulations, especially non-high/retracted.
- We assume that phonetic similarities among post-velar consonants give rise to guttural classhood.
  - See Sylak-Glassman (2014b) for a formal means of deriving post-velar sound classes based on similarity.
  - Guttural uvulars might not belong to oral class, despite their dorsal articulation. We suggest their classhood with consonants centered in the laryngeal vocal tract can pull them away from classhood with oral consonants.[1]
  - Retraction in uvular fricatives can give rise to fricatives being only uvulars included in guttural class.
  - Articulations specific to *laryngeals* or *uvulars* (no aryepiglottal constriction) may still cause them to pattern differently with respect to lowering/retraction (Rose 1996) or transparency – ex. in Aymara, uvulars trigger vowel lowering, but laryngeals do not (Hardman et al 1988).

[1] For a different implementation, see Rose (1996), who proposes that guttural uvulars have a pharyngeal node and not an oral node.

Representation

- We posit that guttural features are also relevant for vowels – enables vowel-guttural interactions.
  - [pharyngeal] is a privative feature present in all gutturals (McCarthy 1994a, Rose 1996). It is an abstract class feature that is non-specific as to precise locus of post-velar constriction.
  - [retracted] is a privative feature present in supralaryngeal gutturals. It refers to general tongue retraction, as enacted by laryngeal articulator (Moisik et al. 2012).[2]
- Vowel specification in laryngeal vocal tract
  - [pharyngeal] and [retracted][3] are present in retracted vowels.
  - When [pharyngeal] alone combines with an oral vowel, it causes lowering and/or backing, but not necessarily into retracted region (Rose 1996).

3. Typology of guttural transparency patterns

3.1 Guttural semi-transparency patterns

Pattern 1: All gutturals trigger vowel lowering; Laryngeals are transparent

The articulation of laryngeals involves less intersection with oral vowel features and lingual retraction, so expect harmony across laryngeals to be less restricted.

(5) **Gitksan** (Tsimshianic; Yamane-Tanaka 2006, 2007, Brown 2008).
guttural class: q q’ χ [ɢ] ʔ h; lowering to [ɛ ɔ ɑ] adjacent to uvulars and laryngeals

a.	ˈwagi’j	‘my (man’s) brother’.
b.	sɪˈsɛʔɛ’j	‘my feet’
c.	ˈtsɑʔɑ’j	‘my eyes (face)’
d.	ˈbɛːhɛ’j	‘my lungs’
e.	ʔnˈdʒɔɢɑ’j ~ ʔnˈdʒɔ́ɢɔ’j	‘my camp’

- the suffix /-’j/ ‘my’ requires an inserted vowel, [i] adjacent to non-gutturals (5a).
- the inserted vowel harmonizes with a preceding vowel (ɛ ɔ ɑ) across a *laryngeal* (5b–d).
- harmony vacillates across a *uvular* consonant (5e); the vowel is realized as [ɑ] if there is no harmony (default adjacent to gutturals – Brown 2008); expansion of translaryngeal harmony to trans-uvular appears to be generational (Yamane-Tanaka 2006).

Sliammon Salish shows the same kind of pattern - uvulars and laryngeals lower vowels, but there is only translaryngeal harmony (Blake 2000)

[2] Where necessary to characterize patterning of laryngeals and pharyngeals separate from uvulars, other features can be employed. For example [constricted epilaryngeal tube] is proposed by Moisik et al. (2012) for pharyngeals and [ʔ].
[3] Sylak-Glassman (2014b: 137) posits [±retracted], which differs in some specifics.

Pattern 2: All gutturals trigger vowel lowering; all gutturals are transparent

As all gutturals have the propensity to lower or retract vowels, all gutturals can be 'semi-transparent' to the exclusion of other consonants

(6) **Jibbali** (Semitic; Hayward et al 1988, Rubin 2014); guttural class: χ ʁ ħ ʕ h

Perfective stem B template: CeCəC

a.	ˈfek'ər	'be(come) poor'	d.	tɑˈʕɑs	'be stubborn/awkward'
b.	ˈbezəg	'be squeezed'	e.	zɑˈʁɑf	'pour/spill liquid in large quantities'
c.	ð'ɛˈhɛr	'be finished, run out'	f.	dɑˈħɑs	'annoy somebody'

- All gutturals lower /e/ and all gutturals participate in guttural transparency, but:
  - e → [ɛ] adjacent to laryngeal [h] (6c)
  - e → [ɑ] adjacent to pharyngeal and uvulars (6d-f)
  - [ɑ] is an allophone of /ɛ/ adjacent to pharyngeals and uvulars (Rubin 2014).

Tigrinya shows the same basic pattern (section 1), but also allows central and back 'raised' vowels (ɨ ə u o) to harmonize

(7) Summary of patterns of transguttural semi-transparency

	Phar/Uvular lowering	Phar/Uvular harmony	Laryngeal lowering	Laryngeal harmony
1. Gitksan	✔	(✔)	✔	✔
Sliammon	✔		✔	✔
2. Jibbali	✔	✔	✔	✔
Tigrinya	✔	✔	✔	✔

- Pharyngeal or uvular semi-transparency entails laryngeal transparency
- Transparency is generally for vowels in the retracted or lowered region: [ɛ ɔ ɑ]

3.2 Guttural Transparency independent of Lowering

Pattern 1: No Lowering, only Transparency

Gutturals do not have to lower vowels to participate in transparency effects.

(8) **Arbore** (Cushitic; Hayward 1984)
No lowering; *laryngeal transparency*; guttural class: ʔ h

a.	méh-a	→	méɦ-e	'are pieces of property'
b.	gereʔ-a		gereʔ-e	'is a belly'
c.	híiz-a			'is a root'
d.	ma beh-i	→	ma bíɦ-í	'he did not go out'
e.	ma beh-o		ma bóɦ-o	'he is not going out'

(9) **Iraqw** (Cushitic; Mous 1993)
No lowering; *all guttural transparency*
guttural class: $q^{(\chi)}$ q^{w} ʕ ħ ʔ h

a.	/tɬ'at-m/	→ tɬ'atiːm	'dream' DUR	
b.	/ɬuq-m/	ɬuquːm	'kill' DUR	
c.	/tuʕ-m/	tuʕuːm	'uproot' DUR	
d.	/ufaħ-m/	ufaħaːm	'blow' DUR	
e.	/waʔalah-m/	waʔalahaːm	'exchange' DUR	
f.	/buʔ-m/	buʔuːm	'harvest, pay' DUR	

(10) **Somali** (Cushitic; Saeed 1999)
No lowering; *[h] transparency*
guttural class: ɢ χ ħ ʕ h ʔ

aabbe 'father'

a.	aabbá-háj	'my father'
b.	aabbé-héed	'her father'
c.	aabbó-hóod	'their father'
d.	aabbí-híin	'your PL father'

- Pharyngeal and uvular 'full' transparency entails laryngeal transparency
- Most vowel qualities are observed to harmonize if lowering does not occur

Pattern 2: Lowering and Transparency may both occur, but be independent

(11) **Kashaya** (Pomoan, Buckley 1994); gutturals: q q' q^{h} ʔ h

Uvulars trigger lowering of /i e/ to [a]; laryngeals do not

a.	s'u^{h}laq-in	→	s'uhlaqán	'while getting a stomach ache'
b.	ʔusaq-in		ʔusáqan	'while washing the face'
c.	simaq-eti		simaqatí	'although he's asleep'
d.	simaq-em		simaqám	'is sleeping (RESP)'

(12) Laryngeals are transparent in roots, uvulars are not; all vowels copy

a.	siʔi	'flesh'	d.	heʔén	'how'
b.	ʔoho	'fire, light, hot'	e.	juhu	'pinole'
c.	maʔa	'food, eat'	f.	nihín	'to oneself'

- No observed cases of uvular transparency without laryngeal transparency

(13) Summary of patterns of transguttural 'full' transparency

	Phar/Uvular lowering	Phar/Uvular Transparency	Laryngeal lowering	Laryngeal Transparency
1 Arbore	n/a	n/a		✔
Iraqw		✔		✔
Somali		(?)[4]		✔
2. Kashaya	✔			✔

Summary:

- Laryngeals are more permissive in transparency, even in systems with other gutturals; this follows from their articulatory independence from oral, lingual articulations.
- Laryngeals are less likely to lower vowels for the same reason.
- Vowel lowering and harmony can co-occur and be mutually reinforcing – this pattern typically restricts the vowels involved to lowered/retracted (ɛ ɔ ɑ) or vowels compatible with gutturals.
- Vowel lowering and transparency can also occur independently; laryngeals still show greater permeability.

4. Analysis of guttural semi-transparency

- Prime issues:
  - Guttural-triggered vowel lowering/retraction can occur together with or separately from transguttural harmony.
  - Gutturals participate in transguttural vowel harmony.
  - Laryngeals can show different behavior from supralaryngeal gutturals within and across languages.

Constraint I: Vowel copy imperative

(14) ***V_xCV_y**:
Assign a violation to a sequence V_1CV_2, where V_1 and V_2 are not associated with the same V-Place features[5] and C = any consonant.

- Formulation of harmony imperative as a sequential restriction, builds on Pulleyblank (2002).
- Because of the feature association requirement in (14), the constraint is satisfied by spreading only.
- Participation of the intervening consonant is enforced by locality, which prevents a representation in which the consonant is skipped (e.g. Gafos & Lombardi 1999, Ní Chiosáin & Padgett 2001).[6]

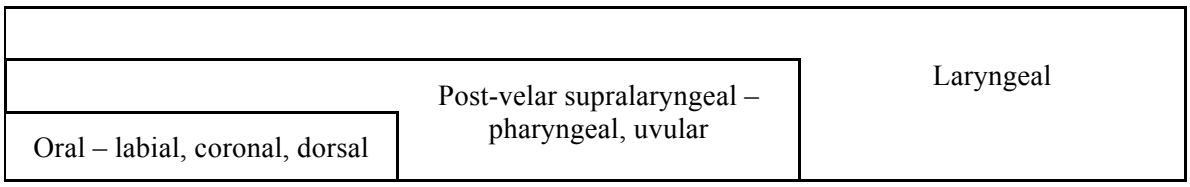
[4] Saeed (1999) also reports three cases of harmony triggered by the suffix –(k)ii across root final ħ ʕ and ʔ. More data is needed to confirm how widespread this is, and whether other vowels may harmonize, too.

[5] We assume that the V-Place class includes all features typical of vowels. Most transguttural vowel harmony involves assimilation of all V-Place features. For cases where assimilation is partial, see the approach proposed by Padgett (2002).

Constraint II (family): No transparent consonants

- Understanding "transparent" consonants here to mean those that undergo spreading of vowel features, though they may not be perceived as such.

(15) Hierarchy of blocking of trans-consonantal vowel copy



(16) a. ***OralC^{V}**: "No transparent oral consonants"
Assign a violation to an oral consonant that is specified for vowel features.

b. ***SLC^{V}**: "No transparent oral consonant or supralaryngeal guttural"
Assign a violation to an oral consonant that is specified for vowel features or a supralaryngeal guttural that is specified for oral vowel features.[8]

c. ***C^{V}**: "No transparent consonants"
Assign a violation to an oral consonant that is specified for vowel features or a guttural that is specified for oral vowel features.

Constraint III (family): Vowel retraction/lowering adjacent to gutturals

(17) a. ***Non-retrV/_SLGut, *Non-retrV/SLGut_**:
Assign a violation to a non-retracted vowel that occurs immediately before/after a supralaryngeal (aryepiglottic) guttural.

b. ***Non-retrV/_Gut, *Non-retrV/Gut_**:
Assign a violation to a non-retracted vowel that occurs immediately before/after a guttural consonant.

c. ***Non-pharV/_SLGut, *Non-pharV/SLGut_**:
Assign a violation to a non-pharyngeal (non-lowered) vowel that occurs immediately before/after a supralaryngeal (aryepiglottic) guttural.

d. ***Non-pharV/_Gut, *Non-pharV/Gut_**:
Assign a violation to a non-pharyngeal (non-lowered) vowel that occurs immediately before/after a guttural consonant.

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[6] Trans-consonantal vowel assimilation could also be effected in a non-local fashion by correspondence between the vowels if driven by the appropriate mechanism (e.g. BE correspondence, Kitto & de Lacy 1999; Agreement by Correspondence, Hansson 2001, Rose & Walker 2004). In that case, sensitivity to the nature of the intervening consonant is not expected if the consonant is not also in correspondence with the vowels.

[7] Blocking by a subset of oral consonants can occur, but is not the focus here. See McCarthy (1998), Gafos & Lombardi (1999) and Kawahara (2007) for overviews.

[8] Because gutturals' primary place is common with that of vowels produced in the laryngeal vocal tract ([pharyngeal], and possibly also [retracted]), there is no penalty assigned to gutturals specified for these features.

(18) *Overview of predicted patterns*

- It is assumed here that the relevant faithfulness and markedness constraints for the assimilating vowel qualities are dominated.

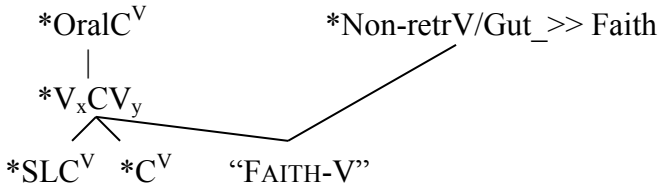
	Ranking	**Pattern**	**Ex. Language**
Vowel harmony via spreading	*OralC^{V} >> ***V$_x$CV$_y$** >> *SLC^{V}, *C^{V}	V copy across all gutturals	Tigrinya
	(*OralC^{V}) *SLC^{V} >> ***V$_x$CV$_y$** >> *C^{V}	V copy across laryngeals only	Kashaya, Gitksan (nonvacillating)
	(*OralC^{V}, *SLC^{V}) *C^{V} >> ***V$_x$CV$_y$**	No V copy across consonants	Various
Vowel retraction and lowering	*Non-retrV/_Gut >> Faith[9] *Non-retrV/Gut_>> Faith *Non-pharV/_Gut >> Faith *Non-pharV/Gut_>> Faith	Vs retracted /lowered adjacent to gutturals	Tigrinya (retraction) Gitksan (lowering)
	*Non-retrV/_SLGut >> Faith *Non-retrV/SLGut_>> Faith *Non-pharV/_SLGut >> Faith *Non-pharV/SLGut_>> Faith	Vs retracted /lowered adjacent to supralaryngeal gutturals	Jibbali (retraction) Kashaya (retraction, lowering)

Exemplification of constraint interactions

Tigrinya

- Vowel harmony across all gutturals.
- Vowel retraction (/ə/ → [a]) adjacent to a guttural.

(19) Ranking:



[9] In some patterns, only epenthetic vowels are affected, in which case, to protect lexical vowel quality, IDENT-IO(F) constraints will dominate the constraint that drives harmony, and that constraint, in turn, will dominate markedness constraints that drive the default epenthetic vowel realization.

(20) Transguttural harmony and vowel retraction

	/sɨħəb/	*Non-retrV /Gut_	*OralC^{V}	*V$_x$CV$_y$	*SLC^{V}	*C^{V}	"FAITH-V"
Retraction & harmony	a. → saħab				*	*	**
Harmony, no retraction	b. səħəb	*!			*	*	*
Retraction, no harmony	c. sɨħab			*!			*
Faithful	d. sɨħəb	*(!)		*(!)			

- Sequences across which vowel features have spread are underlined in candidates.
- Harmony-driving constraint *V$_x$CV$_y$ dominates *SLC^{V}, *C^{V} to enforce harmony across [ħ] (20a–b).
- *Non-retrV/Gut_ dominates identity constraints pertaining to vowels (subsumed under "FAITH-V") to enforce retraction in vowel following [ħ] (20a, c).
- (20a) with transguttural harmony and retraction is selected as the winner.

Gitksan

- Vowel harmony across laryngeals.
- Harmony vacillates across uvulars.
- Vowel lowering adjacent to all gutturals.

(21) Ranking:

*OralC^{V}
|
*V$_x$CV$_y$ ~ *SLC^{V} (variable ranking)
|
*C^{V}

*Non-pharV/_Gut
*Non-pharV/Gut_
|
"FAITH-V"

(22) Translaryngeal harmony

	/sisɛ́ʔ-'j/	*OralC^{V}	(*SLC^{V})	*V$_x$CV$_y$	*C^{V}
Translaryngeal harmony	a. → sɪsɛ́ʔɛ'j			*	*
No translaryngeal harmony	b. sɪsɛ́ʔɑ'j			**!	
Harmony across all consonants	c. sɛsɛ́ʔɛ'j	*!	*		**

- Harmony-driving constraint *V$_x$CV$_y$ dominates *C^{V} to enforce harmony across [ʔ], favoring (22a) over (22b).
- *OralC^{V} dominates *V$_x$CV$_y$ to prevent harmony across [s] (22c).

(23) Vacillating harmony across a uvular
e.g. ʔnˈdʒɔɢɑ'j ~ ʔnˈdʒɔ̝ɢɔ̝'j 'my camp'

- Variable ranking of *SLC^{V} and *V_xCV_y
  - Uvulars block harmony under ranking shown in (22): *SLC^{V} >> *V_xCV_y.
  - Uvulars participate in harmony under ranking shown below: *V_xCV_y >> *SLC^{V}.

	/ʔnˈdʒɔq-'j/	*OralC^{V}	*V_xCV_y	*SLC^{V}	*C^{V}
Trans-uvular harmony	a. → ʔnˈdʒɔ̝ɢɔ̝'j			*	*
No trans-uvular harmony	b. ʔnˈdʒɔɢɑ'j		*!		

- We assume that uvulars in Gitksan belong to the class of gutturals, but not the class of oral consonants (see section 2).

5. Alternatives

Typological observations of this study bear on the adequacy of prior accounts of guttural transparency.

Recall Guttural Semi-transparency:
Gutturals can simultaneously allow transguttural harmony
and influence the quality of harmonizing vowels

Alternative I: Transparency of gutturals by lack of structure on tier (McCarthy 1994a, Rose 1996)

(24) a. Guttural

V ħ V
root root root
| | |
Oral Phar Oral

b. Non-guttural

*V C V
root root root
| | |
Oral Oral Oral

(adapted from Rose 1996:77)

- *Challenge*: If gutturals lack the spreading node in copy harmony and are thus skipped, then the guttural's influence on vowel quality is unexpected, or multiple features that affect vowel height are required, located in different places in the geometry.

Alternative II: Transparency of gutturals by virtue of lesser markedness

- Under this account, [pharyngeal] is the least marked consonantal place feature (Lombardi 2001, 2002).
- It is proposed that due to its lesser markedness, [pharyngeal] is best able to co-occur with V-place (Gafos & Lombardi 1999).
- *Challenge*: A scale based in place-markedness does not predict gutturals' effect on vowels, as triggering of assimilation is diagnostic of a marked feature value (de Lacy 2006).
- *Challenge*: The potentially distinct behavior of laryngeals does not follow from place-markedness, since [pharyngeal] is posited to be present in all gutturals (Lombardi 2001: 30).

Alternative III: Intrusive vowel gestures

- Under this approach, at least some copy vowels are considered to be intrusive gestures that do not form phonological segments or a syllable nucleus (Hall 2003, 2006).
- *Challenge*: Tendency for gutturals to be transparent in contrast to various other consonants is not predicted (as noted by Hall 2006: 417–418).
- *Challenge*: Guttural semi-transparency phenomena are not addressed.
- *Challenge*: Not all copy vowels can be considered intrusive (ex. Iraqw – see appendix). An analysis of transguttural harmony affecting phonological vowels is therefore necessitated.

6. Conclusion

Key insights:

Gutturals participate in transguttural harmony

- Gutturals' participation is diagnosed by "semi-transparency" patterns, where they simultaneously permit harmony and influence vowel quality.

Not all gutturals are created equal

- Laryngeals are more prone to permit harmony than supralaryngeal gutturals, and they are less likely to affect the quality of neighboring vowels.

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Appendix: More on intrusive vowels

- When it comes to inserted vowels, Hall (2003, 2006) draws a distinction between **epenthetic** vowels and **intrusive** vowels.
- Some hallmarks of intrusive vowels:
    - They arise as a transition between consonants; they are not phonological units and do not form a syllable nucleus.
    - The quality of an intrusive vowel is (i) schwa, (ii) a copy of a nearby vowel, or (iii) influenced by the place of neighboring consonants.
    - When an intrusive vowel has a quality that copies that of a nearby vowel, the intervening consonant is a sonorant or guttural.
- Some hallmarks of epenthetic vowels:
    - The quality of an epenthetic vowel may be fixed or a copy of a vowel in a neighboring syllable. If fixed, it is not necessarily schwa.
    - Epenthetic vowels serve to repair marked structures.
- Hall proposes an account of intrusive vowels based in gestural phonology, where a gap between two consonantal constrictions opens up a vocalic transition. This transition may be occupied by an existing vowel gesture that already overlaps the consonantal constriction.

Iraqw (Cushitic, van der Hulst & Mous 1992, Mous 1993)

- Vowels: [i, e, a, o, u] contrastively long or short, plus diphthongs.
- Uvular, pharyngeal and laryngeal consonants: [q$^{(χ)}$ q^{w} ħ ʕ h ʔ].
- Iraqw has an inserted vowel [i(ː)]. In verbal derivation, it can appear preceding the last derivational suffix in the word (-m durative, -t middle or –s causative)
    - The length of the inserted vowel depends on the conjugation (i).
    - Inserted [i(ː)] may be tone-bearing (i).

(i) a. aː xaɬí̱t 'she kept quiet'
    b. aː xaɬí̱ːt 'he kept quiet'

-
    - Since inserted [i(ː)] is tone bearing, alternates in length, and its quality when unassimilated is not schwa-like, it appears to be a phonological epenthetic vowel.

Copy harmony

- Inserted [i(ː)] is identical with preceding [i, a, u] across a guttural consonant (iia).[10]
- Copy vowels do not occur following other consonants, e.g., labial, coronal, palatal (iib).[11]

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[10] Mid vowels [e] and [o] do not usually copy across gutturals; [e] never does, whereas [o] sometimes does.
[11] Harmony from [u] affecting inserted [i(ː)] also occurs across velar and uvular consonants. Rose (1996: 78) argues that these can be considered cases of round harmony only. There are cases of copy of [a] across a uvular stop, too, but the uvular pattern is not as consistent as laryngeals and pharyngeal.

(ii)	a.	/tuʕ-m/	→	tuʕuːm	‘uproot’ DUR
		/ufaħ-m/	→	ufaħaːm	‘blow’ DUR
		/waʔalah-m/	→	waʔalahaːm	‘exchange’ DUR
		/buʔ-m/	→	buʔuːm	‘harvest, pay’ DUR
	b.	/tutuːw-m/	→	tutuwiːm	‘open a new farm’ DUR
		/hamtl’-m/	→	hamtl’iːm	‘to take a bath’ DUR
		/baːl-m/	→	baːliːm	‘defeat’ DUR
		/ʕaːj-m/	→	ʕaːjiːm	‘eat’ DUR

Relevance to analysis of transguttural harmony

- Copy harmony in Iraqw is one example of a case where transguttural assimilation can affect phonologically visible epenthetic vowels.
- Further cases
  - In Tiberian Hebrew inserted vowels have the potential to undergo transguttural harmony but also show evidence of visibility in the phonology (Prince 1975, McCarthy 1979, Malone 1993, Idsardi 1998).
  - Transguttural copy harmony can affect vowels that are underlying in at least some Bedouin dialects of Arabic (Hall 2006).
- An intrusive vowel approach is therefore not sufficient to obtain the full range of guttural transparency phenomena. It is necessary that a phonological account be available.