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Epenthesis in rising sonority clusters in Lakhota

1 Introduction

(1) Goal of this talk

- Analyze two typologically unusual properties of cluster phonotactics in Lakhota (Siouan; Mississippi Valley)
  - Apparent reversals of the cross-linguistic preference for voiceless stop+liquid clusters over other cluster types
- ❶ Epenthesis targets rising sonority clusters, while leaving plateaus intact
- ❷ Regressive voicing assimilation in stop+sonorant clusters reduces sonority rises

(2) Epenthesis in rising sonority clusters

- Cross-linguistic preference for rising sonority onset clusters

  #RT (falling) → #TT, #RR (level) → #TR (rising)

  (Sievers 1893; Greenberg 1978; Selkirk 1982; Berent et al 2007; and many others)
- A preference for plateaus?
  - Hocąk (=Ho-Chunk, Winnebago; Siouan, Winnebago-Chiwere; Susman 1943; Lipkind 1945; Miner 1979)

a.	š-ǰee…	'2sg-die'	b.	ša̠-wapox	'2sg-stab'
	(ha)š-ǰa…	'2sg-see something'		ša̠-waši	'2sg-dance'
	š-kuhe	'2sg-be returning'		šu̠-ruxu̠ruk	'2sg-earn'
	š-kunã	'2sg-come'		šĩ̠-nĩp	'2sg-swim'

- Previous approaches have sought constraints that are violated by sonority rises in onsets (Alderete 1995; Flemming 2008a; Strycharczuk 2009; Davis and Baertsch 2011)
- These have the effect of reversing the usual preference for steeper sonority rises, so that in particular languages, rises are more marked

(3) Preview of the current proposal

- Claim: epenthesis targets CR clusters over plateaus in Lakhota not because they are more marked, but because they are less costly to repair (Fleischhacker 2005; Flemming 2008a; Albright and Magri 2013; Fullwood 2014, Yun in press)
- In all other respects, Lakhota phonology obeys universal markedness hierarchy
  - steep rise ≻ intermediate rise ≻ shallow rise ≻ plateau
  - Apparent "markedness" of rises comes solely from the fact that they are targeted for epenthesis
- Comparison of clusters that do/do not undergo epenthesis reveals that epenthesis is blocked just in case the schwa would be perceptually salient/obtrusive
  - Analysis: contextual Dep(ə) constraints more strongly penalize epenthesis in certain contexts, including plateaus
  - Epenthesis in a cluster depends not just on ranking of markedness constraints, but also ranking of relevant Dep(ə)

(4) Voicing in stop+sonorant clusters

- An unusual process: sonorants trigger regressive voicing assimilation: /pw/, /pj/ → bw-, bj-
- Opaque interaction: epenthesis counterbleeds assimilation: /pl/ → bl- → bəl-
  - Such interactions with voicing assimilation are otherwise unattested
- I will argue that this is not assimilation at all, but faithfulness to the short duration of C_1 in clusters

2 Lakhota onset clusters

2.1 The data

(5) Consonant inventory of Lakhota (Boas and Deloria 1941; Carter 1974; Ullrich 2008)

		Stops		Fricatives
Obstruents	Unaspirated	p, t, tʃ, k	Voiceless	s, ʃ, x, h
	Aspirated	pʰ, tʰ, tʃʰ, kʰ	Voiced	z, ʒ, ɣ
	Ejective	p', t', tʃ', k'	Ejective	s', ʃ', x'
Nasals		m, n		
Liquid		l		
Glides		w, j		

(6) CC onset clusters

- Representative clusters

	Stop	Fric	Nasal	Liquid	Glide
Stop	pt-, kt-, kp-[1]	ps-, pʃ-, ks-, kʃ-[2]	gəm-, gən-[3]	bəl-, gəl-[4]	bw-, bj-, gw-, gj-[5]
Fric	xp-, xt-, sp-, st-, ʃp-[6]	—	sn-, ʃm- xn-[7]	sl-, ʃl-, xl-[8]	sw-, xw-[9]
Nasal			mən-[10]	—	—
Liquid				—	—
Glide					—

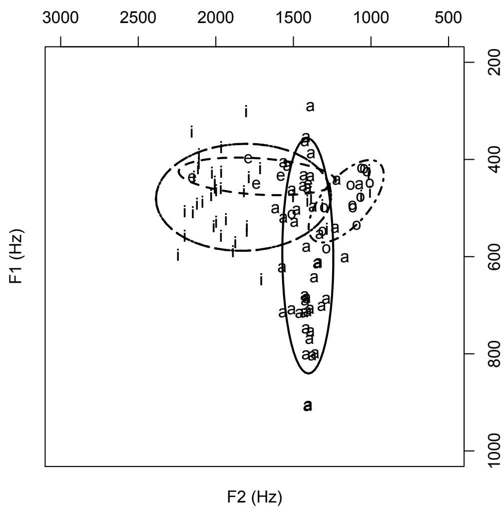
- Level or rising sonority (*lp-, *mʃ-, etc.)
- Obstruents: no ejectives, aspirated stops, voiced fricatives
- Voicing
  - Allophonic voicing in stop+sonorant clusters: bj-, gw- instead of *pj-, *kw-
- Epenthesis: four asymmetries
  - Sonority rise vs. plateau: epenthesis in stop+liquid, stop+nasal, but not in stop+fricative, stop+stop
  - Shallow/intermediate vs. steep sonority rise: epenthesis in stop+liquid, stop+nasal but not in stop+glide
  - Manner: epenthesis in stop+sonorant, but not fricative+sonorant
  - Nasality: epenthesis in nasal+nasal, but not (oral) stop+stop

[1] Examples: pte 'buffalo', kte 'to kill', kpe 'to make a cracking noise'
[2] Examples: psa 'reed', pʃa 'to sneeze', ksa 'to be cut', kʃa 'to be coiled'
[3] Examples: gəma 'walnut', gənajã 'to play tricks'
[4] Examples: bəle '1SG-went', gəle '3SG-went back'
[5] Examples: sabwaje 'blacken-1SG-CAUS', sabja 'darkly', gweza 'rippled', sagje 'cane'
[6] Examples: xpã 'soggy', xtã 'rough and absorbent/porous', spã 'slushy', stã 'purple', ʃpã 'burned/frozen'
[7] Examples: sna 'jingle', ʃma 'deep (water)', xna 'make bear-like noises'
[8] Examples: sli 'ooze', ʃla 'bald', xla 'rattle'
[9] Examples: swaka 'frayed', xwa 'sleepy (human)'
[10] Examples: məni 'water'

2.2 CəCV = /CCV/ with epenthesis

(7) Phonetic realization

- Element written here as [ə] is a short vocalic period between the consonants
- Boas and Deloria (1941, p. 5): “a very weak vocalic sound between the two consonants”, which they transcribe as a copy of the following vowel: g^{a}la, g^{i}li
- Miner (1979) explicitly contrasts this ‘schwa-epenthesis’ with the short copy vowel that appears in the Hocąk examples in (2). Hocąk also has schwa epenthesis in other contexts, which Miner (p. 27) describes as “a slight schwa (or more precisely, a barely audible intrusive vowel having more or less the quality of a short version of the following full vowel)”
- Acoustic measurements of Lakhota suggest a relatively central vowel, with quality influenced by following vowel, but not actually identical to it



- Variability: shorter in careful speech, (proportionately) longer in casual speech
- This phonetic shortness, and variability in duration and quality, is by itself often taken as an indication that the vowel is epenthetic or ‘intrusive’

(8) Alternations: derived clusters

- Lakhota bans codas in most contexts, so not much opportunity to create clusters through morpheme concatenation
- Reduplication:[11]

Base	Redup	Surface form	Gloss
/luta/	/luk-luta/	lugəlúta	‘red’
/lila/	/lik-lila/	ligəlíla	‘very’

- Possessed objects
  - Prefix /ki-/ loses vowel before /j/, and glide becomes a liquid
  - /ki-juha/ ‘POSS-have’ → k-luha → gəluhá ‘have one’s one’
- Ranking: *stop+liquid ≫ *ə, DEP/stop_liquid

/lik-lila/	*stop+liquid	*ə	DEP/stop_liquid
a. liglila	*!		
b. ligəlila		*	*

[11] The reduplicants in these examples involve a process of coronal dissimilation, in which a CVC reduplicant of a root containing two coronals changes the second consonant of the reduplicant to a dorsal: /lut/, /lil/ → luk, lik.

(9) Distributional gaps (Carter 1974)

*plV	✔bəlV	
*klV	✔gəlV	(etc.)

- Richness of the Base: requires that we rule out *plV, *klV, …
- Based on complementary distribution and evidence from alternations in (8), reasonable to assume that these are repaired through epenthesis
- Same ranking: *stop+liquid ≫ *ə, Dep/stop_liquid

/plV/	*stop+liquid	*ə	Dep/stop_liquid
a. blV	*!		
b. bəlV		*	*

- Phonotactic restriction further supports active process of epenthesis
- Compatible with representing [bəlV] as underlying cluster, but doesn't require it

(10) Reduplication

Final	hą́ska	hą́ska<u>ska</u>	'tall'
	hĩʃmá	hĩʃmá<u>ʃma</u>	'furry'
	hãbəlé	hãbəlé<u>bəle</u>	'dream'
	wiktʃémənа	wiktʃéməna<u>məna</u>	'ten'
Non-final	káɣe	<u>kax</u>káɣe	'do, make'
	gəléɣa	<u>gəle</u>gəléɣa	'striped'

- Reduplication copies one syllable (final or penultimate)
- Exception: CəCV always copied as a unit
- Supports analysis in which CəCV are underlyingly /CCV/
- Opacity: 'reduplication precedes epenthesis'

(11) Also potentially relevant

- Cluster phonotactics
  - Several missing C_1əC_2V sequences involve C_1-C_2 combinations that are often banned as clusters
  - E.g., *dəlV, *dənV correspond to cross-linguistically common ban on tl/dl clusters (Kawasaki 1982; Tobin 2002; Flemming 2007; Michaels 2011) and tn/dn clusters
  - Opacity: MSC's on clusters precede epenthesis (Carter 1974)
- Stress assignment
  - Schwa is also invisible for stress, which is regularly peninitial
    a. σσ́…: kimímila 'butterfly', pteptétʃela 'short'
    b. σəσ́…, əσσ́…: wagəlékʃũ 'turkey', agəléʃka 'lizard', wagəmíza 'pumpkin'
    c. əσəσ́…: gənugənúʃka 'grasshopper', gəlugəlúka 'saucy, disrespectful'
  - Unlike Hocąk, stress *always* ignores schwas
  - Often taken as evidence that schwas are not present underlyingly
  - Opacity: 'stress assignment precedes epenthesis'
- These are suggestive, but open to more possible reanalyses; fuller arguments omitted for lack of time

(12) The representation of CəC

- Two possibilities
  - Epenthetic segment: [ə]
  - Open phasing/articulatory transition, with voicing: $C^{ə}C$
- Either way, distribution is controlled in a Lakhota-specific way
  - Duration: short, dependent on speech style)
  - Quality: ə-like, not copy vowel as in Hocąk morpheme-internal epenthesis
  - Distribution: stop+liquid, stop+nasal, nasal+nasal, but not other CC
  - Language-specific control = grammar (phonetic or phonological)
- To be shown below: distribution of ə depends on perceptibility in relevant context (CCV ∼ CəCV)
- Formalization: represent as short segment [ə], subject to contextual Dep(ə) constraints
  - Allows us to build on work employing perceptually motivated faithfulness rankings (P-Map Hypothesis; Steriade 2001)
- Similar results could be obtained with constraints on gestural coordination (Gafos 1999, 2002), as long as they are sensitive to perceptual consequences of open transition

3 Epenthesis into clusters with shallower sonority rises

(13) Two asymmetries

- Like Hocąk, Lakhota has epenthesis in rising sonority clusters, while tolerating plateaus
  - Rising: /plV/, /knV/ → [bəlV], [gəmV]
  - Plateau: /ptV/, /ksV/ → [ptV], [ksV]
- However, unlike Hocąk, Lakhota does not epenthesize into stop+glide clusters, with steep sonority rises
  - Shallow: /knV/ → [gənV]
  - Intermediate: /klV/ → [gəlV]
  - Steep: /kwV/ → [gwV], /sap+yA/ → [sabye] 'make black'
  - Also depends on manner of C_1 (next section)

(14) Goal of this section

- Show that this pattern emerges from two simple preferences
  - Sonority preference for steep rise ≻ intermediate rise ≻ shallow rise ≻ plateau
  - Faithfulness preference for epenthesis before more sonorous elements
- Upshot: plateaus are preserved intact not because they're unmarked, but rather, because epenthesis is costly (violates high-ranking Dep)

(15) The plateau vs. rise asymmetry

- Challenge: eliminate (some) rises through epenthesis, while allowing (some) plateaus
- A common approach: identify ways in which obstruent+sonorant clusters are more marked than plateaus
  - Ban on rises: *CRV (Strycharczuk 2009)
  - Ban on CRV ∼ CVRV contrasts (Flemming 2008)
  - Ban on R in C_2 position of onsets (Davis and Baertsch 2011)

- An issue
  - The specific proposals cited above don't extend automatically to the more nuanced set of epenthesis contexts in Lakhota
  - The more general issue, though: whatever markedness constraint we find to pick out the right set of rising sonority clusters must be ranked high, in order to derive the sonority reversal
  - This effectively allows languages to choose which profile is more marked (rises or plateaus)
  - Prediction: within a given language, all processes that care about sonority profiles of onsets should prefer the same contours
  - As we will see, this is not true for Lakhota! Epenthesis favors plateaus, but other patterns favor rises

(16) An alternative approach

- Universal ranking of markedness constraints prefers steeper sonority rises
  - No plateaus (*obstruent+obstruent, *sonorant+sonorant) ≫ No shallow rise (*obstruent+nasal) ≫ No intermediate rise (*obstruent+liquid) ≫ No steep rise (*obstruent+glide)
- Universal ranking of context-specific faithfulness constraints prefers epenthesis before sonorants
  - Dep(ə)/stop__stop ≫ …≫ Dep(ə)/stop__liquid

(17) Epenthesis and the P-Map

- Fleischhacker (2005), Zuraw (2007), Flemming (2008a), Albright and Magri (2013), Fullwood (2014), Yun (in press), and others: clusters differ in their propensity to be split by a vowel
  - Epenthesis (L1, loanword, child phonology), infixation, $C_1C_2V \sim C_1VC_2V$ puns,
- Fleischhacker (2005, p. 29): "epenthetic vowels are located in minimally obtrusive contexts"
- Proposal: universal ranking of faithfulness constraints prefers perceptually unobtrusive changes over perceptually salient ones (P-Map hypothesis: Steriade 2001)
- Getting started: stop+liquid clusters involve a rapid sonority rise, which is perceptually similar to stop+vowel in epenthesized correspondent (to be refined below)

(18) Result: stop+stop plateaus are more marked than rising sonority stop+liquid clusters, but epenthesis into them is also more costly

- i.e., violates a higher-ranked faithfulness constraint

/plV/	Dep/p_t	*pt	*pl	Dep/p_l
a. blV			*!	
☞ b. bəlV				*

/ptV/	Dep/p_t	*pt	*pl	Dep/p_l
☞ a. ptV		*		
b. pətV	*!			

(19) A sonority preference in Lakhota

- Shallow/intermediate rises (stop+nasal/liquid) are repaired through epenthesis
- Steep rises (stop+glide) are tolerated
- Required ranking: Dep/p__w ≫ *pw
- Compatible with univeral markedness and faithfulness hierarchies

/pwV/	Dep/p_t	*pt	*pl	Dep/p_l	Dep/p_w	*pw
☞ a. bwV						*
b. bəwV					*!	

(20) Clusters that are created through syncope

- Possessive conjugation: prefix k(i)-
- Syncope creates gl-, but not gn-, kt-, ks-

juha	gəluha	'have'
kaksa	gəlaksa	'cut something off'
naʒĩ	kinaʒĩ	'stand'
naksa	kinaksa	'hurt by stepping'
so	kiso	'cut string'
sũ	kisũ	'braid'
tãjã	kitãjã	'stick to one's opinion'

- Schematically: *SHALLOW RISE ≫ SYNCOPATE ≫ *INTERMEDIATE RISE

/ki-juha/	*SHALLOW RISE	SYNCOPATE	*INTERMED RISE	DEP/stop__son
a. kijuha			*!	
☞ b. gluha				*

/ki-naʒĩ/	*SHALLOW RISE	SYNCOPATE	*INTERMED RISE	DEP/stop__son
☞ a. kinaʒĩ			*	
b. gnaʒĩ		*!		

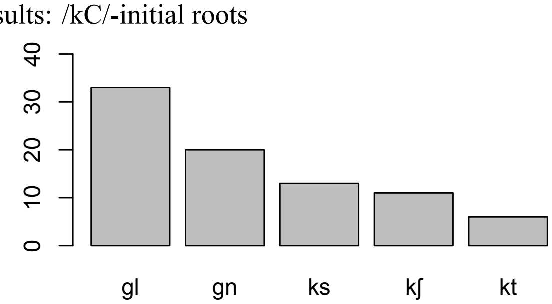
- This pattern also favors steeper sonority rises over intermediate/shallow rises and plateaus
- Opaque interaction with epenthesis (not analyzed here, due to time constraints)

(21) Markedness and frequency in the lexicon

- Commonly observed correlation: less marked structures are more frequent in the lexicon
- The current account proposes that rising sonority stop+liquid and stop+nasal clusters are less marked than plateau stop+fricative nad stop+clusters, even though only the former undergo epenthesis
- Question: are these rising sonority clusters more frequent in the lexicon?

(22) A test

- Database: 12,396 consonant-initial words from Buechel and Manhart (2002) dictionary
- Filtered to remove derived and reduplicated forms, allomorphic alternants, etc., and did rough morphological segmentation to extract morphemes
- Focus here on 2,275 monosyllabic and disyllabic roots
- Results: /kC/-initial roots



- Mirrors universal markedness preference
  - ○ *stop+stop, *stop+fricative ≫ *stop+nasal ≫ *stop+liquid

(23) Summary of this section

- Although Lakhota has epenthesis in stop+sonorant clusters and tolerates plateaus, there is converging evidence that in many respects, it still favors sonority rises
  - Glide/liquid asymmetry
  - Type frequencies in the lexicon
  - Clusters created through syncope
- Proposal: Lakhota grammar employs universal ranking of markedness constraints on sonority contours
  - *stop+stop, *stop+fricative ≫ *stop+nasal ≫ *stop+liquid ≫ *stop+glide
- High-ranking Max requires preservation of C's, so deletion is not a possible repair for /CC/ clusters
- Epenthesis in stop+obstruent plateaus would repair a severe markedness violation, but it would violate a strong faithfulness constraint: Dep(ə)/stop_obstruent
- Epenthesis in shallow/intermediate sonority rises (stop+nasal, stop+liquid) repairs a less serious violation, but can be accomplished by violating a weaker faithfulness constraint: Dep(ə)/stop_sonorant

4 Other cluster types

4.1 Fricative-initial clusters

(24) A fricative/stop asymmetry

	Nasal	Liquid
Stop	gəmV, gənV	bəlV, gəlV
Fricative	ʃmV, snV, …	xlV, ʃlV, …

- Unlike stops, fricative-initial clusters never show epenthesis in Lakhota, even when the second member is a nasal or liquid
- Claim: this asymmetry provides additional support for the claim that the choice of which clusters to epenthesize into is controlled by contextual faithfulness constraints, and not by markedness

(25) The fricative/stop asymmetry and the P-Map

- Fleischhacker (2005, p. 109): more TRV ∼ TVRV puns than SRV ∼ SVRV puns in an English puns corpus
- Interpretation: Δ(sla,sVla) > Δ(pla,pVla)
- Formalization: Dep(ə)/fricative_sonorant ≫ Dep(ə)/stop_sonorant
- Yun (10am today, this room): attributes greater similarity of TRV ∼ TVRV to specific properties of the transition from T to R (stop burst, intensity rise)

/plV/	Dep/S_R	*OO	*OR	Dep/T_R
a. blV			*!	
☞ b. bəlV				*

/xlV/	Dep/S_R	*OO	*OR	Dep/T_R
☞ a. xlV			*	
b. xəlV	*!			

4.2 Nasal-nasal clusters

(26) An asymmetry among plateaus

- Stop+stop: ptV, ktV, kpV
- Nasal+nasal: mənV

(27) The stop/nasal asymmetry and the P-Map

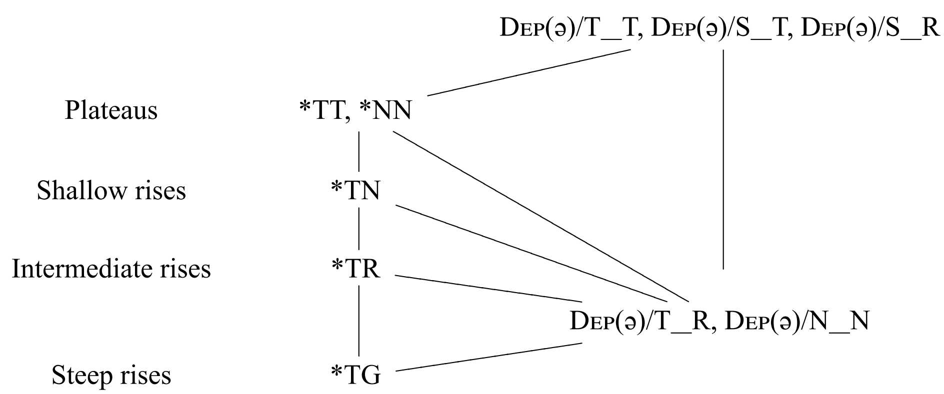
- Yun (in press): English and Korean listeners judge mnV ∼ mənV to be more similar than a pair that preserves the cluster intact (mnV ∼ əmnV)
- Flemming (2008a), Fullwood (2014): sonority contour preservation
  - pt → pə: large increase in sonority
  - mn → mə: smaller increase in sonority
- Necessary ranking: Dep(ə)/stop__stop ≫ Dep(ə)/nasal__nasal

/mnV/	Dep/T_T	*OO/RR	*OR	Dep/N_N
a. mnV		*!		
☞ b. mənV				*

/ptV/	Dep/T_T	*OO/RR	*OR	Dep/N_N
☞ a. ptV		*		
b. pətV	*!			

(28) Summary of epenthesis discussion: two components

- Markedness constraints on clusters respects cross-linguistic tendency to favor sonority rises
  - *stop+stop, *stop+fricative ≫ *stop+nasal ≫ *stop+liquid ≫ *stop+glide
- Faithfulness constraints penalizing epenthesis in different contexts, ranked so that perceptually more salient changes are penalized more than less salient changes
  - Dep(ə)/p__t, Dep(ə)/s__t ≫ Dep(ə)/m__n, Dep(ə)/p__l
- Ranking summary:



5 Voicing

(29) Regressive voicing assimilation in stop+sonorant clusters

- /pjV/, /kwV/ → bjV, gwV
- /plV/, /kmV/ → bəlV, gəmV

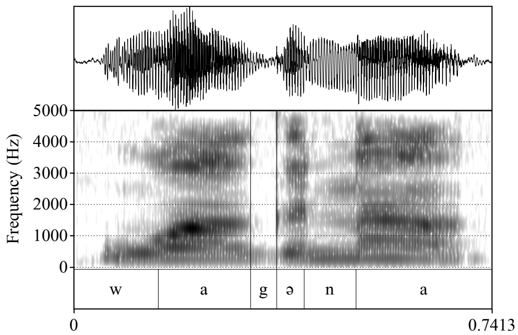
(30) Two questions

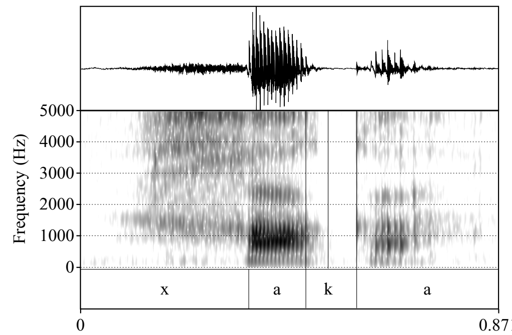
- What motivates voicing assimilation by sonorants?
- What does it overapply in clusters that have undergone epenthesis?

(31) Claim (Albright 2012): stop voicing is a function of closure duration

- Voicing in stops is not contrastive
- 'Plain' stops: substantial passive voicing during closure, even V__V
  - [−voi] achieved with modest glottal abduction, helped by aerodynamic forces (gradual build-up of pressure)

- Stop+sonorant cluster: closure almost as short as (passively) voiced portion of intervocalic stop



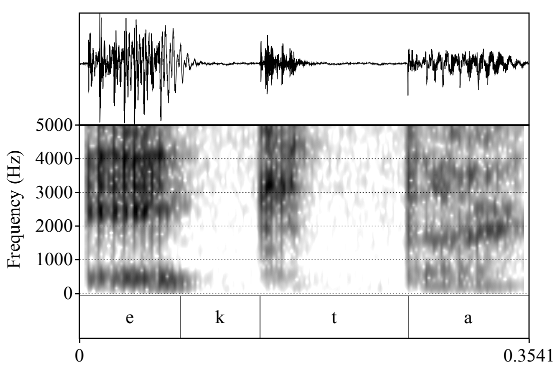


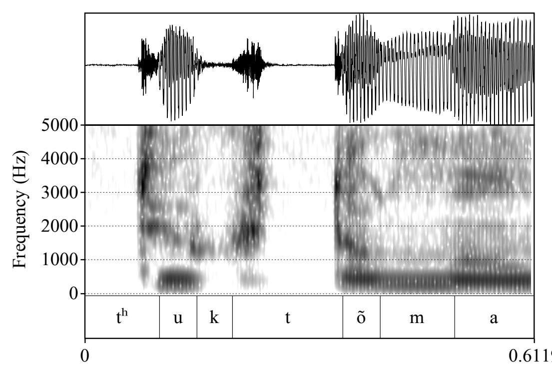
(32) Approach:

- Stops in C1 position of clusters are short
- If stops are short, they must be voiced (very short voiceless stop requires rapid glottal abduction)

(33) The realization of stops in C_1 position

- Stops in clusters are strongly released
- Duration of C1 closure prior to release is typically short (much less than half of total cluster dur.)
- Closure of C1 may also be incomplete, with substantial frication (Tiberian Hebrew, Quechua)
- Substantial passive voicing in post-vocalic position (large proportion of brief C_1 closure)
- Examples of voiceless clusters: [kt] tuktõma 'which of two'





(34) Voicing

- In stop+obstruent clusters, C_2 is always voiceless
  - Stops: no contrastively voiced stops
  - Fricatives: voiced fricatives banned in clusters (C_1 or C_2; Albright 2012)
  - Entire stop+obstruent cluster can be devoiced with a single glottal abduction gesture
- In stop+sonorant clusters, C_2 is always voiced
  - No voiceless sonorants in Lakhota
  - Voiceless stop in C_1 position would require rapid glottal abduction, and resumption of voicing for sonorant
- We see from passive voicing of C_1 in voiceless clusters in (33) that the preferred way to cut off voicing in Lakhota is slow abduction, relying on aerodynamic help (build-up of oral pressure)
- Hypothesis: C1 voices in stop+son clusters because devoicing it would require too much effort

(35) Constraints

- *Long closure(C_1 stop)
  - A type of lenition? Or perhaps helps provide time for long/fricated release?
- *Rapid gesture
  - Voicing: penalizes rapid glottal abduction needed to produce short voiceless stop
  - Closure: also may penalize complete closure of C_1
- *Voiced stop
  - Eliminates voiced stops, except where compelled
- Ranking (k̆ = short k)

/kV/	*LongC1	*Rapid	*D
☞ a. kV			
b. k̆V		*!(dors) *(s.g.)	
c. ğV		*(dors)	*!

/kwV/	*LongC1	*Rapid	*D
a. kwV	*!		
b. k̆wV		*(dors) *!(s.g.)	
☞ c. ğwV		*(dors)	*

/ktV/	*LongC1	*Rapid	*D
a. ktV	*!		
☞ b. k̆tV		*(dors) ✓(s.g.)	
c. ğtV		*(dors)	*!

(36) Interaction with epenthesis

- In stop+nasal and stop+liquid clusters, epenthesis puts C_1 in prevocalic position
  - /knV/, /klV/ → [gənV], [gəlV]
- Prevocalic stops are normally long enough to be (categorically) voiceless
- If the constraints posited above are to apply, it must be the case that in this context, the stop is constrained to be short
- Proposal: this is a faithfulness condition, requiring C_1 to have the short duration that it would have had as the first member of a surface CC cluster
- Flemming (2008b): inputs are first evaluated to determine phonetic properties ("realized input")

(37) Implementation: input /klV/

- Phonetic realization: input /klV/ is assigned short C1 duration: /k̆lV/
- Phonotactics: constraint Ident(closure duration) demands that surface stops maintain closure duration of input correspondents
- Ranking: *Long closure(C_1 stop), Ident(duration) $\gg$ *Voiced stop

/k̆lV/	*LongC1	*TR	Ident(clos.dur)	*Rapid	*D	Dep/T_R
a. k̆lV		*!		*(dors) *(s.g.)		
b. ğlV		*!		*(dors)	*	
c. kəlV			*!			*
☞ d. ğəlV				*(dors)	*	*

(38) Lakhota and the typology of voicing assimilation

- Voicing assimilation by sonorants is treated here as a by-product of durational reduction (lenition), not as true voicing assimilation
- A consequence of this is that we do not necessarily expect voicing to occur only in 'assimilation contexts' (i.e., immediately pre-consonantal)
- Under this approach, the typologically unusual fact that voicing is triggered by sonorants, and the otherwise unattested interaction with epenthesis, are not counterexamples to the constrained typology of voicing assimilation

6 Discussion and conclusion

(39) Summary: three components

- Fixed Markedness hierarchy, preferring steeper sonority rises
  - *plateau ≫ *shallow rise ≫ *intermediate rise ≫ *steep rise
- Fixed Faithfulness hierarchy, preferring perceptually minimal repairs
  - Dep(ə)/T__T, Dep(ə)/S__T, Dep(ə)/S__R ≫ Dep(ə)/T__R, Dep(ə)/N__N
- Constraints on duration of C's in clusters, and speed of gestures
- Taken together, these conspire to produce two surprising patterns
  - Epenthesis targeting rising sonority clusters, while leaving plateaus intact
  - Voicing assimilation in stop+sonorant clusters, creating apparently shallower plateaus, and overapplying with epenthesis

(40) Blocking prothesis

- Lakhota, fricative+stop clusters are preserved intact, while other clusters undergo epenthesis
- In other cases, the difference is in the location of epenthesis (Broselow 1992; Fleischhacker 2005)

	/STV/	/TRV/
Lakhota	STV	T**V**RV
Egyptian Arabic	**V**STV	T**V**RV

- Albright and Magri (2013) argue that this is best analyzed as an Align effect, requiring root/morphemic material to coincide with the left edge of the word

(41) Lack of true 'reversals'

- An important prediction of an account that does not rely on special Markedness for CRV
  - Apparent reversals arise only if Faith distinguishes the relevant clusters in an 'inverse' fashion
  - Shown here: Dep can favor epenthesis in less marked clusters
  - For processes other than epenthesis, universal hierarchy of cluster markedness still holds
  - Lakhota data confirms that this is true: other processes prefer rises
- To be explored: apparent reversals due to other faithfulness hierarchies

(42) Similar effects in other languages

- Lakhota shows a more general version of a well documented epenthesis asymmetry: TəR vs. ST
- Hawai'ian Creole (Nagara 1972, speaker AM; Fleischhacker (2005))

ST:	ST	ste:'stay', stóp:'stop', sku:ru:'school'
TR:	TVR	p**u**rantè:ʃon 'plantation', p**u**ránti:'plenty'
STR:	STVR	st**o**ré:ta:'straight', st**u**rí:to 'street'

- Child English
  - Albright and Magri (2013): examined epenthesis patterns among elicited productions from children in the Iowa Articulatory Norms Project (Smit, Hand, Freilinger, and Bernthal 1990; Smit 1993)
  - Overall higher rate of epenthesis in TR clusters than ST clusters
  - Implicational relation: epenthesis in ST → epenthesis in TR
  - Child 1182 (8 years old)

ST:	ST	skate, spoon, star
SN:	SN	smoke, snake, snail
SR:	SR	flag, frog, three, swing
TR:	TR	twins, queen, grass, dress, glass, clock, clown, plate, spray, straw, screen, square, splash
	TVR	train, crayons, present, bread, bridge, block

- Most such cases in the literature show only a very limited sonority asymmetry: TR vs. sT
  - Potentially attributable to special properties of [s]
  - E.g., sC not a sonority sequencing violation (Barlow 2001)
- Lakhota shows that the same epenthesis asymmetry extends to a wider range of plateaus
- Asymmetries involving fricatives and nasals provide more fine-grained support for the claim that epenthesis is licensed in contexts where it is perceptually least obtrusive

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