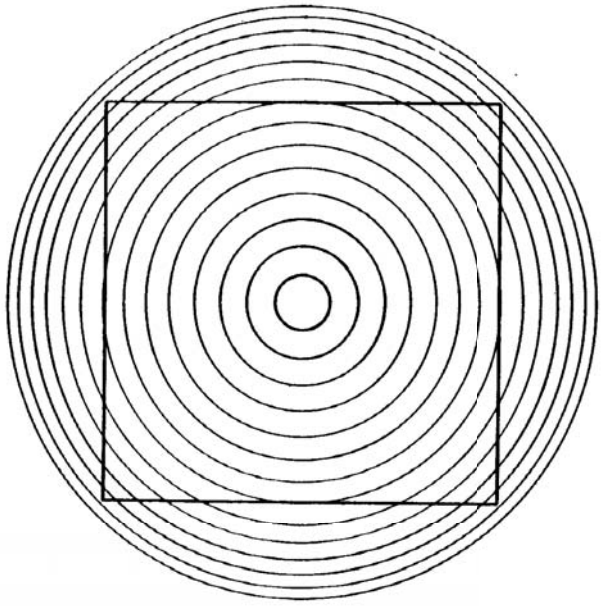
24.914

Language Variation and Change

Phonetics and Sound Change



Courtesy of Chicago Linguistic Society. Used with permission.
Source: Ohala, John. "J. 1981. The listener as a source of sound change."
Papers from the Parasession on Language and Behavior: 178-203.

Phonetics and Sound Change

- Phonetic considerations have long been hypothesized to play a central role in accounting for the nature of sound change.
- The Neogrammarian hypothesis: sound change is exceptionless and purely phonetically conditioned.
  - 'sounds change not words'.
  - Suggests that the mechanisms of sound change involve phonetics, i.e. properties of speech production and perception.
- Recurrence of similar sound changes across languages and across time.
  - The properties of speech production and perception are basically the same for all speakers at all times.

Initiation vs. Propagation

- What are the mechanisms of sound change? How do they involve phonetics?
- Phonetic considerations are assumed to influence the initiation of a sound change, e.g. in the speech of a single speaker.
- Whether the sound change spreads through a population depends on social factors etc.

The role of the speaker in sound change

- 'Ease of articulation' has commonly been regarded as the basis for sound changes such as lenitions and assimilations.

Old Italian	Italian	
okto	otto	'eight'
nokte	notte	'night'
lakte	latte	'milk'

Latin	Portuguese	French	
bon(um)	bõ	bɔ̃	'good'
un(um)	ũ	œ̃	'one'

The role of the listener in sound change

- However there are many sound changes that cannot easily be understood in terms of reduction of effort, e.g. fortition.

Latin	French	
jumentum	[ʒ]ument	‘draft animal’
jocus	[ʒ]eu	‘game’
junius	[ʒ]uin	‘June’

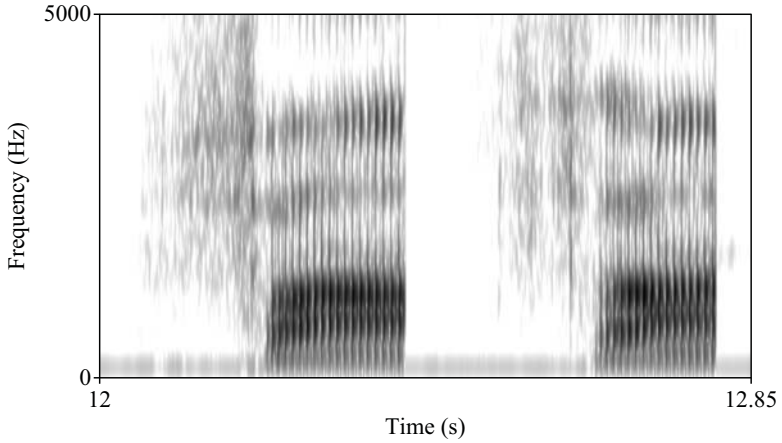
- Ohala (1981) proposes an account of the origins of sound changes that gives a central role to the listener

Changes between perceptually similar sounds

- Regardless of the precise mechanism involved, the relevance of speech perception is indicated by frequent changes involving articulatorily dissimilar, but perceptually similar sounds.
- f > θ

RP English	Cockney	
θɹu	fɹu	'through'
θin	fɪn	'thin'

- This change is acoustically gradual, but articulatorily abrupt



Changes between perceptually similar sounds

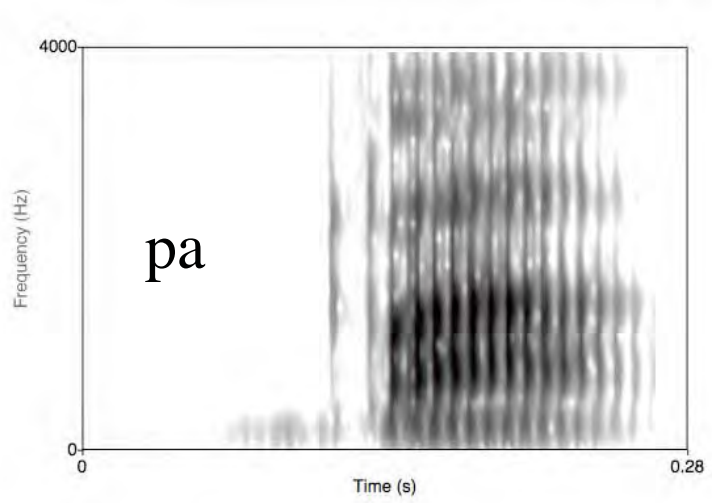
- Labialized stops > labials

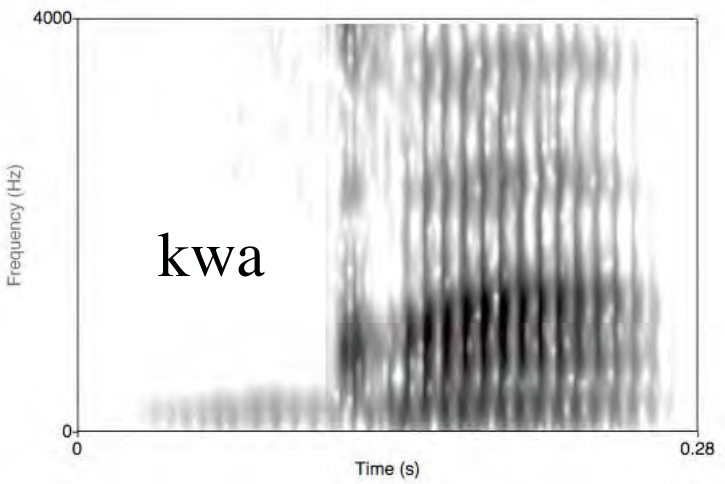
Early Latin	Classical Latin	
dwellom	bellum	‘war’
dwonos	bonus	‘good’
dwis	bis	‘twice’

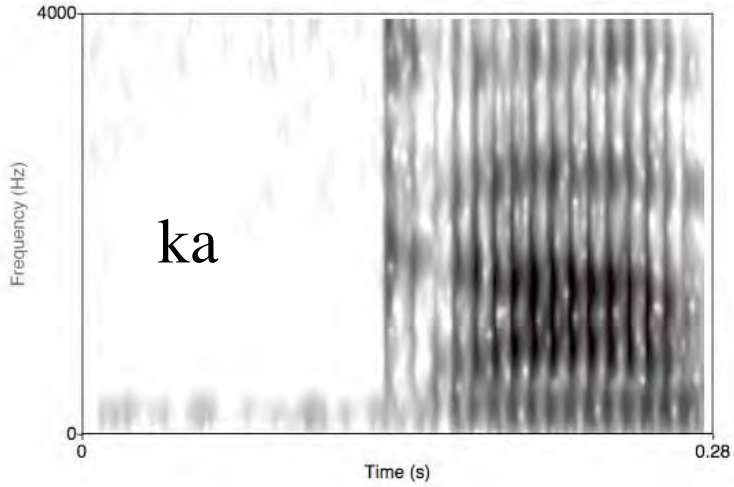
Classical Latin	Romanian	
akwa	apa	‘water’
liŋgwa	limba	‘tongue’
ekwa	iapə	‘mare’

Changes between perceptually similar sounds

- Labialized stops > labials







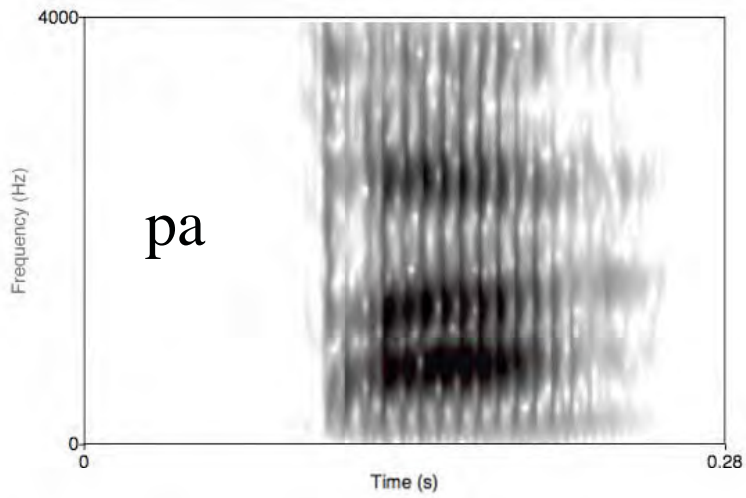
Spectrograms of Korean C(G)V sequences (Suh 2009)

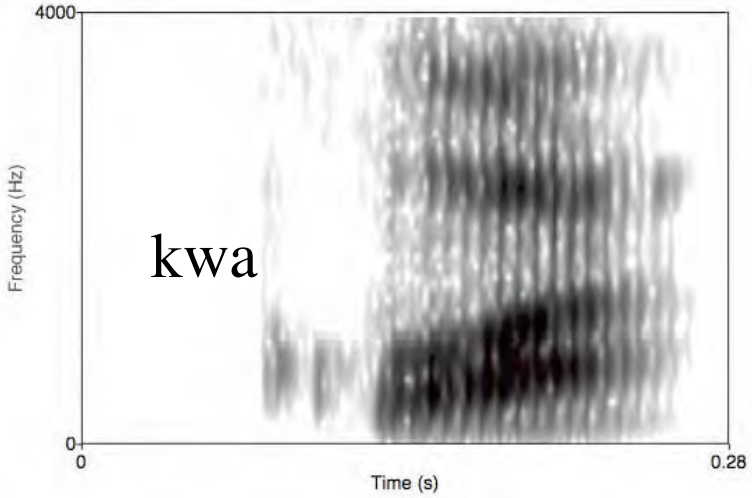
- tense stops

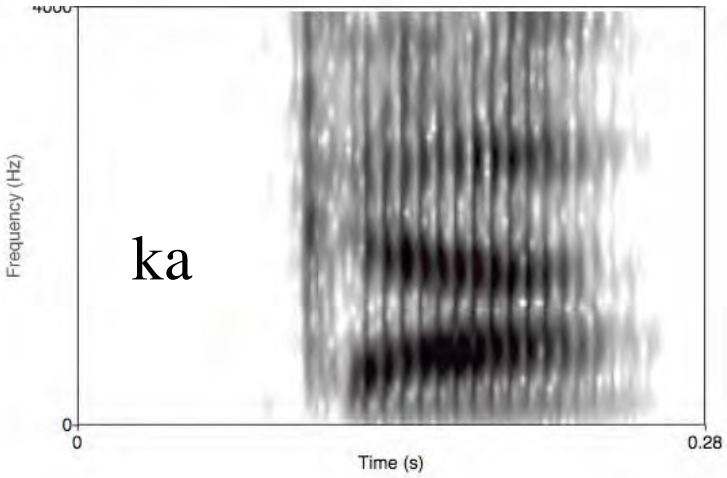
Source: Suh, Yunju. "Phonological and Phonetic Asymmetries of Cw Combinations." PhD diss., Stony Brook University, 2009.

Changes between perceptually similar sounds

- NB similarity between labialized stops and labials depends on exactly how [Cw/C^{w}] are realized







Spectrograms of Spanish C(G)V sequences (Suh 2009)

- [w] is longer, consistently low F2.

Source: Suh, Yunju. "Phonological and Phonetic Asymmetries of Cw Combinations." PhD diss., Stony Brook University, 2009.

Changes between perceptually similar sounds

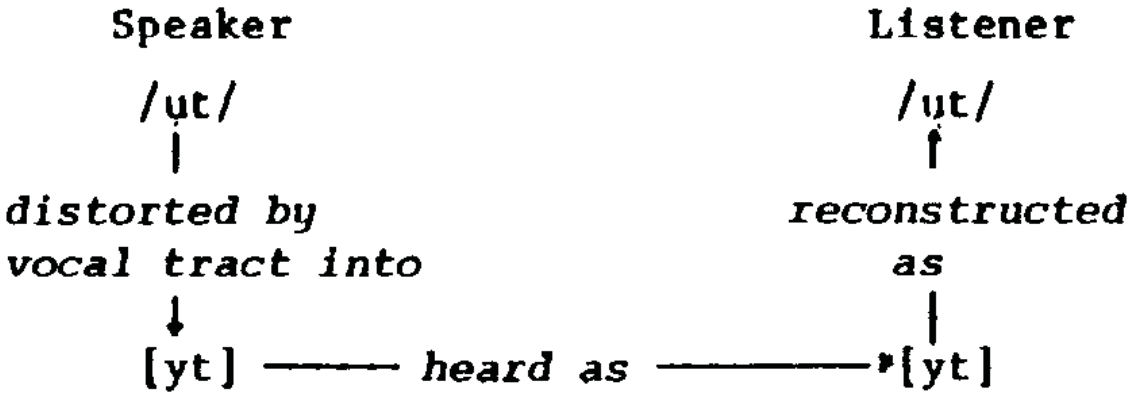
- Palatalized labials > Coronals

Old Czech	Žitomyšl Czech	
pʲeknʲe	teknʲe	'nicely'
bʲeʒeti	deʒet	'run'
mʲesto	nesto	'town'

  - Palatalization was lost in all contexts, but without change in primary place of other palatalized consonants.

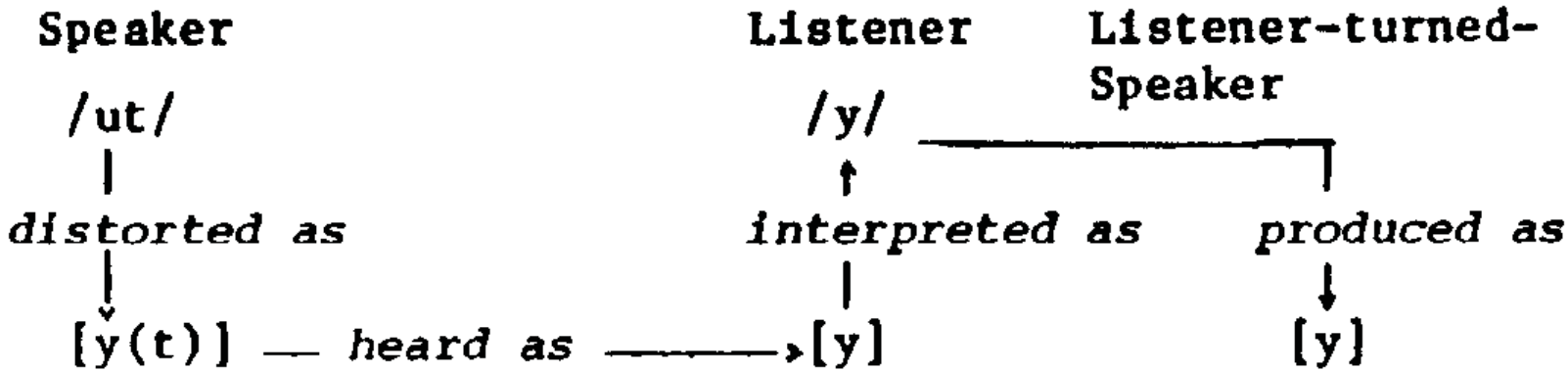
Ohala's model: undoing contextual effects

- Contextual effects of one segment on another are claimed to be largely mechanical, and unintended by the speaker.
  - Coarticulation, e.g. raising of F2 in back vowels due to an adjacent coronal.
  - Effects of obstruent voicing on f0, etc.
- Listener's factor out these 'distortions' of the speaker's intentions in the process of speech perception.



‘Sound change from failure to apply reconstructive rules’

- Note that Ohala does not claim that context must be lost at the same time – there may be other reasons for the failure to apply reconstructive rules.



Courtesy of The Chicago Languistic Society. Used with permission.
Source: Ohala, John. "J. 1981. The listener as a source of sound change." Papers from the Parasession on Language and Behavior: 178-203.

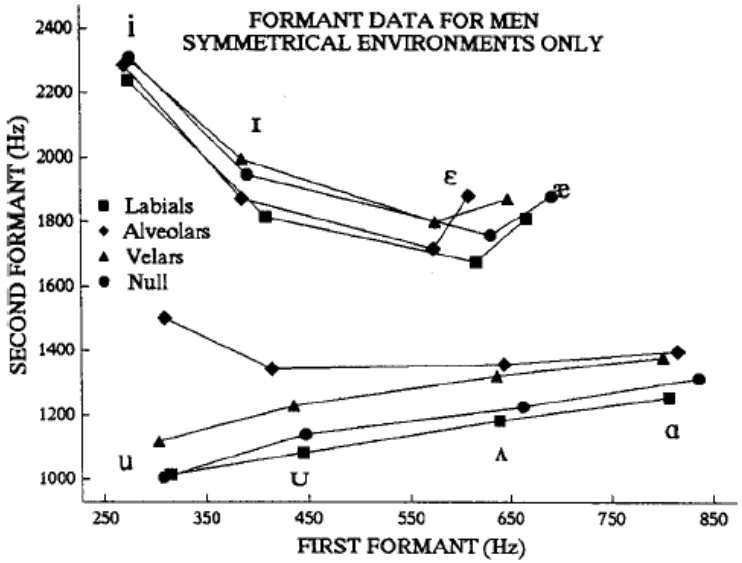
Example: Lhasa Tibetan

	8th Century Tibetan	>	Lhasa Tibetan	
a.	lus		ly:	'body'
	jul		jy:	'country'
	bod		phø:	'Tibet'
	spos		pø:	'incense'
	sman		mɛ̃:	'medicine'
	skad		qɛ:	'language'
b.	goŋ		qhõ:	'price'
	gjag		ja:	'yak'
	nub		nu:	'west'

- Other examples:
  - Development of nasalized vowels (above).
  - Tonogenesis/tone split accompanied by loss of stop voicing contrast (e.g. Chinese dialects, Kammu).

Example: Lhasa Tibetan

- Coronals have coarticulatory fronting effects on adjacent vowels.
- E.g. in English



Hillenbrand, Clark & Nearey 2001

Source: Hillenbrand, James M., Michael J. Clark, and Terrance M. Nearey. "Effects of consonant environment on vowel formant patterns." The Journal of the Acoustical Society of America 109, no. 2 (2001): 748-763.

Example: tonogenesis in Kammu

Gloss	E. Kammu	W. Kammu Tone 1	W. Kammu Tone 2	W. Kammu Register
'rice wine'	bu:c	pù:c	p^{h}ù:c	pṳ:c
'to take off clothes'	pu:c	pû:c	pú:c	pû:c
'to cut down a tree'	bok	pòk	p^{h}òk	po̤k
'to take a bite'	pok	pók	pók	pók
'to chew'	bu:m	pù:m	p^{h}ù:m	pṳ:m
'to fart'	pu:m	pû:m	pú:m	pû:m
'stone'	gla:ŋ	klà:ŋ	k^{h}là:ŋ	kla̤:ŋ
'eagle'	kla:ŋ	klâ:ŋ	klá:ŋ	klâ:ŋ
'to weigh'	ɟaŋ	càŋ	c^{h}àŋ	ca̤ŋ
'astringent'	caŋ	câŋ	cáŋ	câŋ

- Data from Suwilai (2003) via Kingston (2011).
- NB laryngeal contrast is retained in W. Kammu dialect 2.

F_0 and stop voicing

Ohde (1984)

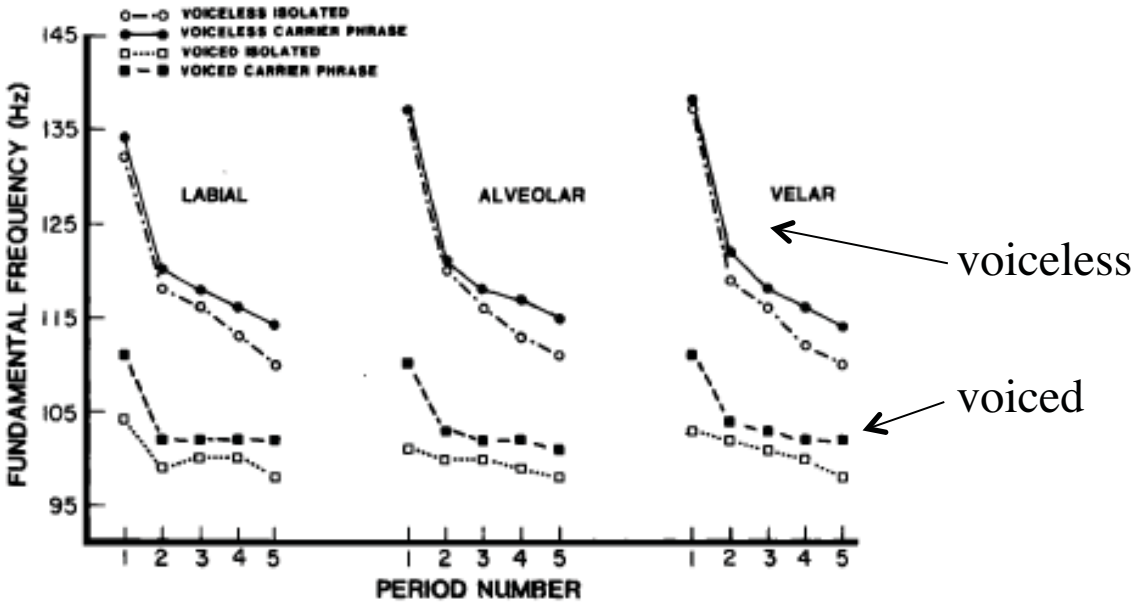


FIG. 2. Average *F*0 from voicing onset to the fifth glottal period for voiceless aspirated and voiced stops as a function of linguistic context and place of articulation.

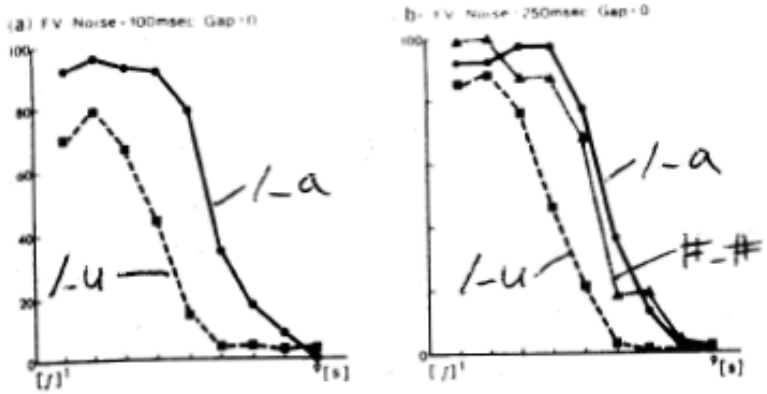
Source: Ohde, Ralph N. "Fundamental frequency as an acoustic correlate of stop consonant voicing." The Journal of the Acoustical Society of America 75, no. 1 (1984): 224-230.

- F_0 is higher after voiceless obstruents than after voiced obstruents (other things being equal)

Compensation for coarticulation

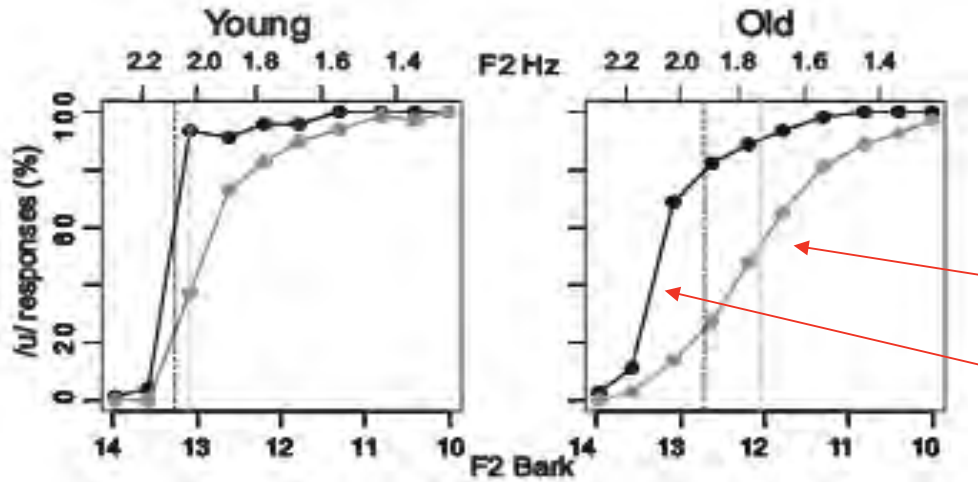
- The process that Ohala proposes is similar to compensation for coarticulation. How does it differ?
- Are the differences crucial to Ohala's analysis?
- What would be the expected result of a failure to compensate for coarticulation?

s-ʃ, lip-rounding



Source: Mann, Virginia A., and Bruno H. Repp. "Influence of vocalic context on perception of the [ʃ]-[s] distinction." Attention, Perception, & Psychophysics 28, no. 3 (1980): 213-228.

i-u, fronting vs. backing contexts



Source: Harrington, Jonathan, Felicitas Kleber, and Ulrich Reubold. "Compensation for coarticulation, /u/-fronting, and sound change in standard southern British: An acoustic and perceptual study." The Journal of the Acoustical Society of America 123, no. 5 (2008): 2825-2835.

Automaticity of coarticulation?

- The magnitude of coarticulatory fronting of vowels due to coronals is language-specific (Flemming 2001, 2008).
  - Undershoot = difference in F2 of [u] in a neutral context, e.g [hu] and in a context between anterior coronal stops [tut].

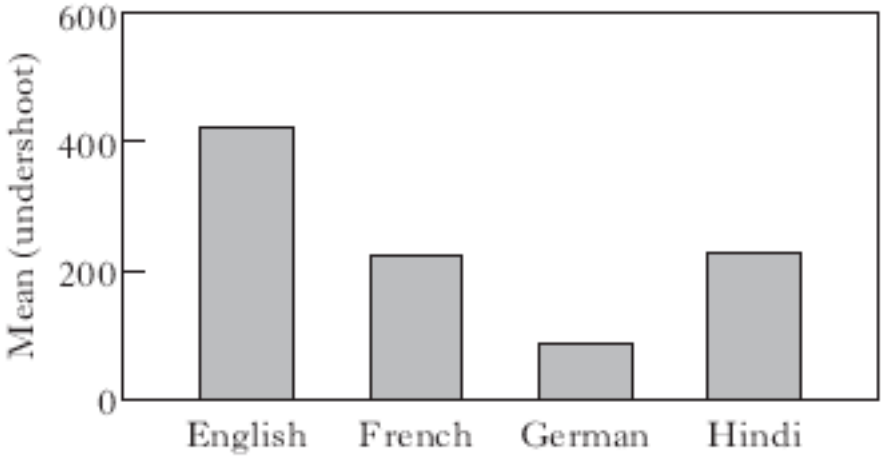
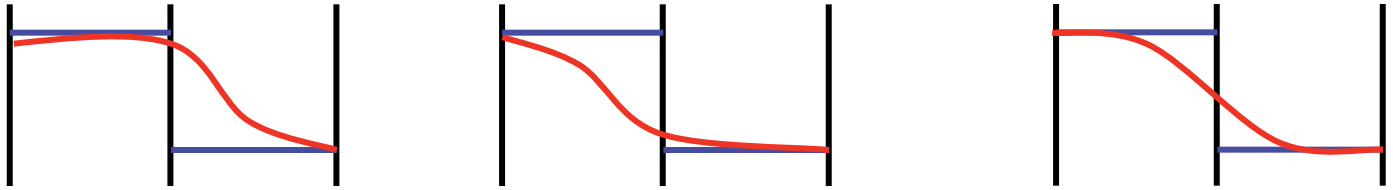


Figure 4

/u/ undershoot between coronals in four languages (in Hz).

Automaticity of coarticulation?

- As discussed earlier in the course, even where there are inviolable physiological constraints on speech production, those are never sufficient to fully determine coarticulatory patterns.



- How does it change Ohala's picture if coarticulation is intentional, and derives from the grammar of a language?

Perceptually-based change without loss of context: Velar palatalization

- Palatalization of velars to palato-alveolar affricates is a common sound change.
- It is not obviously assimilatory – C changes from dorsal to coronal under the influence of a dorsal (front) vowel.

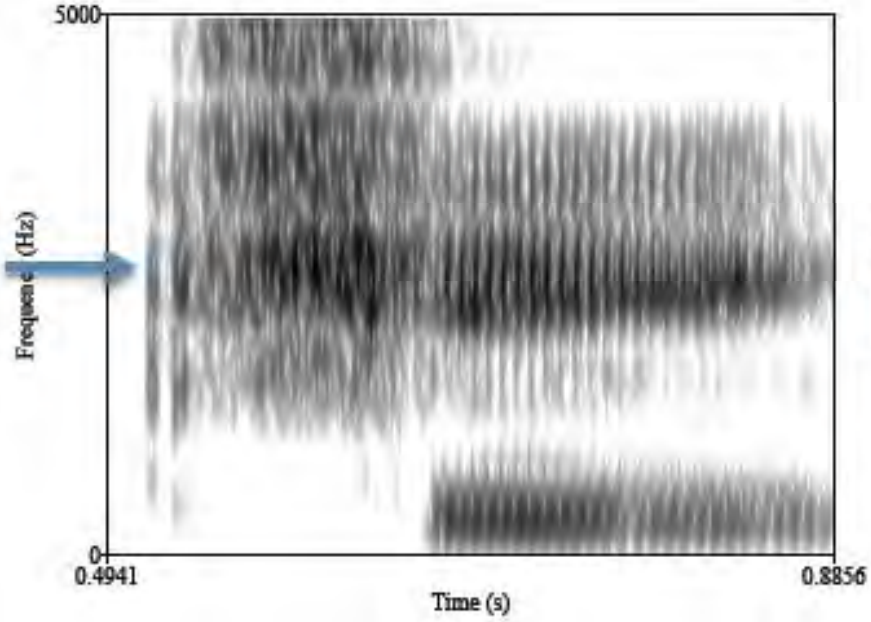
E.g. Slavic 1st palatalization:

Pre-proto-Slavic	OCS			
*wilk-e	vlʲitʃe	cf.	vlʲikŭ	'wolf'
*pla:k-j-o:-m	platʃõ	cf.	plakati 'cry'	
*mog-e	moʒe	cf.	mogoxŭ	'was able'
*lug-j-o:-m	lŭʒõ	cf.	lŭgati	'lie'

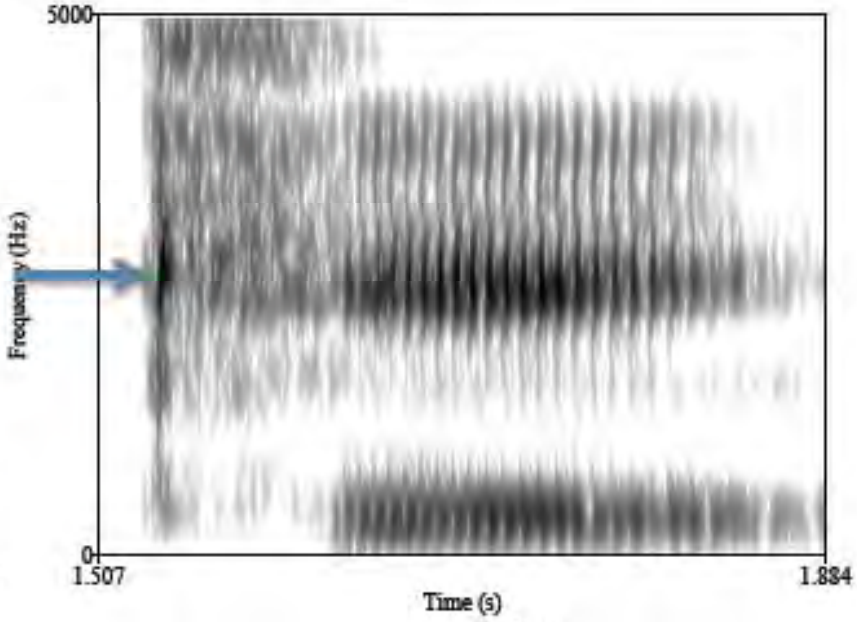
Old Chinese	Middle Chinese	
*kje	tɕje	'branch'
*kʰjet	tɕʰjet	'to trail, drag'
*gjip	dʑjip	'ten'

Perceptually-based change without loss of context: Velar palatalization

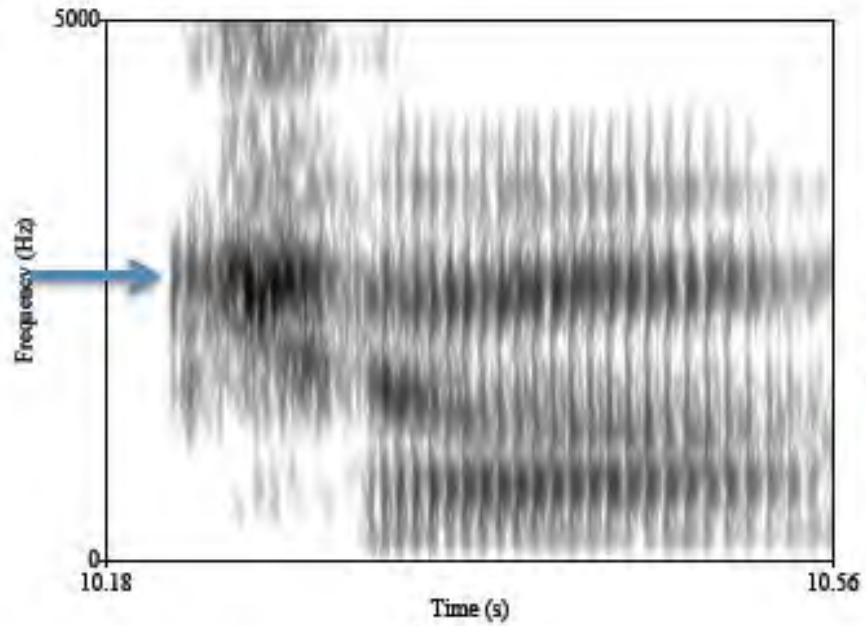
- Ohala (1992) argues that the change is based on perceptual similarity between fronted velars and palato-alveolars (also Guion 1998).
- The affrication of [tʃ] has its first major spectral peak at 2-3 kHz – close to F2/F3 of [i].
- The burst of [k] in [ki] has its main spectral peak at around the same frequency because the peak of a [k] burst generally tracks F2 of the following vowel because it assimilates in place to following (non-low) vowels.
- Onset of F2 is high after both consonants in [ki, tʃi].



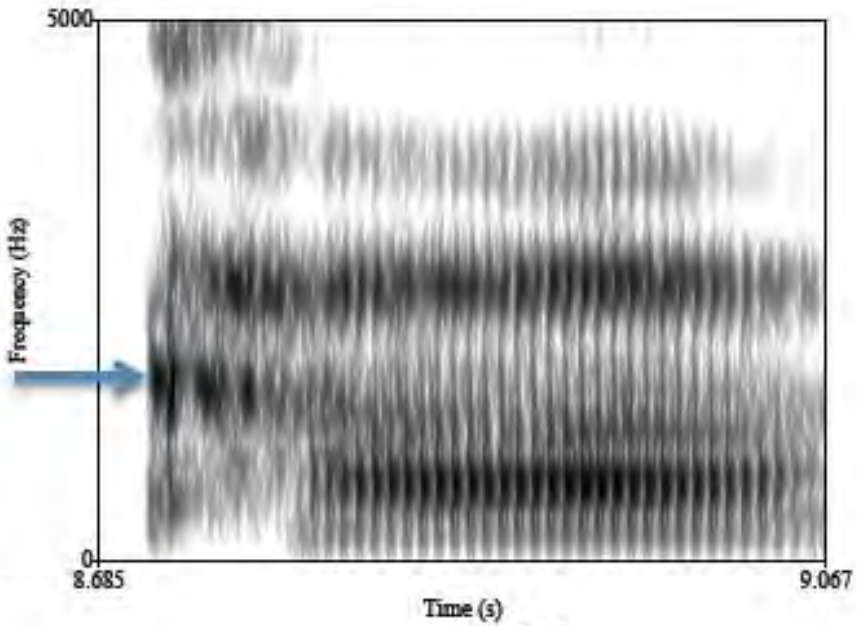
[tʃi]



[kʰi]



[tʃɑ]



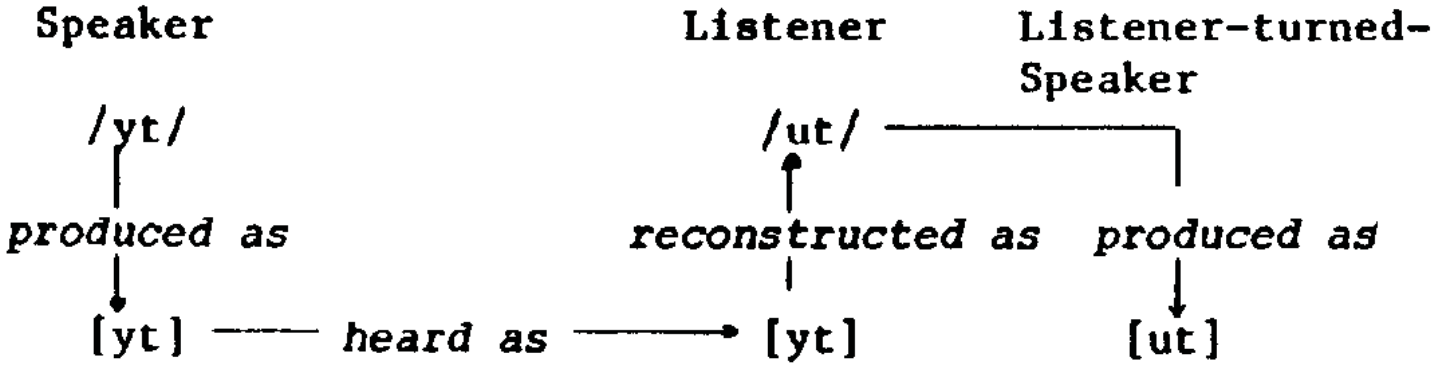
[kʰɑ]

Perceptually-based change with and without loss of context

- Misinterpretation of contextual effects with loss of context makes the failure of reconstruction understandable.
- But why is context misperceived? If it is due to an error of production or perception, or accidental noise, is that sufficient to generate a sound change?
- Occasional perceptual errors seem unlikely to translate into novel productions because they will be overwhelmed by correct perceptions.
  - Systematic/frequent misperception is required to account for a regular sound change.
  - Paul: 'A single inaccuracy of the ear cannot possibly have any lasting results for the history of language. If I do not accurately catch a word…but I guess his meaning from the context…then I supply the word in question according to the memory-picture which I have in my mind. If the connexion is not sufficient to explain clearly the meaning, it may be that I shall supply a wrong meaning, or I may supply nothing at all…But how I should come to think that I have heard a word of a different sound, and still set this word in the place of the one I understand, is to me incomprehensible' (p.21)
- Why would misinterpretation of contextual effects occur systematically?

Sound change via hyper-correction

- Ohala argues that dissimilation results from erroneous over-application of reconstructive processes.



- Local dissimilation

Slavic			
mõgutʃājsij	>	mõgutʃājʃiji	'softest'
stoj-ā-	>	stojā-	'stand'

Proto-bantu	Pre-Shona	Shona	
*-bua	*-bwa	-bya	'dog'
*-mu-	kumwakumya 'to drink'		

Sound change via hyper-correction

- Non-local dissimilation

E.g. IE > Sanskrit *bʱendʰ > bandʰ- 'bind'

Proto-Quechumaran > Quechua *t'ant'a > t'anta 'bread'

Latin: /nav-alis/ navalis
/popul-alis/ popular̲is
/milit-alis/ militar̲is

- Are the required coarticulatory effects attested/strong enough to motivate the required reconstructive processes?
- An alternative account for a subset of these case: Gallagher (2010) – it is harder to discriminate plain vs. ejective in the presence of another ejective.
  - Same applies to aspirated stops, and between ejective and aspirated stops.

Gallagher (2010)

a. *Same*				
0 *vs.* 0	heterorganic	[kapi-kapi]		
	homorganic	[kaki-kaki]		
1 *vs.* 1	heterorganic	[k'api-k'api]	*or*	[kap'i-kap'i]
	homorganic	[k'aki-k'aki]	*or*	[kak'i-kak'i]
2 *vs.* 2	heterorganic	[k'ap'i-k'ap'i]		
b. *Different*				
1 *vs.* 0	heterorganic	[k'api-kapi]	*or*	[kap'i-kapi]
	homorganic	[k'aki-kaki]	*or*	[kak'i-kaki]
2 *vs.* 0	heterorganic	[k'ap'i-kapi]		
2 *vs.* 1	heterorganic	[k'ap'i-k'api]	*or*	[k'ap'i-kap'i]

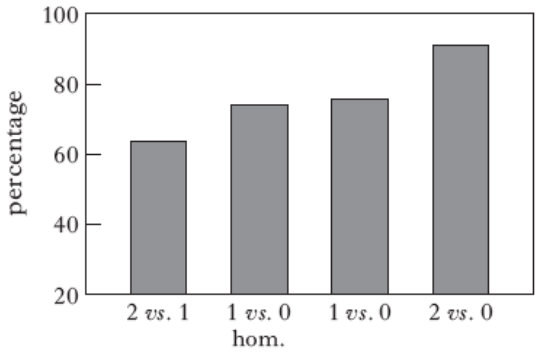


Figure 2
Percentage correct by contrast category, averaged across all subjects.

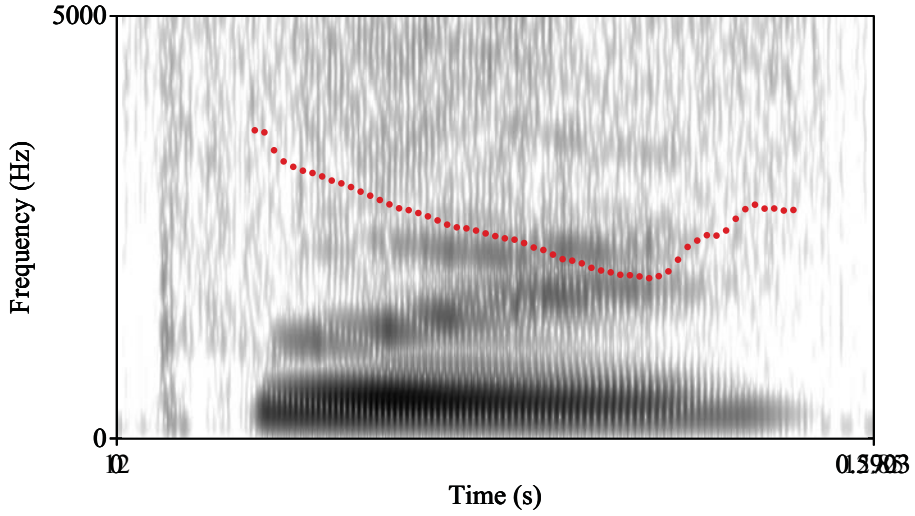
An alternative approach to the role of the listener (and speaker)

- Contrasts are distinguished by multiple cues, and by different cues in different contexts.
- Speakers aim to produce distinct speech without excessive effort.
- They can exploit a variety of cues to ensure distinctness of speech.
- 'Exaggeration' of one cue can compensate for articulatorily motivated reduction of another (cf. vowel fronting/coronal reduction, tonogenesis etc).
- A cue may be enhanced in a non-compensatory fashion (i.e. without loss of context) in the service of clarity.
- Predicts gradual shifts in cues and their relative importance over time.
  - Example: Korean lax-aspirated contrast

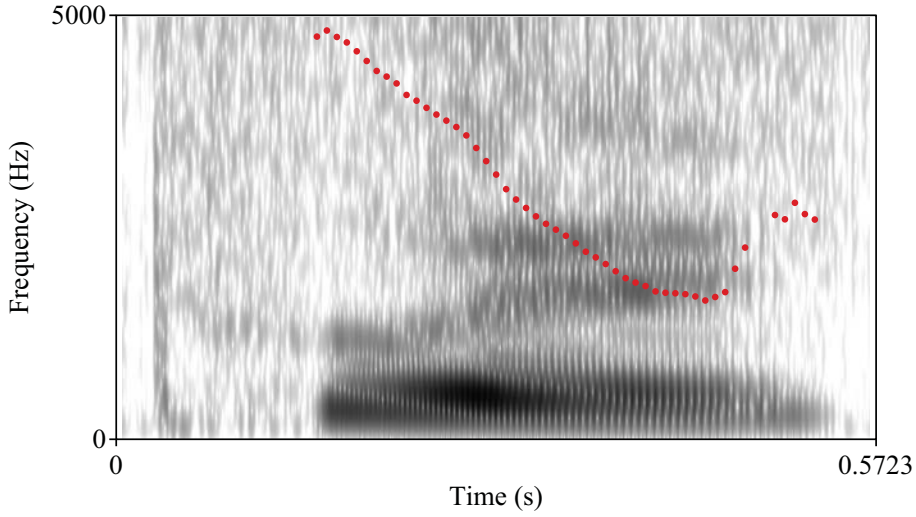
Cue shifting the in the Korean lax-aspirated contrast

- Korean contrasts unaspirated ('lax'), aspirated and tense stops.
  - http://www.phonetics.ucla.edu/appendix/languages/korean/korean.html
- Differentiated by Voice Onset Time and F_0 following the stop.

[pul] 'fire'

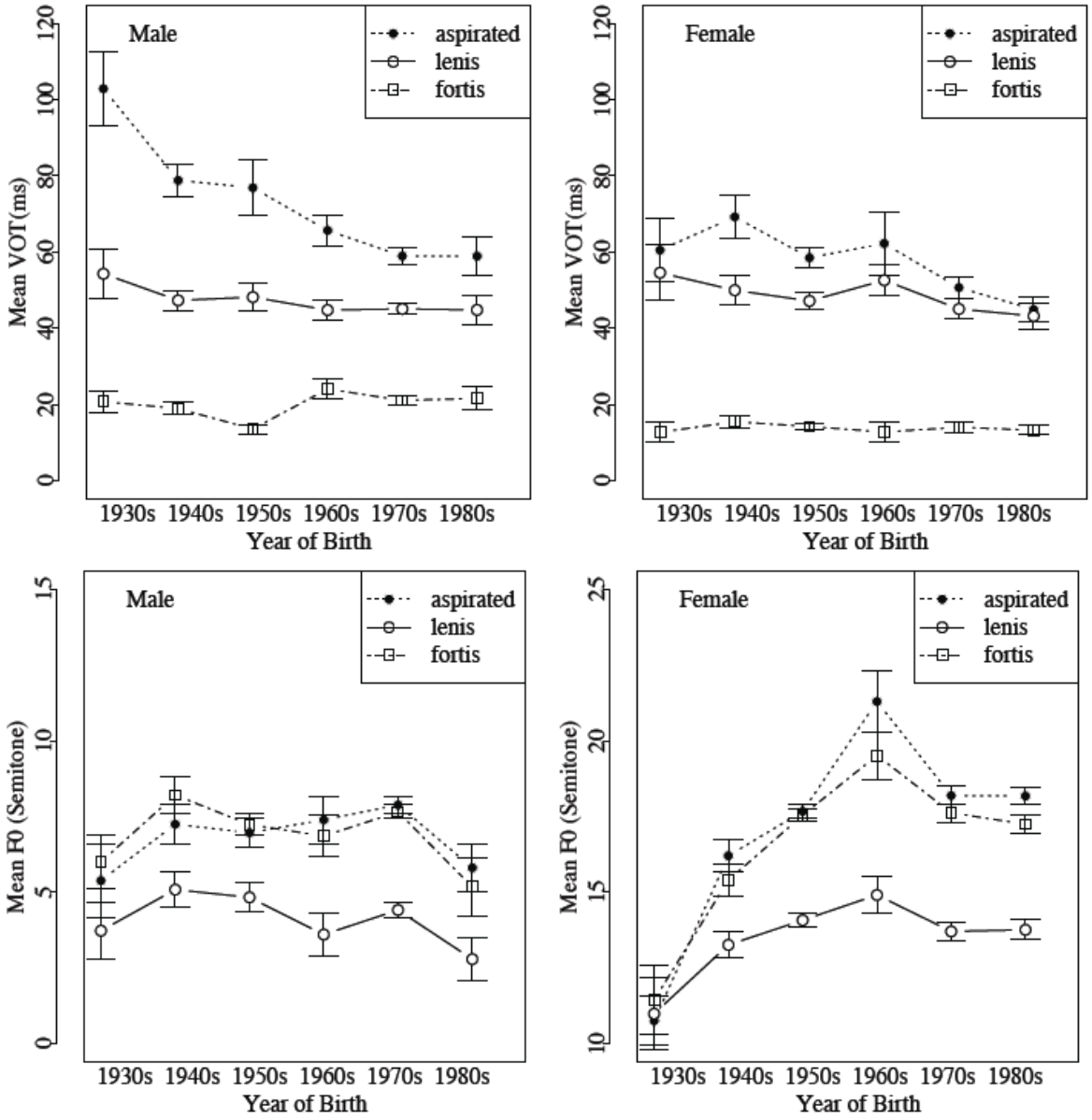


[p^{h}ul] 'grass'



Cue shifting the in the Korean lax-aspirated contrast

- VOT used to be a significant cue to the contrast betweenAP-initial initial lax and aspirated stops in Korean (at least for males).
- In Seoul Korean, the VOT difference is now small and F0 is a significant cue (Kang 2013)
- Speakers recorded in 2003
- VOT difference between aspirated and lax stops differs significantly by gender and YoB.
- No gender*YoB interaction (few speakers born in 1930s – 4 m, 2 f)



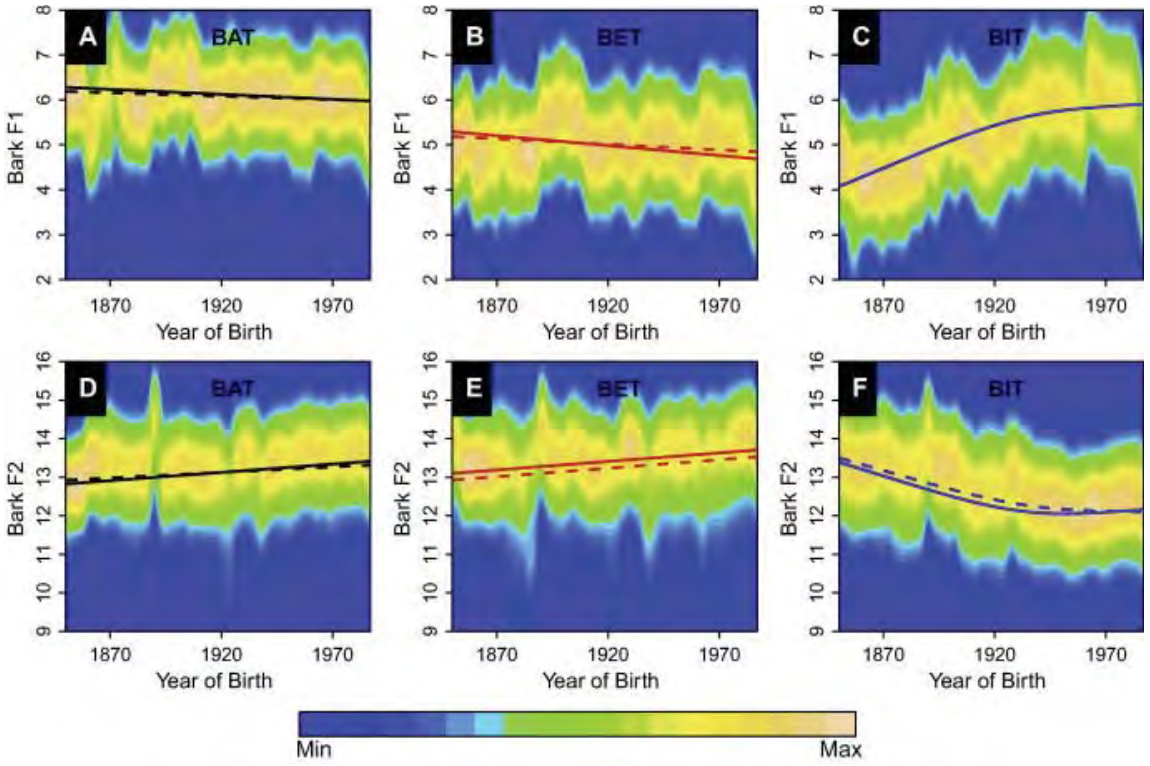
 Source: Kang, Yoonjung, and Sungwoo Han. "Tonogenesis in early Contemporary Seoul Korean: A longitudinal case study." Lingua 134 (2013): 62-74.

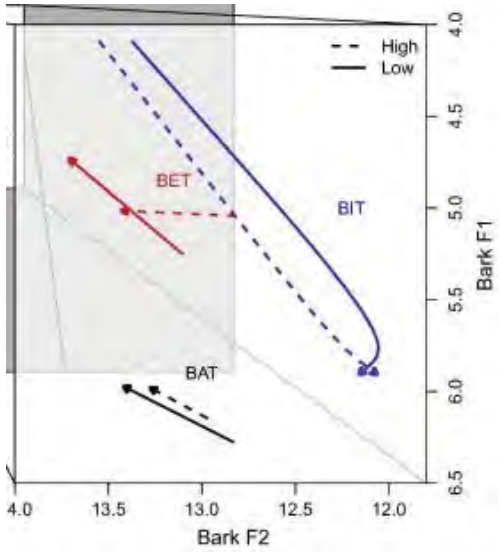
An alternative approach to the role of the listener (and speaker)

- Gradual shifts in the relative importance of cues is not expected given Ohala's model.
- But why do cue weights sometimes shift in the same direction for an extended time period?
  - Why not random fluctuations?
- Kirby (2010, 2013) explores models based on a similar conception of the phonetic bases of sound change.

New Zealand Vowel Shift

- æ > ɛ > ɪ > ɜ
  - push chain (æ moved first)
- Some changes progress for ~100 years (Hay et al 2014)





References

- Gallagher, G. (2010). Perceptual distinctness and long-distance laryngeal restrictions. *Phonology* 27: 435-480
- Guion, S. G. (1998). The role of perception in the sound change of velar palatalization. Phonetica, 55, 18–52.
- Kingston, John (2011) Tonogenesis. In M. van Oostendorp, C. J. Ewen, E. Hume, & K.Rice (Eds.), *The Blackwell Companion to Phonology*. Blackwell Publishing.
- Kirby, J. (2010). Cue selection and category restructuring in sound change. PhD diss, U of Chicago.
- Kirby, J. (2013). The role of probabilistic enhancement in phonologization. In A. Yu (ed.), *Origin of Sound Patterns: Approaches to Phonologization*. Oxford: OUP, pp. 228-246

24.915 / 24.963 Linguistic Phonetics

Fall 2015