

## Revisiting geminate inalterability: Evidence from Florentine Italian

Christina Villafañá Dalcher, Georgetown University

### Abstract

*Are geminates “inalterable”? It has been said that geminates resist the phonological processes affecting singletons: they won’t lenite without degeminating. This paper offers acoustic evidence contradicting the inalterability theory. Measurements of VOT, constriction duration, intensity, and voicing indicate 1) underlyingly voiceless geminate stops show evidence of voicing, and 2) oral geminates show signs of weakening in the form of shortened VOT and higher intensity. Both occur without degemination -- attesting to the ability of long consonants to weaken without losing their characteristic length and to the importance of rigorous laboratory techniques in the development of phonological theory.*

### 1. Introduction

- a. This paper examines the acoustic qualities of geminate/long consonants undergoing lenition in *Gorgia Toscana*.
- b. ...and addresses a conflict in assertions regarding the behavior of geminates in the Florentine dialect:
  - i. Assertion (1)
 

“At last, the spirantization of long [consonants] to [x: θ: φ:], realizations which are very closed and easily perceived as stops, is not rare.” (Giannelli and Savoia 1978: 41).
  - ii. Assertion (2)
 

“Geminates are immune to this obligatory spirantization.” (Kirchner 1998: 255) and “Geminate stops never undergo voicing or reduction of oral constriction unless they concomitantly degeminate.” (Kirchner 2004).

### 2. Background

- a. *Gorgia Toscana* is the process by which consonants in intervocalic (or quasi-intervocalic) position lenite.
  - i. examples
 

a.	la casa	[lakaza] → [la xaza / laħaza / laaza]	‘the house’
b.	la torta	[la tɔrta] → [la θorta]	‘the cake’
c.	la palla	[la pal:a] → [la φal:a]	‘the ball’
  - ii. details
    1. occurs with both voiced and voiceless stops
    2. subject to various prosodic restrictions
    3. also subject to speech rate/register
    4. varies within Tuscany by region

- b. Do geminate segments also undergo lenition?
- i. Giannelli and Savoia claim that geminates weaken to long fricatives, but offer no acoustic/quantitative data on consonant behavior in GT.
  - ii. Kirchner presumes that the spirantized geminates discussed by G&S are “probably no longer phonetically ‘long’,” but also offers no quantitative evidence.
- c. If geminates do not lenite without degeminating, then we should see robust relationships between lenition indicators and duration as follows:
- i. reduced VOT duration should entail reduced constriction duration
  - ii. increased voicing should entail reduced constriction duration
  - iii. increased intensity should entail reduced constriction duration
  - iv. visible signs of lenition in their spectrograms should entail constriction durations approaching those of singleton segments
- d. I present acoustic data from six native speakers of Florentine Italian as counterevidence to the predictions above:
- i. geminates with the shortest VOT durations actually have the longest constriction durations
  - ii. there is no significant correlation between increased voicing (as measured by RPP) and duration of geminates
  - iii. there IS a significant positive correlation between increased intensity and increased duration of geminates
  - iv. most oral geminate stops that exhibit visible patterns of lenition do not reduce their length to that of singletons

### 3. The data

- a. variables used as lenition indicators (Lavoie 2001)
- i. relative constriction duration (absolute constr. dur / absolute VCV dur)
  - ii. relative VOT duration (absolute VOT dur / absolute VCV dur)
  - iii. relative intensity (mean int of constriction – mean int of utterance)
  - iv. voicing (relative periodicity power of constriction period)
- b. results for geminate segments (bb, dd, gg, pp, tt, kk)

	Means				
	N	Rel constr dur	Rel VOT dur	Rel intensity (dB)	Rel voicing (RPP)
Voiceless	244	.34	.10	-21.62	.75
Voiced	108	.33	.04	-10.15	.90

c. results for singleton segments (b, d, g, p, t, k)

	Means				
	N	Rel constr dur	Rel VOT dur	Rel intensity (dB)	Rel voicing (RPP)
Voiceless	609	.26	.05	-14.67	.70
Voiced	325	.20	.02	-7.95	.92

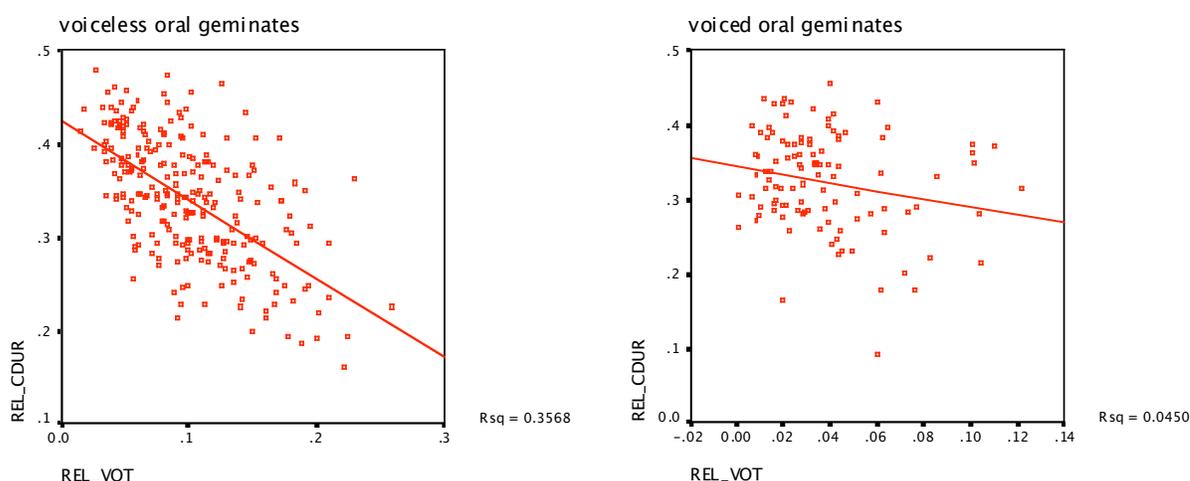
#### 4. Analysis of geminate segments

a. correlations: relative constriction duration x relative VOT duration

i. significant negative correlations:

1. voiceless geminates ( $\rho = -.582$ ,  $p = .000$ )
2. voiced geminates ( $\rho = -.196$ ,  $p = .042$ )

ii. voiced and voiceless geminate segments with the shortest VOTs have relative constriction durations generally above .35



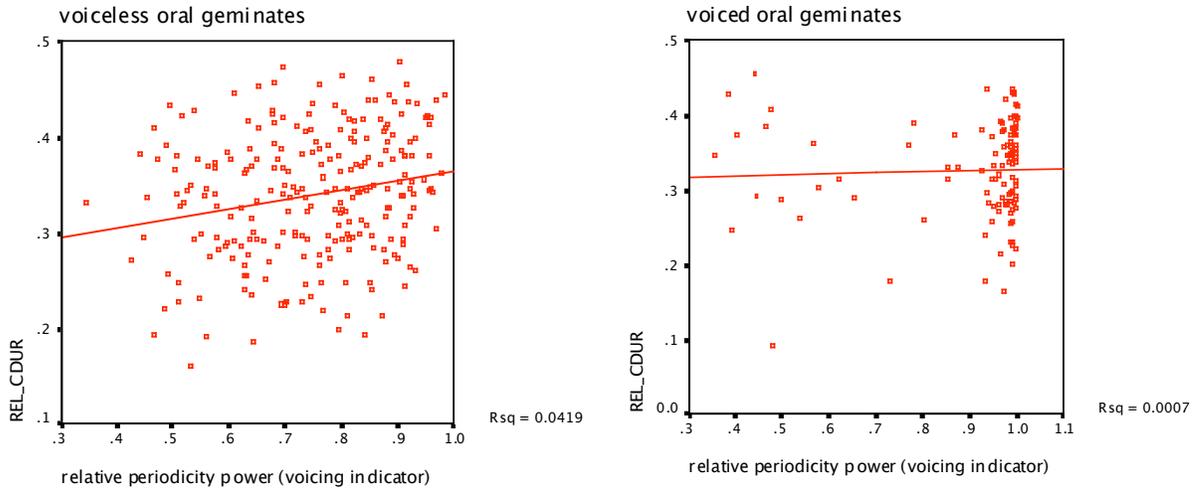
Observation 1: geminate segments with reduced VOT do *not* exhibit decreased constriction duration

b. correlations: mean constriction duration x voicing (RPP)

i. significant positive correlation for voiceless segments, n.s. for voiced segments:

1. voiceless geminates ( $\rho = .204$ ,  $p = .001$ )
2. voiced geminates ( $\rho = .137$ ,  $p = .157$ )

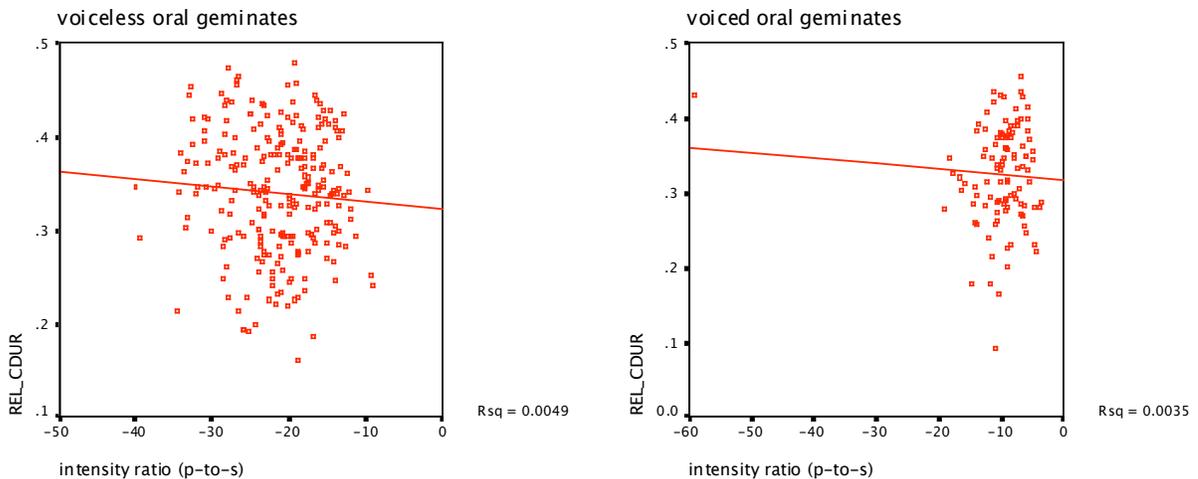
ii. voiceless geminate segments with higher intensities (more lenition) are generally longer in constriction duration



Observation 2: geminate segments with increased voicing do *not* exhibit decreased constriction duration

c. correlations: mean constriction duration x mean relative intensity

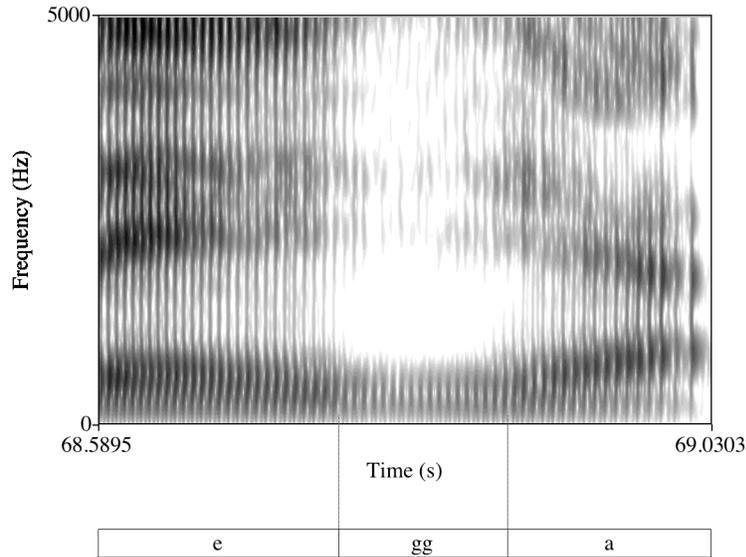
- i. no significant positive or negative correlation
  - 1. voiceless geminates ( $\rho = -.063$ ,  $p = .326$ )
  - 2. voiced geminates ( $\rho = .088$ ,  $p = .365$ )
- ii. neither voiced nor voiceless geminates exhibit shortened durations as their intensity increases



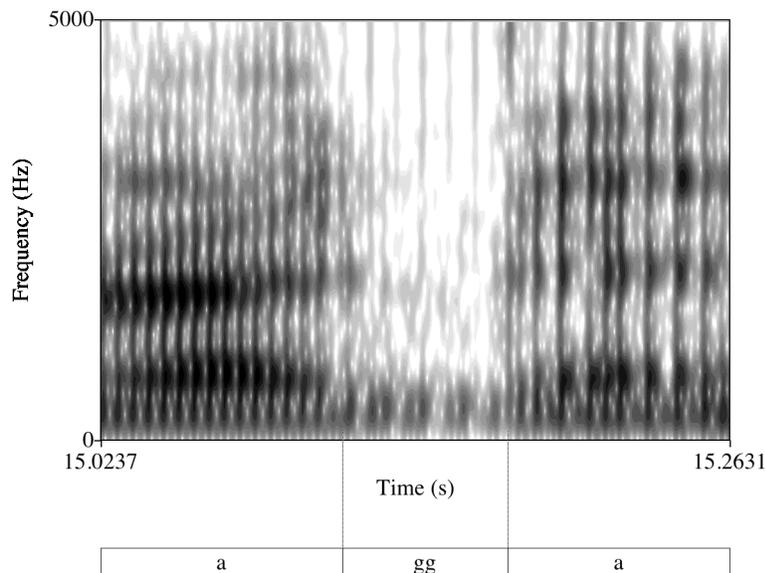
Observation 3: geminate segments with increased intensity *do* exhibit decreased constriction duration, but the correlation is not statistically significant.

d. constriction duration of geminate segments surfacing as fricatives (2 cases in 352)

- i. Example 1a: /gg/ lenites to a fricative with relative oral constriction duration of .28 –below the mean duration for voiced geminates (.33), but well above the mean duration for voiced singletons (.20).



- ii. Example 1b: /gg/ lenites to a fricative with relative oral constriction duration of .26 – again, below the mean duration for voiced geminates (.33), but well above the mean duration for voiced singletons (.20).



Observation 4: in the rare cases where geminates exhibit visible signs of frication, they do *not* reduce their constriction duration to that of singletons.

- e. Constriction durations of geminates surfacing as fricated stops (resembling canonical stops in all ways, except that their constriction period contains some diffused noise not generally associated with stop closures) or semi-fricatives (tokens that contain two distinct periods – the first with very low amplitude or waveform activity and a second with diffused noise resembling VOT – and no visible burst between the two) There are only 33 cases in 352 (<10%), but of these visibly lenited geminates:
  - i. 27% have oral constriction durations less than or equal to the mean for singleton segments
  - ii. 24% have oral constriction durations somewhere between the means for singleton and geminate segments.
  - iii. **49%** have oral constriction durations that are greater than or equal to the overall mean for geminate segments

*(n.b. comparisons of duration means are phoneme- and subject-specific)*

Observation 5: Half of all geminate segments exhibiting visible signs of lenition maintain geminate-like constriction durations.

- f. What conclusions can we draw from these observations?
  - i. assuming the following are reliable acoustic indicators of lenition:
    - 1. increased intensity
    - 2. increased voicing
    - 3. reduced VOT
    - 4. visible signs of frication/approximantization in spectrogram
  - ii. we do NOT see consistent signs of reduced oral constriction duration when
    - 1. intensity rises
    - 2. voicing rises
    - 3. VOT reduces
    - 4. spectrograms exhibit frication/approximantization

## 5. Conclusion – a tripartite contribution

- a. The sound system of Florentine Italian appears to
  - i. allow for limited cases of long fricatives, in contrast to assertions that geminates are categorically immune to lenition, and
  - ii. offer counterevidence to the generalization that geminates exhibiting quantitative signs of lenition will always reduce in duration
- b. Conflicts such as that between Giannelli & Savoia and Kirchner may best be resolved by fieldwork and quantitative analysis.
- c. Usage of data from Florentine Italian need no longer be limited to the subjective (although excellent in its breadth) analysis found in G&S 1978.

**Acknowledgments:**

This project is supported by a National Science Foundation Doctoral Dissertation Improvement Grant. Many thanks are due to my Florentine subjects and informants: AC, FP, GA, RG, MA, and LV.

**Contact information:**

Christina Villafaña Dalcher  
 cmv2@georgetown.edu  
<http://www.georgetown.edu/users/cmv2/>

**References**

- Antelmi, D. 1989. "Caratteristiche fonetiche e morfosintattiche nella varietà fiorentina di italiano." *Rivista Italiana di Dialettologia Scuola Società Territorio*, 13, 47-73.
- Bafile L. 1997. "La spirantizzazione toscana nell'ambito della teoria degli elementi", in AA.VV., *Studi linguistici offerti a G. Giacomelli dagli amici e dagli allievi*, Firenze, Unipress, pp. 27-38.
- Boersma, P. 1993. "Accurate short-term analysis of the fundamental frequency and the harmonics-to-noise ratio of a sampled sound". *Proceedings of the Institute of Phonetic Sciences Amsterdam*, 17, 97-110.
- Contini G. 1960. "Per un'interpretazione strutturale della cosiddetta 'gorgia toscana'", *Boletim de Filologia* 19, pp. 269-281.
- Cravens, T. 1984. "Intervocalic consonant weakening in a phonetic-based strength phonology: Foley hierarchies and the *Gorgia Toscana*." *Theoretical Linguistics*, 11, 269-310.
- DeMauro, T., F. Mancini, M. Vedovelli, M. Voghera. (1993). *Lessico di frequenza dell'italiano parlato*. Fondazione IBM Italia.
- Fry, D.B. 1979. *The Physics of Speech*. Cambridge: Cambridge University Press.
- Giannelli, L. 1997. "Tuscany." In M. Maiden and M. Parry (Eds.), *The Dialects of Italy*. New York: Routledge.
- Giannelli, L. and T. Cravens. 1997. "Consonantal weakening". In M. Maiden and M. Parry (Eds.), *The Dialects of Italy*. New York: Routledge.
- Giannelli L. e L. M. Savoia. 1978. "L'indebolimento consonantico in Toscana" I, *Rivista Italiana di Dialettologia* 2, pp. 25-58.
- Giannelli L. e L. M. Savoia. 1979-1980. "L'indebolimento consonantico in Toscana" II, *Rivista Italiana di Dialettologia* 3-4, pp. 39-101.
- Giannelli, L. and L. M. Savoia. 1991. "Restrizioni sull'esito [h] da t in fiorentino e nelle altre varietà toscane". *Studi Italiani di Linguistica Teorica e Applicata* 20: 3-57.
- Kirchner, R. 1998. "Geminata Inalterability and Lenition". ROA 249-398.
- Kirchner, R. 1998. *An Effort-based Approach to Consonant Lenition*. University of California at Los Angeles Ph.D. Dissertation.
- Kirchner, R. 2001. "Phonological contrast and articulatory effort." In L. Lombardi (Ed.), *Segmental Phonology and Optimality Theory*. Cambridge: Cambridge University Press.
- Kirchner, R. 2004. "Consonant lenition." In Hayes, Kirchner, and Steriade (Eds.), *Phonetically Based Phonology*. Cambridge: Cambridge University Press.
- Lavoie, L. 2001. *Consonant Strength: Phonological patterns and phonetic manifestations*. Cornell University Ph.D. dissertation.
- Lepschy, A.L. and G. Lepschy. 1977. *The Italian Language Today*. London: Hutchinson.
- Lewis, A. 2001. *Weakening of intervocalic /p, t, k/ in two Spanish dialects: Toward the quantification of lenition processes*. University of Illinois at Urbana-Champaign Ph.D. Dissertation.
- Marotta, G. 2001. "Non solo spiranti. La 'gorgia toscana' nel parlato di Pisa". *L'Italia Dialettale*, num. LXII, vol. 1, pp. 27-60.
- Nespor, M. 1987. "Vowel degemination and fast speech rules". *Phonology Yearbook* 4:61-85.
- Nespor, M. and I. Vogel. 1986. *Prosodic phonology*. Dordrecht: Foris.
- Savoia, L. 1997. "The geographical distribution of the dialects." In M. Maiden and M. Parry (Eds.), *The Dialects of Italy*. New York: Routledge.
- Sorianello, P. 2001. "Un'analisi acustica della 'gorgia' fiorentina". *L'Italia Dialettale*, num. LXII, vol. 1, pp. 61-94.
- Stevens, K.N. 1997. "Articulatory-acoustic-auditory relationships." In W. Hardcastle and J. Laver (Eds.), *The Handbook of Phonetic Sciences*. Oxford: Blackwell.
- Vennemann, T. 1988. *Preference Laws for Syllable Structure and the Explanation of Sound Change*. Berlin: Mouton de Gruyter.
- Vogel, I. 1997. "Prosodic phonology". In M. Maiden and M. Parry (Eds.), *The Dialects of Italy*. New York: Routledge.