Temporal Effects and the Multidimensionality of Spanish Stop Lenition

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INTRODUCTION

Background: The nature of Spirantization

- Stop lenition in Spanish has been described as a weakening process by which /b, d, g/ are spirantized to [b̞, d̞, g̞] in all contexts except in initial position, after nasals, and exceptionally after /l/ in the case of /d/.
- Recent accounts have depicted Spanish stop lenition as a gradual phenomenon with variable closure degrees in the spirantized realizations (Colantoni and Marinescu, 2010).
- Different factors have been posited to play a role in the resulting realizations of Spanish spirantization, pointing to its multidimensional nature (Hualde et al., 2011; Soler and Romero, 1999):
  I. Influence of context conditions: flanking segments
  II. Stress and position with respect to prosodic constituents
  III. Time aspects
- Experimental evidence of the phenomenon is mainly based on acoustic data and acoustic analysis, which has evolved towards the complementary observation of several acoustic parameters (Hualde et al., 2010).

Objective

To revise the multidimensional nature of stop spirantization in Spanish as a weakening phenomenon and characterize its variability in the light of experimental data based on controlled conditions and systematic analysis procedures. The present work attempts to provide a picture of the process involved in Spanish stop spirantization by investigating the role of the temporal dimension and contextual factors.

Hypothesis

We hypothesize that the principle underlying stop spirantization in Spanish involves decreased gestural magnitude whereby the target realization is undershot and so is not completely achieved due to timing constraints. The resulting realization of the process will thus show reduced constriction degree and reduced duration, which would go along in this phenomenon.

METHOD

Speakers

- ✓ 1 **male**; 1 **female**
- ✓ **Age**: 24-29
- ✓ Native Speakers of **Castilian Spanish**

Stimuli

- Choice of non-words to control for syllabic pattern and vowel contexts
- Selection of contexts to provide a range of flanking segments
- Position in word: medial position, to control the flanking segments
- Position in syllable: onset
- Two speaking rates

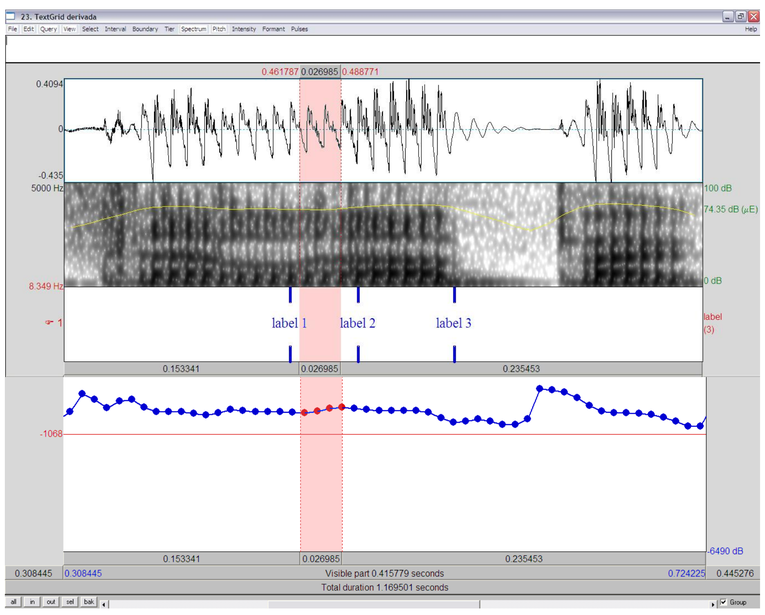
	LABIAL	DENTAL	VELAR
	V= /a/ /e/ /u/ C=/b/, /d/, /g/		
INTERVOCALIC	*t*VCV*p*V	*t*VCV*p*V	*t*VCV*p*V
AFTER FRICATIVE	*t*V*s*CV*p*V	*t*V*s*CV*p*V	*t*V*s*CV*p*V
AFTER RHOTIC	*t*V*r*CV*p*V	*t*V*r*CV*p*V	*t*V*r*CV*p*V
AFTER LATERAL	*t*V*l*CV*p*V	*t*V*l*CV*p*V	*t*V*l*CV*p*V
AFTER NASAL	*t*V*m*CV*p*V	*t*V*n*CV*p*V	*t*V*n*CV*p*V
VOICELESS STOP	*t*V*p*V*p*V	*t*V*t*V*p*V	*t*V*c*V*p*V

Data Collection

- "*Diga___ cada vez.*"
- 540 **randomized** tokens
- Computer .ppt slide presentation
- 2 **readings** at 2 speaking rates:
  – **slow**: 3-s. intervals;
  – **fast**: 1-s. intervals;
  3-s. break every 5 tokens
- Soundproof booth
- Sampling rate of 44.1 kHz / 16-bit sample resolution
- Directly into a **computer**
- AKG C444L cardioid condenser headset microphone
- Alesis MultiMix 16USB mixer with USB audio
- **Praat** speech analysis software

Data Processing and Analysis

- **Identification** of | **beginning** / **end** | of | consonant / vowel | on the basis of:
  – *intensity derivative* (Kingston, 2008)
  – *acoustic wave form observation*
  – *spectrographic observation*
  – *auditory perception*
- **Extraction of**
  – Minimum / maximum values shown by the derivative in the transitions to spirantized consonant
  – Minimum intensity for consonant / Maximum intensity for vowel
- **Calculation**
  – Consonant duration based on derivative: minimum and maximum values
  – Intensity ratio obtained as follows: $\frac{\text{C intensity minimum}}{\text{V2 intensity maximum}}$



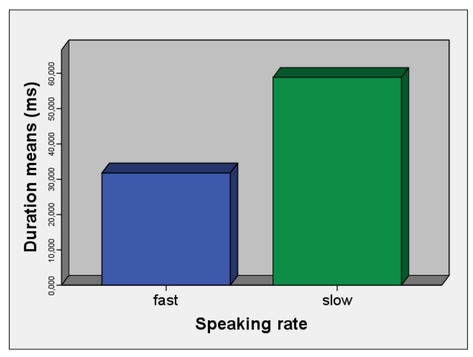
/talgapa/ (fast)

Statistical Analysis

- **Two-way factorial ANOVAs**
  To check for significant differences in consonant durations and constriction degrees as a function of time and context
- **Independent variables:**
  – **rate** (slow vs. fast)
  – c**ontext** (intervocalic, after fricative, after rhotic, after lateral, after nasal, voiceless stop)
- **Dependent variables**:
  – duration values
  – intensity ratio values

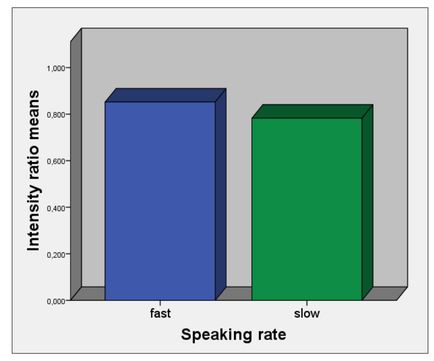
RESULTS

Speaker 1



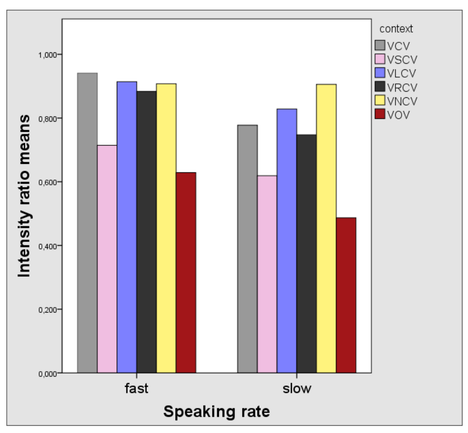
Significant main effect of speaking rate on duration

Speaker 2

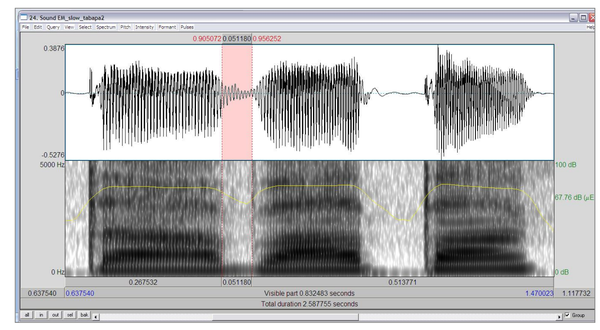


Significant main effect of speaking rate on intensity ratio

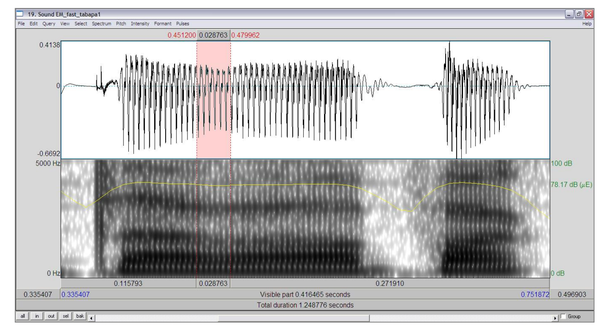
Effect of speaking rate on intensity ratio by context



Context patterns for intensity ratio by speaking rate



/tabapa/ (slow)



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- Consonant durations are significantly affected by speaking rate in all contexts.
- Global intensity ratio values are significantly affected by speaking rate, but the effect of context conditions significance in some individual comparisons: VNCV, VSCV.
- Effects of contexts are altered significantly as a function of time in some individual comparisons.

DISCUSSION and CONCLUSIONS

- Effect of time on consonant duration has an associated effect on constriction degrees: spirantization tends to fail as a result of speaking rate effects, even in VCV contexts.
- Contextual effects on constriction degree are observed to follow a general pattern with voiceless stops (VOV) and VSCV standing as the closest realizations.
- Other coarticulatory effects are observed as a function of rate variation: vowel insertion in VRCV and VSCV contexts.
- Speaking rate appears to have no effect on constriction degree in VNCV contexts. A longer constriction for both the N and the C as well as the need for sustained nasality result in stable intensity values.

- ✓Time effects play a crucial role in stop spirantization in Spanish.
- ✓Stop lenition fails at slow speaking rate.
- ✓The effect of context results in a range of constriction degrees.
- ✓The combined effect of context and speaking rate allow for variable constriction degrees, where coarticulation phenomena are made apparent.

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