PALATALIZATION EFFECTS AND DEGREES OF ARTICULATORY CONSTRAINT IN TWO CATALAN DIALECTS

DANIEL RECASENS

Department of Catalan Philology
Universitat Autònoma de Barcelona, Bellaterra
SPAIN

ABSTRACT

Data reported in this paper suggest that the phonetic output of a phonological rule may depend on small but systematic articulatory differences for the same phoneme. Thus, the application of a progressive assimilation rule for the phonemic cluster /ʎs/ in Catalan is conditioned by the degree of palatal constriction for /ʎ/: the phonetic realization is [ʎʃ] in dialects showing a high degree of palatal constriction for /ʎ/ and [ʎs] in dialects showing a lower degree of palatal constriction for the same palatal consonant.

INTRODUCTION

It has been pointed out that the phonetic realization of a given phoneme may show systematic differences from one dialect to another. Thus, a higher F2 for [w] and a lower F2 for [j] in Zuni vs Amharic and Yoruba suggest that the two approximants ought to be produced with a less constrained gesture in Zuni than in Amharic and Yoruba (Maddieson and Emmorey [3]). Moreover, such articulatory differences may be related to contrasting degrees of coarticulatory resistance. Indeed, according to the data of Maddieson and Emmorey, Zuni semivowels appear to be less resistant than those of Amharic and Yoruba to coarticulatory effects from the adjacent vowels.

In the light of these observations, it is plausible to hypothesize that small articulatory differences for the same production gesture may have an effect on the phonetic output of given phonological processes. The validity of this claim will be tested with reference to the presence vs absence of a progressive assimilation rule changing /s/ into [ʃ] after alveolopalatal [ʎ] in Catalan. Catalan dialects A (spoken in the Girona region) and B (spoken in the Tarragona, Lleida and València regions) differ as to the availability of the phonological rule; thus, the rule applies in dialect B but not in dialect A, as indicated by the fact that the realization of /ʎ s/ is [ʎs] in dialect A and [ʎ(ʒ)ʃ] in dialect B. It can be suggested that the presence vs absence of progressive assimilation in Catalan dialects is related to two possible context-independent factors. A possible conditioning factor would be the palatalized nature of /s/ in dialect B (i.e., [ʂ]) vs dialect A (i.e., [s]); in that case, an increase in the degree of palatal constriction for /s/ after a palatal consonant would result in alveolopalatal [ʃ] in dialect B and palatalized alveolar [ʂ] in dialect A. An alternative factor may be that alveolopalatal /ʎ/ is produced with a higher degree of linguopalatal contact in dialect B than in dialect A; in that case, the change of /s/ into [ʃ] would be dependent on the degree of palatal constriction for the preceding [ʎ]. The purpose of the research reported in this paper is to find out whether dialects A and B differ with respect to the degree of palatality for /s/ and /ʎ/. If so, it follows that the progressive assimilation rule involving the feature palatal may be associated with small but systematic cross-dialect differences in the execution of the tongue-dorsum raising gesture towards the palatal region.

METHOD

Possible differences in the degree of palatal constriction for /s/ and /ʎ/ were inferred from acoustic measurements in VCV sequences. The two consonants /ʎ/ and /s/ were uttered in symmetrical and asymmetrical VCV sequences for V= /i/ and /a/. All sequences were preceded and followed by [t] in the Catalan carrier sentence Digues _____ sempre ("Say _____ always"). The recording material was repeated ten times by two speakers of dialect A (Pi, Ca) and two speakers of dialect B (Re, Ba) in a sound-proof room. Speecg data were digitized at a sampling rate of 10 kHz for acoustical analysis. Spectral analysis was performed with a Brüel and Kjaer 2033 spectrum analyzer.

Measurements for /s/ were based on frequency readings of the first spectral maximum at the midpoint of the fricative noise. Data were interpreted on the grounds that an increase in the degree of palatal constriction for the fricative causes a decrease in formant frequency values; according to acoustic theory of speech production, such a decrease is mainly due to an increase in front cavity size as the tongue dorsum is raised (Heinz and Stevens [2]).

Formant measurements for /ʎ/ were taken at the midpoint of the consonantal period. Data on F2 were collected on the grounds that, for palatal articulations, F2 frequency varies directly with the degree of palatal constriction (Fant [1]). A comparison of F2 frequency values across vowel contexts for each speaker should provide useful information about changes in palatal constriction and degree of coarticulatory resistance for the consonant. F3 readings are not given due to the fact that this formant was often cancelled or attenuated in the vicinity of a spectral zero.

Another measurement of the degree of palatal constriction for /ʎ/ was inferred from data on C-to-V coarticulation. Values for F2 and F3 of V1 and V2 were taken into consideration since, for /i/ and /a/, the two formants are inversely related to changes in front cavity size and directly related to changes in the degree of tongue-dorsum raising (Fant [1]). First, V1 and V2 formant frequencies were taken at the vowel midpoint, separately for the sequences /VsV/ and /VʎV/. Then, mean frequency values for a vowel adjacent to /ʎ/ were substracted from mean frequency values for the same vowel adjacent to /s/. Differences between vowel formant values in the contexts /VʎV/ and /VsV/ across speakers were considered to reflect cross-speaker differences in the degree of palatal constriction for /ʎ/, in line with the fact that, as shown in the Results section, the phonetic realization of /s/ was found to be highly analogous for dialects A and B. Thus, it was predicted that a higher degree of palatality for /ʎ/ ought to cause a larger departure from the F2 and F3 vowel frequencies in the context /VsV/.

RESULTS

Degree of palatality for /s/

Data on the frequencies for the /s/ spectral maximum are shown on Figure 1 for all speakers. They are highly consistent with data reported in Recasens [4] showing a first high amplitude spectral peak at about 4000 Hz. Cross-dialect differences are neglegible and inconsistent with the originary hypothesis that /s/ should be more palatal in dialect B than in dialect A. Were there a contrast, the /s/ peak in dialect B would presumably approach the first aplitude spectral peak for /ʃ/ which lies around 3000 Hz (Recasens [4]). Therefore, for the speakers chosen in this study, the claim that the presence vs absence of progressive assimilation in the /ʎ s/ sequence is associated with differences in the degree of palatality for /s/ must be rejected.

Degree of palatality for /ʎ/.

Figure 2 shows changes in F2 across VCV contexts for all speakers. According to the figure, F2 of /ʎ/ increases with adjacent /i/ vs /a/, more so for speakers of dialect B than for speakers of dialect A. Thus, it can be suggested that the palatal gesture for /ʎ/ is more constrained in dialect B than in dialect A when the consonant is adjacent to a high front vowel.

Figure 3 shows F2 and F3 frequency differences for /i/ in the symmetrical sequences /iʎi/ vs /isi/. Figure 4 shows F2 and F3 frequency differences for /a/ in the symmetrical sequences /aʎa/ vs /asa/. In both figures, data are plotted separately for each speaker, each dialect, and anticipatory (C-to-V1) vs carryover (C-to-V2) effects. Of all formant frequency differences plotted in the figure, those exceeding 50 Hz were found to be significant at the $p < 0.05$ or $p < 0.01$ levels. Overall, C-to-V coarticulatory effects in /iCi/ sequences are larger for speakers of dialect B than for speakers of dialect A. This is particularly the case for speaker Re who, contrary to the other three speakers, shows larger C-to-V effects when V= /i/ than when V= /a/. C-to-V data for V= /a/ in Figure 4 does not allow stating any contrasting coarticulatory trend between the two dialects.

CONCLUSIONS

Data on V-to-/ʎ/ and /ʎ/-to-V effects reported in this paper suggest that dialects A and B of Catalan differ as to the degree of palatal constriction during the production of the entire /iʎi/ gesture. It may be that the same contrasting production strategy takes place for /ʎ/ in the vicinity of other high front articulations. Therefore, it is plausible to maintain the view that the presence vs absence of the progressive assimilation rule /s/→ [ʃ]/ [ʎ] _____ in Catalan is dependent on contrasting degrees of palatality for /ʎ/.

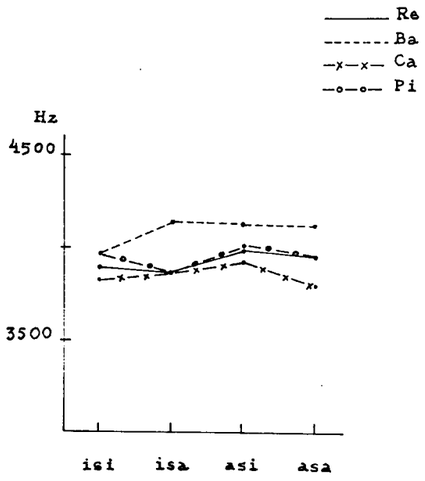

Figure 1. Frequency values for the first spectral maximum of /s/ as a function of vowel context. Data are plotted separately for speakers Re, Ba (dialect B), Pi and Ca (dialect A).

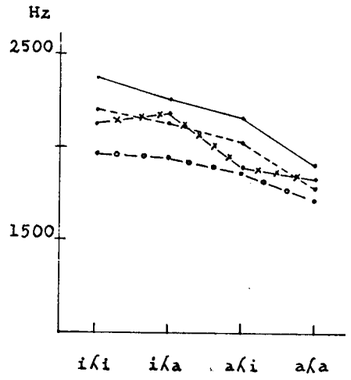

Figure 2. F2 frequency values for /ʂ/ as a function of vowel context. Data are plotted separately for speakers Re, Ba (dialect B), Pi and Ca (dialect A).

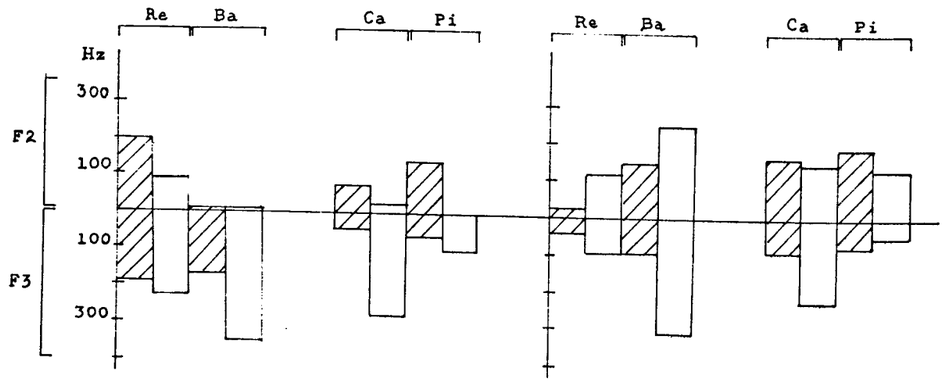

Figure 3. Differences in F2 and F3 frequency values at V1 (C-to-V anticipatory effects; solid bars) and V2 (C-to-V carryover effects; white bars) between /iʂi/ and /isi/. Data are plotted separately for speakers Re and Ba (dialect B), and Ca and Pi (dialect A).

Figure 4. Differences in F2 and F3 frequency values at V1 (C-to-V anticipatory effects; solid bars) and V2 (C-to-V carryover effects; white bars) between /aʂa/ and /asa/. Data are plotted separately for speakers Re and Ba (dialect B), and Ca and Pi (dialect A).

It is believed that to account for these phonological facts, the phonemes /ʂ/ and /s/ should be specified for degrees of the feature palatal. Thus, /ʂ/ would be [1 palatal] in dialect A and [2 palatal] in dialect B, in line with contrasting degrees of the tongue-dorsum raising gesture. On the other hand, /s/ would be [- palatal] for speakers of dialects A and B in the present study, but possibly [1 palatal] for other speakers of dialect B. Progressive assimilation for Catalan /ʂ s/ clusters would only apply in the following cases: (1) in dialect B, when C1 and C2 differ sufficiently in degree of palatality, as for /ʂ/ being [2 palatal] and /s/ being [- palatal]; (2) possibly in dialect B as well, when C1 and C2 agree (entirely or partly) in degree of palatality, as for /ʂ/ being [1 palatal] or [2 palatal] and /s/ being [1 palatal].

REFERENCES

[1] Fant, G. 1960 Acoustic Theory of Speech Production, The Hague.

[2] Heinz, J.M. and K.N. Stevens 1961 On the properties of voiceless fricative consonants, Journal of the Acoustical Society of America, 33, 5, 589-596.

[3] Maddieson, I. and K. Emmorey 1985 Relationship between semivowels and vowels: Cross-linguistic investigations of acoustic difference and coarticulation, Phonetica, 42, 4, 163-174.

[4] Recasens, D. 1968 Estudis de Fonètica Experimental del Català Oriental Central, Barcelona.