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Cubans' production of /s/ in consonant clusters in Norwegian

1 Introduction

1.1 Background

During the last decades Norway has been the scene of a moderate immigration process. Today the immigrant population comprises about 11% of the total population, of which more than half are Europeans. The Cubans constitute a minor group of less than 400 persons[1].

There is a great amount of dialectal variation throughout the Spanish-speaking world. Cuban Spanish maintains a few features that permit a classification as Caribbean Spanish along with other varieties in the area. As with any other language, Spanish from Cuba can be divided into different registers: educated or standard; informal/colloquial; and slang. The regional variation can be classified into 5 different dialects, including the Havana dialect (Rivas 2000). *1.2 /s/ in Spanish*

In Castilian Spanish /s/ is described as a voiceless, apico-alveolar fricative (Bejarano and Jörving 1967:10). In Cuban Spanish, /s/ is produced in several ways. In a summary of findings Lipski (1994) reports that "syllable- and word-final /s/ weakens to an aspiration [h], while prepausally complete elision is more common". Examples of this will be los [loh]; tres [tre]; escuela [ek'wela].

1.3 /s/ and /S/ in Norwegian

The Norwegian /s/ is described as a voiceless lamino-alveolar fricative (Kristoffersen 2000), and is not object to elision irrespective of position in a syllable or word. In addition to the alveolar fricative, this study deals with the Norwegian voiceless retroflex fricative /S/[2], a sound that is absent in Castilian Spanish (Husby and Kløve 1998:77). The place of articulation of this fricative is a discussed issue. While some claim that it is a retroflex, others mean that it is a post-alveolar. For a look into this matter, see Kristoffersen (2000). In the following, we will refer to it as a retroflex.

1.4 Syllable structures in Norwegian and Spanish

The syllable structures of Spanish and Norwegian are different. Norwegian syllable structur can be described as (C)(C)(C)V(V)(C)(C)(C)(C)(C) (Kløve 1997). Both onset and coda structures are more complex than those found in Spanish. Contrary to Norwegian, /sC/ and /sCC/ onsets are not permitted in Spanish as /s/ is not allowed in word initial position in CC and CCC-onsets. The corresponding Spanish onset is structured as /es.C-/ (Stockwell and Bowen 1965:84). Thus the Spanish equivalents to the Norwegian words /'spa:nia/ - "Spain" and /'skri:ve/ - "write" are /e'spanja/ and /eskri'bir/. In Norwegian monosyllabic roots /s/ is allowed in ultimate and penultimate position, like in /las/ - "a load", /'dans/ - "dance", /'fisk/ - "fish" and /falsk/ - "false". In derivations the structure can be even more complex: /'falskt/ - "falsely", /'Selmskt/ - "roguishly".

The Norwegian /S/ can be a result of a number of different processes. In Eastern parts of Norway the sequence /r/+/s/ is usually assimilated to a voiceless retroflex fricative /S/. This is an obligatory feature if the sequence occurs as coda <kors> /'koS/ - "cross" and across syllable borders <farse> /'faSe/ "farce"). In most cases the assimilation is also found across word boundaries (<mor sa> /'mu: 'Sa:). In the latter case /r/ may be dropped under certain circumstances, causing the assimilation not to take place. In syllable initial position, /s/ is assimilated to /S/ in front of /l/ (<slik> - /'Sli:k/ - "such").

1.5 Potential pronunciation difficulties for Cuban Spanish speakers' Norwegian second language

The different treatments of /s/ in the two languages makes it an excellent object of study in the perspective of second language acquisition with special attention to errors resulting form transfer. Richards (1971) refers to interference errors that occur as "the use of elements from one language while speaking another". As the described treatment of /s/ seems to be well documented in Cuban Spanish, we wanted to see if these features are carried over to Norwegian spoken by Cuban immigrants.

We expect three possible ways of handling the differences between Cuban Spanish and Norwegian:

1) Pronunciation according to Norwegian pronunciation rules (i.e. /s/ as [s], /S/ as [S])

2) Pronunciation according to Cuban Spanish pronunciation rules (i.e. /s/ as [h] or elision of /s/, absence of /S/)

3) Compensatory strategies, i.e. /s/ and /S/ replaced by other consonants than [s] and [S], respectively

2 Method

2.1 Speech material

The speech material was developed in order to elicit production of /s/ in different positions in words and syllables. The reading list contains 77 sentences with 96 occurrences of <s>.

2.2 Subjects

Recordings were made of two male speakers called "CA" and "EN". They are both from Havana, and were 37 and 38 years old at the time of the recordings. Both are proficient in Norwegian, after 4 and 9 years of residence in the eastern part of Norway. While informant CA has lived in Eastern Norway during his whole stay in Norway, informant EN has lived 5 years in Western Norway and 4 years in Eastern Norway. In addition, a male East-Norwegian phonetically trained speaker aged 67 was recorded in order to establish a reference pronunciation. The Norwegian speaker will be called "NO".

2.3 Measurements

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[1] http://www.ssb.no/emner/02/01/10/innvbef/tab-2001-10-29-03.html

[2] /S/ in this paper means voiceless post-alveolar or retroflex fricative, as opposed to the alveolar /s/.

Using Signalyze™ 3.12 (Keller 1994) the following fricative parameters were measured:

a) duration

b) three frequency characteristics based on long-term averaged spectrum of the current fricative:

i) the frequency belonging to the maximum amplitude (Peak)

ii) the lower boundary (Left boundary) frequency measured at an amplitude of 8 dB below the maximum (the 8 dB being chosen as the best operational value)

iii) the upper boundary (Right boundary) frequency measured at an amplitude of 8 dB below the maximum

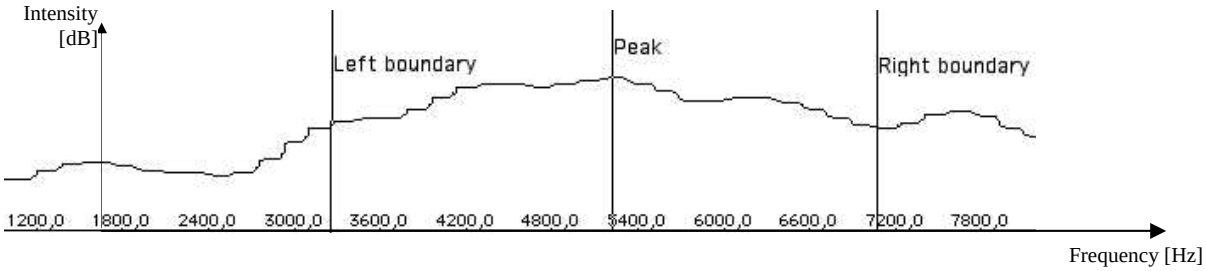

Figure 1. Long-term averaged spectrum of a fricative spectrum of /s/ spoken by speaker NO, illustrating positions of the three frequencies "Left boundary", "Peak" and "Right boundary" defined in 2.3 b) above.

Discrepancies between number of items in the analyses and the reading list are due to some occurrences of repetitions or exclusions. Items were excluded from the acoustic analysis if the reader hesitated on, or didn't produce, the /s/ of current interest. We also excluded /s/-articulations that were perturbed by background noise, or if the word with the /s/ was produced in isolation (i.e. without the carrier sentence).

2.4 Categorization of items

The items are categorized with reference to a number of factors.

a) auditive impression of pronunciation as [s] or [S]

b) orthographic surroundings of the current <s>

c) syllable position

d) word position

e) phonological length of the vowel preceding single occurrences of <s> in stressed syllables

3 Results

3.1 Duration of /s/ in /Vs#/ sequences in stressed syllables

Stressed syllables in Norwegian contain either a short or a long vowel, as in the minimal pairs <viss> -/vis/ - "if" and <vis> - /vi:s/ - "wise". Phonologically the syllables are of the same length because the single post nuclear consonants in the example will have long and short durations, respectively. Phonetically, however, the duration of the vowel is the main contribution to the maintenance of minimal pairs that have length opposition.

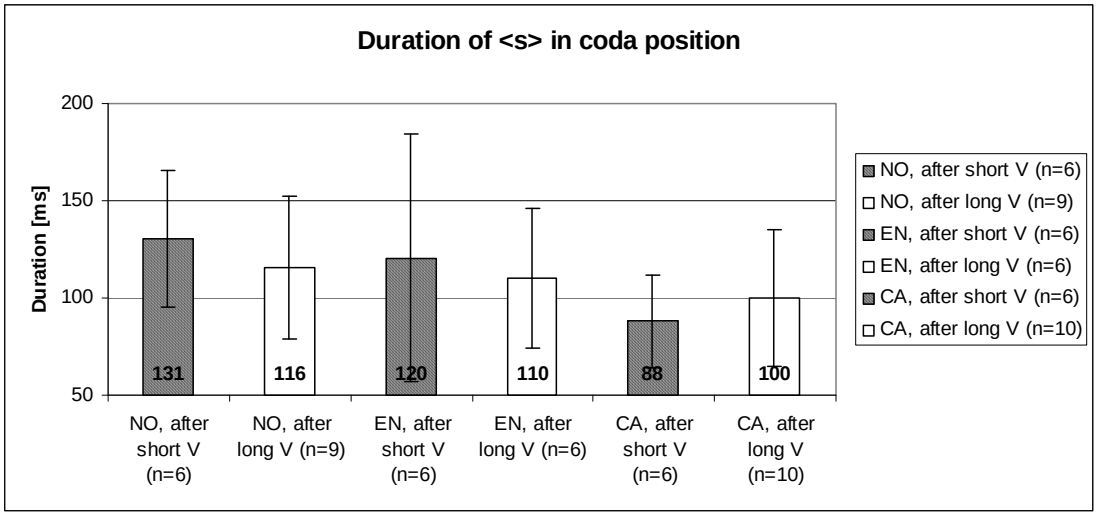

Figure 2. Mean duration of /s/ in /V(:)s#/ sequences in stressed syllables. /s/-durations after phonologically short and long vowel. Two speakers with Cuban Spanish origin (EN and CA); One Norwegian speaker (NO).

Figure 2 shows that this description also fits the production of Cuban speaker EN. Speaker CA's production, however, seems to be based on a different system as a shorter /s/ is following short vowels, and a longer /s/ is following long vowels. With reference to how CA and EN realizes the phonological length opposition in their Norwegian, the picture is somewhat unclear, and has to be looked closer into through analyses of the speakers' vowel durations.

3.2. Orthographic surroundings of the current <s>

The stimuli were categorized according to whether <s> was preceded or not by <r> in the written material, as in <Det var si jeg sa> - "It was say I said" og <Det var is jeg sa> - "It was ice I said". If /s/ is thus preceded by /r/ across word boundaries, a native Norwegian speaker has three options, mainly dependant on dialectal background: /r/ may be deleted (not West Norwegian), <rs> may be pronounced as /rs/ (West Norwegian), or assimilated to /S/ (not West Norwegian).

Our East Norwegian informant NO chose to omit /r/, and consequently <s> was produced as /s/ in the actual cases. This is confirmed by the acoustic analysis, as we can see in figure 3 below. The fricative produced in single /s/ surroundings (i.e. with no <r> preceding <s> in the written material) and in <rs> sequences are identical with respect to acoustic characteristics. The mean frequencies of maximum intensity (henceforth called FMI) are 4993Hz and 5023Hz, respectively. The left and right boundaries are also almost identical for the two categories. In single /s/ occurrences however the relative amplitude is approximately 1.5 dB lower than in <rs> occurrences. This difference in intensity is probably not perceptually relevant, though. Auditive inspection of the material gives a clear impression that NO always pronounced all occurrences of <s> following <r> as /s/.

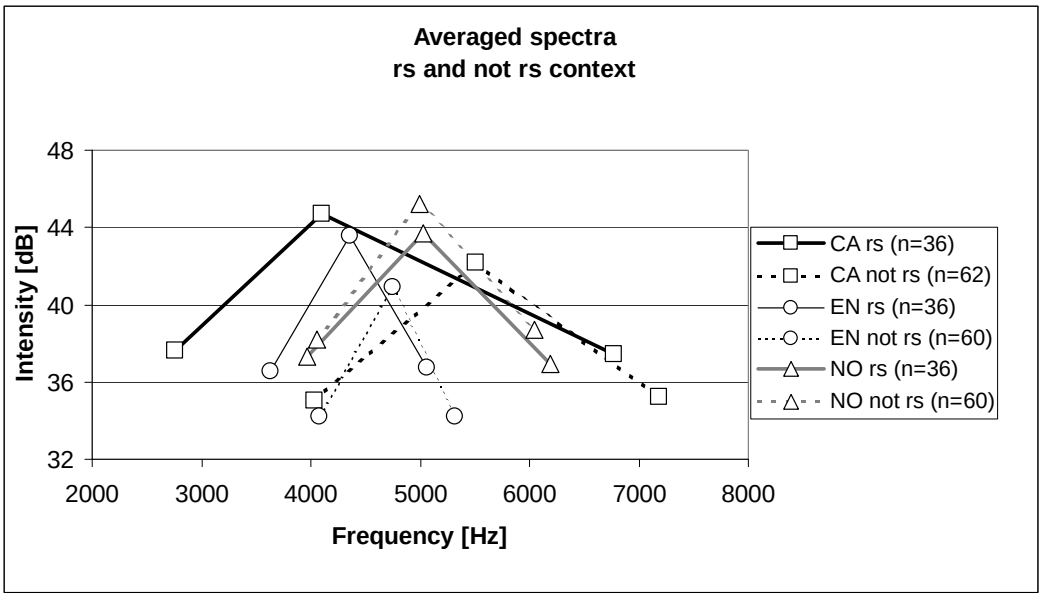

Figure 3. Averaged spectra of <s> preceded by <r>, compared to <s> *not* preceded by <r>. Comparison of the three speakers.

When we look at the acoustic data in figure 3, the Cuban informant EN seems to reveal two production patterns. FMI of <s> following <r> is lower (4358Hz) than when <s> is not following <r> (4744Hz). There is also a difference in intensity: <s> following <r> has an intensity that is about 2.6dB greater than <s> not following <r>. The analysis shows that informant EN is aiming at different production patterns based on the visual stimuli expressed by the written word list. Figure 3 indicates that EN has two production patterns with relatively close intensity peaks. But auditive inspection of the production reveals that this acoustic difference is not perceptually salient to Norwegian listeners: All productions of <s>, irrespective of context, are perceived as /s/.

The Cuban informant CA reveals a pattern that is different from EN. The FMI for <s> following <r> is clearly lower than that of <s> not following <r> (4097Hz and 5512Hz, respectively). The average intensity maximum for CA's realisation of <s> following <r> has the lowest frequency of all the speakers, while the maximum frequency for /s/ not following <r> has the highest frequency of all. Clearly the orthographic representation triggers two distinctly different fricative productions. This is also corroborated by auditive inspection: CA's <s> following <r> is perceived as /S/, while <s> not followed by <r> is perceived as /s/. For both Cuban informants one may observe overlap in frequency variability for the two intended fricatives. Figure 3 shows that the intensity peaks for informant EN is much closer in frequency than those of informant CA. However, informant EN shows much smaller spectral width (i.e. distance in Hz between right and left boundary).

The main difference between the Cuban speakers is given above. But we should say something more about the acoustic properties of the different categories, in order to explain the results of the auditive inspections. We see that EN has a difference in peak frequencies that goes in the same direction as CA, but still we categorize their productions differently. The acoustic cause to this difference is mainly EN's lack of spectral energy in the lower frequencies in his production of <s> following <r>, which prevents it from sounding like a typical /S/ (Lindblad 1980).

3.3 Distribution of /s/ and /S/ productions

One has observed that the Cuban informants have different production strategies in identical orthographic contexts. Informant EN produces the sequence <rs> as /rs/ while CA most often produces the same sequence as /S/. EN's production is most clearly revealed in /r/+/sCV/ and /r/+/sCCV/ sequences. Informant CA's production is most clearly shown in /r/+sCV sequences. The analysis is clearly showing that no informant is deleting /s/, so there is no sign of transfer from (casual) Cuban speech.

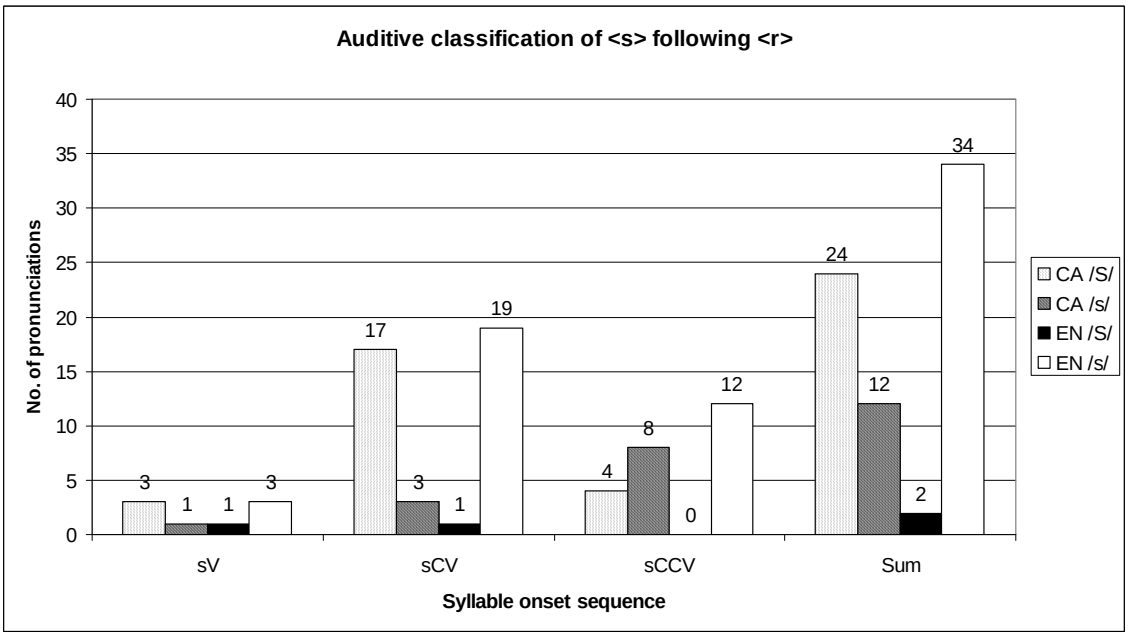

Figure 4. Pronunciation of <s> following <r>, as retroflex (/S/) or alveolar (/s/).

The different pronunciation patterns of EN and CA shown in figure 4 may be explained by reference to dialectal patterns of the variant of Norwegian they have experienced while acquiring Norwegian as a second language. In parts of Norway where /r/ is an apical sound, there is usually an assimilation of /r/+/s/ to /S/. In Western parts of Norway the assimilation of /r/+/s/ to /S/ is rare. Informant EN, who lived in Western Norway for the 5 initial years, may have observed the explicit production of /r/ is /r/+/s/ sequences. This is also identical to production of this type of sequence in Spanish.

3.4 Production of /s/ and /S/ based on auditive categorization

The Cuban informants' production of the fricative in focus was classified auditively with respect to pronunciation as /s/ or /S/. The analysis shows that the production in general is in accordance with Norwegian pronunciation patterns. Both informants have distinctly different production of /s/ and /S/.

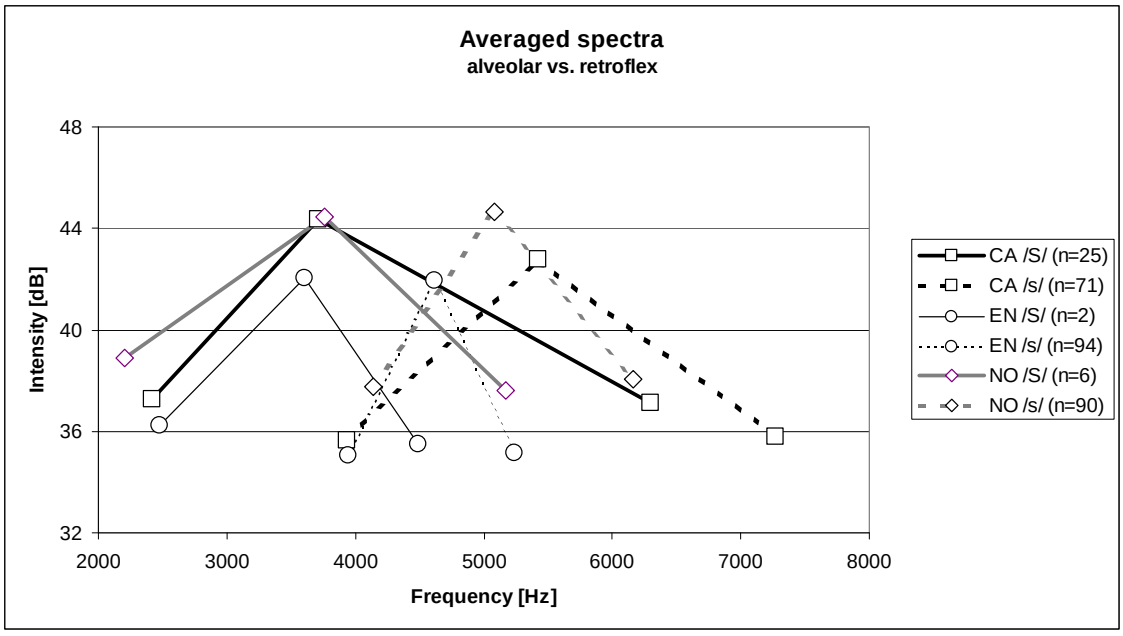

Figure 5. Averaged spectra of /S/ and /s/-productions, respectively. Observe the variation in n!

For both Cuban speakers the frequency of maximum intensities (FMI) for both /s/ and /S/ are quite close to the Norwegian reference person's production (fig. 5). As the figure shows, the FMI of /s/ is more diverse as EN's FMI is lower than the Norwegian's while CA's FMI is higher. One striking feature is the differences regarding spectral width as EN's widths are considerably smaller than NO's, while CA's are considerably greater. As the left boundary of the /s/ is approximately the same for all speakers (i.e. around 4000 Hz), the spectral width and henceforth the right boundary values are of less interest.

Both the Cuban speakers have acquired, and can produce, the retroflex /S/. The production patterns are however different, and also deviating from the Norwegian reference pronunciation. However, this does not mean that the production may be classified as non-Norwegian. The difference between the Norwegian speaker NO, who is deliberately deleting /r/ in /r/ + /s/ sequences in order to avoid assimilation to /S/ in our recording, and speaker CA may be explained with reference to linguistic competence. The Norwegian informant explicitly declared that he was omitting /r/ in order to minimize the risks of being misunderstood. In Norwegian there are minimal pairs like /si:/ - <si> - "say" and /Si:/ - <ski> - "ski". The initial fricative in <ski> is always pronounced /S/, i.e. in the same way as the assimilation product of /r/+/s/ in <var si>. In order to avoid the ambiguity, the Norwegian informant chose to delete /r/, which is possible, but not obligatory in this specific context.

4 Conclusions

As we have seen, the Cuban informant CA does seem to pay attention to lexical information and the risk of producing ambiguous utterances. His production is in accordance to what is described in introductory books of Norwegian as a second language, and what is also used in several Norwegian dialects.

Informant EN chooses almost never to assimilate /r/+/s/ to /S/. This may be explained by reference to dialectal patterns of the variant of Norwegian he experienced in his first years of acquiring Norwegian as a second language.

Both speakers demonstrate a clear non-Norwegian pronunciation with an accent mainly based on the phonetics and prosody transferred from Cuban Spanish. They do *not*, however, transfer one crucial feature, namely the deletion of /s/ in sCC sequences. Their pronunciation is also according to Norwegian phonotactic rules with respect to this feature, as the speakers do not insert any epenthetic /e/ before word initial sCC clusters.

The speech patterns of the two speakers differ from each other, both reflecting the phonological rules of the dominating dialect at their places of residence during initial acquisition of Norwegian as a second language. The phonetic patterns can probably be described as automatic, thus meaning that both informants with respect to their /s/ realization can be described as above minimal function level. As speaker EN has moved to another dialect area of Norway, it will be interesting to observe his future realizations of /r/+/s/ sequences. Normally, a change in pronunciation of the <r>+<s> sequence from /rs/ to /S/ is very rarely found among Norwegians.

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