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### ► To cite this version:

Leonardo Contreras Roa, Paolo Mairano, Caroline Bouzon, Marc Capliez. The acquisition of /s/ -/z/ in a phonemic vs neutralised context: comparing FrenchL1, ItalianL1 and SpanishL1 learners of L2 English. XVII AISV Conference, Feb 2021, Zurich (online), Switzerland. hal-03343042

**HAL Id: hal-03343042**

**<https://hal.science/hal-03343042v1>**

Submitted on 13 Sep 2021

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## The acquisition of /s/ - /z/ in a phonemic vs neutralised context: comparing French<sub>L1</sub>, Italian<sub>L1</sub> and Spanish<sub>L1</sub> learners of L2 English

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**Introduction.** English has a high functional load voice contrast between /s/ and /z/, which is active word-initially (*sing* /s/ - *zing* /z/), word-medially (*fussy* /s/ - *fuzzy* /z/) and word-finally (*rice* /s/ - *rise* /z/). However, this contrast is neutralised in the pronunciation of morphemic -s (for plural, 3<sup>rd</sup> person, genitive, and clitic forms of *has* and *is*). In this specific context, it is subject to a progressive voice assimilation rule (/s/ in *pets* due to /t/ being voiceless, but /z/ in *beds* due to /d/ being voiced) (cf. [1]). In this study we investigate the acquisition of /s/ - /z/ in L2 English by comparing contexts in which these sounds have a phonemic value vs contexts in which they are determined by a voice assimilation rule. We observe English<sub>L2</sub> productions by French<sub>L1</sub>, Northern Italian<sub>L1</sub> and Southern American Spanish<sub>L1</sub> learners, on the assumption that the three groups will show different patterns depending on the status of [s] and [z] in their L1s. These sounds are phonemic in French (*hausse* /os/ - *ose* /oz/), and allophones in varieties of Northern Italian, where [z] appears before voiced Cs and between non-C segments, and [s] in front of voiceless consonants (cf. [2]). Spanish only has /s/ (although partial or total voicing can occur in syllable coda due to non-obligatory voice assimilation with the following C in casual speech, cf. [3]). So, based on SLM predictions (cf. [4]), we expect that (i) French<sub>L1</sub> learners will show categorically distinct realizations for /s/ and /z/; (ii) Northern Italian<sub>L1</sub> learners will be able to produce the voice opposition, though potentially to a lesser degree since these sounds are allophones in their L1; (iii) Spanish<sub>L1</sub> learners may not be able to produce any difference for /s/ and /z/; (iv) voice assimilation for morphemic -s will be difficult for all learners because word-final /z/ is universally more marked (cf. [5]), and all L1s have regressive (rather than progressive) voice assimilation rules.

**Data.** We analysed productions by 40 instructed learners from the IPCE-IPAC corpus of L2 English. Learners were 15 speakers of Metropolitan French (12 F, 3 M, age = 24, SD = 6.59), 15 speakers of Northern Italian (11 F, 4 M; age = 22.5, SD = 2.38), 10 speakers of Spanish (3 F, 7 M; age = 30.2, SD = 6.98) from Peru (n = 5), Chile (n = 3), Colombia (n = 2). For the present study we only considered recordings of the read-aloud task (506 words), which provides perfectly comparable data. The recordings were transcribed orthographically, phonetized and aligned with *WebMAUS*, and manually verified. For each occurrence of /s/ and /z/, the proportion of periodic signal was extracted via a custom Praat script, thereby obtaining a value ranging from 0 (no periodicity detected) to 1 (periodicity detected throughout the whole target segment). Additionally, we also extracted the duration of segments as a secondary cue of voicing, but durational data are not discussed in this abstract due to space constraints. The results were then imported to *R* for visualisation and statistical analysis.

**Results.** The results for phonemic /s/ and /z/ (Figure 1) reflect the expected pattern: Spanish<sub>L1</sub> learners tend not to produce any difference in periodicity between /s/ and /z/, whereas French<sub>L1</sub> and Italian<sub>L1</sub> participants show distinct realizations for these two sounds. This is confirmed by a linear mixed-effects model predicting the periodicity on the basis of Sound (/s/, /z/), Group (FR, IT, SP), Context (intervocalic, non-intervocalic) and Position (word-media, word-final). Post-hoc tests confirmed that the difference in periodicity between /s/ and /z/ is significant for French<sub>L1</sub> and Italian<sub>L1</sub> learners ( $p < .001$ ), but not for Spanish<sub>L1</sub> learners ( $p = .11$ ). Instead, the results for the pronunciation of morphemic -s (figure 2) show that all learner groups tend to reproduce (at least globally) the output of the voice assimilation rule: the target segments are voiceless when following a C<sub>[-voice]</sub>, and partially periodic if following a C<sub>[+voiced]</sub> or a vowel. While French learners clearly show the highest differentiation among conditions, it is surprising to observe that Spanish<sub>L1</sub> learners seem to be able to reproduce the assimilation pattern, and even more neatly than Italian<sub>L1</sub> learners. This is confirmed by a linear mixed-effects model similar to the one above, revealing that differences across conditions are significant for

the French<sub>L1</sub> group (all  $p$  values < .001) and the Spanish<sub>L1</sub> group (all  $p$  values < .03), but for the Italian group the condition C<sub>[-voice]</sub> does not significantly differ from the condition C<sub>[+voice]</sub> ( $p = .27$ ).

**Conclusions.** SLM predictions were confirmed in phonemic contexts. Instead, we find unexpected results for the voice assimilation rule, whereby Spanish<sub>L1</sub> learners manage to produce more voiced realisations than Italian<sub>L1</sub> learners. The existence of a non-obligatory voice assimilation rule in Spanish (incl. morphemic -s, used for plural in Spanish) may promote voice assimilation in syllable-coda in L2 English, although with a change in directionality (regressive to progressive assimilation). Moreover, the behaviour shown by Spanish<sub>L1</sub> and Italian<sub>L1</sub> learners in morphemic vs non-morphemic -s may reflect [6]’s findings for L1 English that morphemic and non-morphemic -s are not homophonous. If confirmed on more data, such results may have an impact on mainstream models of L2 phonology acquisition.

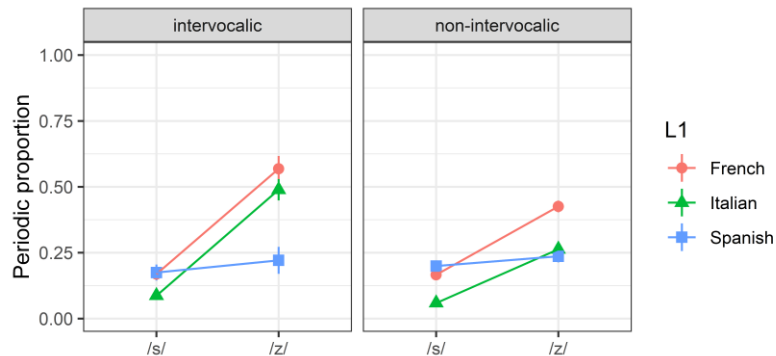


Figure 1. Average periodic proportion for realizations of /s/ and /z/ in phonemic contexts.

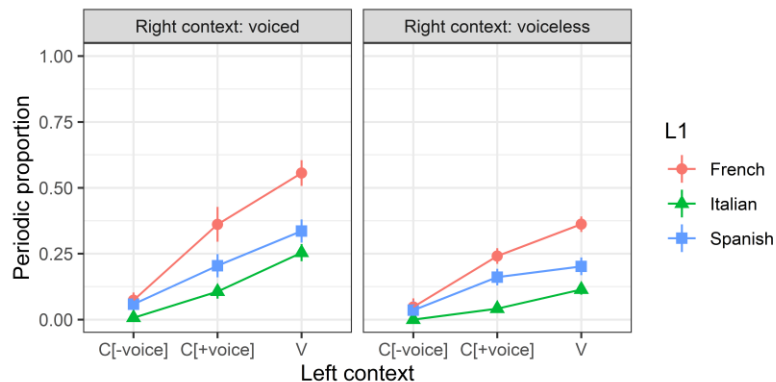


Figure 2. Average periodic proportion for realizations of morphemic -s.

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