

Explaining the distribution of hiatus in Spanish and Romanian

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ABSTRACT

In this paper we argue that it is possible to explain in part the distribution of exceptional hiatus in Spanish, as well as similar but not categorical facts in Romanian, from more general patterns of duration. Although in Spanish sequences of the type *iV* are generally realized as diphthongs when the high vocoid is not stressed, this rule has a number of exceptions. These exceptions, however, have a very restricted distribution: They are found in word-initial position and in words stressed on the sequence itself or on the next syllable, but not further to the right. Regarding the stress condition, we show that in Spanish and Romanian immediately pretonic syllables tend to have greater duration than other unstressed syllables further to the left. This increased duration, due to a general rhythmic pattern, is what appears to have prevented the recategorization of *iV* sequences as diphthongs in the relevant positions. The motivation of the initiality effect remains to be investigated.

1. INTRODUCTION

In both Spanish and Romanian, diphthongs of rising sonority have arisen from the “breaking” of certain stressed mid vowels; e.g.: Lat. *petra* > Sp. *p*[jé]*dra*, Rom. *p*[já]*tra* ‘stone’. In addition, historical sequences in hiatus have been reduced to diphthongs. The tendency for historical hiatus sequences to become diphthongs is stronger in Spanish than in Romanian. In Spanish, the general rule is that <unstressed high vowel + vowel> sequences (henceforth *iV*) are realized as diphthongs. What needs to be explained is why some exceptional items with this type of sequence show a lexical hiatus instead (i.e. why diachronic contraction of hiatus to diphthong has been blocked in certain cases). In Romanian, on the other hand, *iV* sequences not historically derived from breaking have a more variable realization and have not been systematically recategorized as diphthongs [1], a situation more similar to Catalan [2].

In Spanish and Romanian the syllabification of vowel sequences is generally predictable. Sequences containing high vocoids are heterosyllabic if the high vocoid is stressed, as in Sp. *env*[í-o] ‘shipment’, *c*[a.í]*da* ‘fall’, and are, otherwise, generally tautosyllabic (diphthongs): *v*[áj]*na* ‘seath’, *v*[aj]*nilla* ‘vanilla’, *cam*[jó]*n* ‘truck’, *cam*[jo]*néro* ‘truck driver’. Nevertheless, in the class of

words containing sequences of rising sonority of the type *iV* without stress on the first vocoid several lexical exceptions have been noted. A sequence in hiatus surfaces in some dialects, against the general rule e.g. [gi-ón] ‘script’ [3]. The existence of variation in this respect is recognized by the Spanish Academy. Many of these exceptions have a morphological or paradigmatic explanation for the hiatus. Leaving such cases aside, exceptional hiatus forms have a very restricted distribution: (a) they may occur only in initial position in the word and, in addition, (b) are found either in the stressed syllable or immediately before it (but not all words meeting these conditions have a lexical hiatus. This is where we find dialectal variation).

Just like different Spanish dialects appear to be at different diachronic stages in a process of reduction of hiatus sequences to diphthongs, Romanian may represent a more conservative Romance language, subject, nevertheless, to similar reductive forces. The hiatus/diphthong categorization in Spanish depends in part on a durational difference: hiatus sequences are longer than diphthongs [4], [5]. We expect that to the extent that the same rhythmic/durational factors are relevant in both languages, Romanian *iV* sequences will be longer in the same phonological contexts that favor the preservation of hiatus in Spanish, even if in Romanian there has not been systematic recategorization of hiatus sequences as diphthongs in other contexts.

2. INITIALITY EFFECT

As mentioned, one restriction in Spanish is that the exceptional (non-morphological) hiatus sequences are always found in word-initial position. Thus, a contrasting pair for many speakers is *b*[i-ó]*logo* vs. *rad*[jó]*logo*, where the relevant factor is initiality.

In Experiment 1 (reported in greater detail in an unpublished poster, [6]), for Spanish and Romanian, we measured the duration of *iV* sequences under three conditions: initial-stressed (e.g. Sp. *fiordo*/R. *fiordu.*, Sp./R. *liana*), initial-unstressed (e.g. Sp. *pionero*/R. *pioneru*, Sp. *diamante*/R. *diamantu*) and medial-stressed (e.g. Sp. *mediocre*/R. *mediocru*, Sp./R. *italiana*). Items were chosen to be as similar as possible in the two languages (excluding diphthongs derived from “breaking”). For Spanish, we may expect the initial-stressed and initial-unstressed groups to contain some items with a lexical hiatus (with some

possible variation among speakers), whereas the medial-stressed group would contain only lexical diphthongs. We would thus expect for medial-stressed sequences (all diphthongs) to have in average shorter duration than initial-stressed ones (some possible hiatuses) and for unstressed-initial syllables not to be necessarily shorter than medial-stressed ones, since the potential presence of lexical hiatuses in this group may compensate for the lack of stress. Similar predictions are made for Romanian. Even if Romanian lacks a lexical contrast in this group of items, the same forces that have preserved some instances of lexical hiatus in initial position in Spanish may operate in Romanian to give greater length to sequences in this position.

For the Spanish part of the experiment, 4 Spanish speakers from Spain, 3 female and 1 male (Sp4 = author JH) read a randomized list of 33 words in a carrier phrase. Four repetitions were recorded and analyzed (132 tokens per speaker). (It should be noted that the effects of lexical stress and intonational pitch accent are conflated here since in the carrier phrases the test item was systematically pronounced with a pitch accent). The duration of the iV sequence was measured from waveforms and spectrogram, using PRAAT. The results showed that for all four subjects initial-stressed sequences were the longest and initial-unstressed sequences were the shortest. A main effect of Position&Stress on duration of the sequence was found for all four Spanish speakers ($p < .0001$). Most relevantly, medial-stressed sequences were significantly shorter than initial-stressed ones for all subjects.

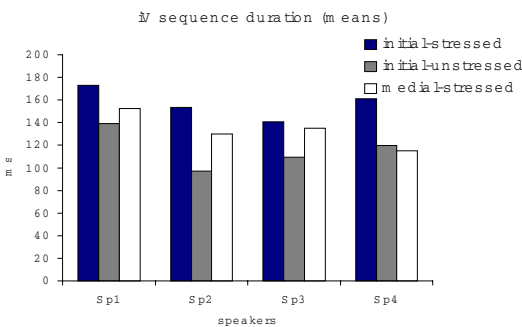


Figure 1. Average duration of iV sequence for 4 Spanish speakers (ms).

These results are consistent with the greater tendency for hiatus to be preserved in initial position, under the assumption that increased duration of sequences of the type iV correlates with the percept of hiatus [4], [5].

A parallel experiment with two Romanian speakers, using cognate words in a carrier phrase, showed an effect of stress on duration, but no initiality effect (i.e. initial-stressed and medial-stressed sequences had similar duration). But when the same comparisons were done in a balanced wordlist, controlling for stress, a robust initiality effect was found. For this experiment four native speakers

of Romanian were recorded reading a list of 20 sentences, 10 containing word-initial iV sequences, 10 word-medial (e.g., *ca-n pión / campión, din Diána / Indiána*). Seven repetitions were analyzed (total 140 tokens per speaker). The results showed that for all four speakers word-initial iV sequences were significantly longer than word-medial ones ($p < .05$). We leave the motivation for this effect for further research.

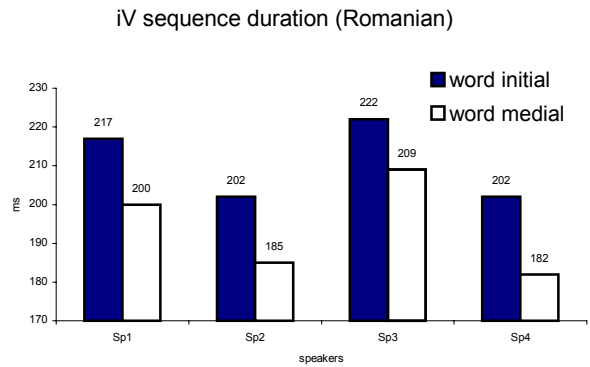


Figure 2. Average duration of iV sequence for four Romanian speakers (ms)

3. PROXIMITY TO STRESS EFFECT

A second condition affecting the syllabification of iV sequences in Spanish is stress. All exceptional hiatus words are stressed on the sequence itself or on the next syllable, but not further to the right: *d[i-á]logo* ‘dialogue’, *d[i-a]lómo* ‘I converse’ but *d[ja]logó* ‘s/he conversed’ [3].

A subset of the Spanish data in Experiment 1, those starting with the sequence *dia-* were classified into three groups, depending on the position of this sequence with respect to the stress: stressed (*diáspora, diácono, diána*), pretonic (*diamánte, diafrágma, diatriba, diabétes, diagráma*) and prepretonic (*diapasón, diagonál, diametrál*).

	Sp1	Sp2	Sp3	Sp4
strssd	192.61	161.74	136.77	165.87
Pton	154.19	94.574	108.19	127.85
Ppton	118.33	95.10	99.38	107.09

Table 1. Mean duration (in ms) of *(d)ia-* under three stress conditions for 4 Spanish speakers.

An ANOVA and post hoc comparisons for each speaker produced the following results:

Sp1: $F(2,41)=26.912$, $p < .0001$, pairwise: ppton,pton $p = .0003$, ppton,strd $p < .0001$, pton,strd $p < .0001$.

Sp2: $F(2,41)=63.349$, $p < .0001$, pairwise: ppton,pton n.s., ppton,strd $p < .0001$, pton,str $p < .0001$.

Sp3: $F(2,41)=12.750$, $p < .0001$, pairwise: ppton,pton n.s., ppton,strd $p < .0001$, pton,strd $p = .0002$.

Sp4: $F(2,41)=17.132$, $p < .0001$, pairwise: ppton,pton $p = .0287$, ppton,strd $p < .0001$, pton,strd $p = .0002$.

As expected, stressed sequences are significantly longer

than the others. In addition, for two of the four speakers, Sp1 and Sp4, pretonic sequences have significantly greater duration than those in words where the stress is further to the right. Similar results were obtained for the Romanian data. For all 3 speakers stressed sequences are significantly longer than sequences in prepretonic position. For two speakers (R2 and R3) stressed sequences are also longer than pretonic ones, and for R3 pretonic sequences (*diamántu*) are significantly longer than prepretonic ones (*diapazón*).

R1: $F(2,37)=4.139$, $p<.05$, pairwise: ppton, strd $p<.01$.

R2: $F(2,65)=8.295$, $p<.01$, pairwise: ppton, strd $p<.001$, pton, strd $p<.001$.

R3: $F(2,57)=20.803$, $p<.001$, pairwise: ppton, pton $p<.01$, ppton, strd $p<.001$, pton, strd $p<.001$.

As before, we notice that iV sequences tend to be perceived as hiatus in those positions where they are realized with greater duration. Given the difference between tonic and pretonic sequences, however, we expect that the perception of hiatus should be more robust or consistent across speakers in stressed than in (immediately) pretonic position.

4. EXPLAINING THE DISTRIBUTION

These distributional facts require an explanation. The diachronic tendency in Spanish for hiatus sequences to become diphthongs has failed to apply in a regular fashion to items where the sequence is initial and either stressed or in the immediately pretonic syllable. The question is why these phonological conditions favor preservation of the hiatus. The hypothesis we want to test is that this distribution in Spanish derives from more general rhythmic/durational patterns affecting all syllables, not only sequences of vocoids. In the case of /CiV/ sequences, the greater/lesser duration of syllables in the relevant positions would contribute to their categorization as hiatus or diphthongs. (A different proposal is made in [2].)

In Experiment II we examine the motivation for the proximity to stress condition on the distribution of lexical hiatuses. We test the hypothesis that, besides stressed syllables being longer than other syllables, immediately pretonic syllables are also longer than other unstressed syllables in Spanish, at least word-initially (see [7]). If this is correct, this would explain the occurrence of exceptional hiatus in these two stress contexts (i.e. the hypothesis is that exceptional hiatus is found in positions that for independent reasons have greater duration in the language).

Three Spanish speakers participated in this experiment, 2 female and 1 male (author JH = Sp3). Subjects were asked to read a list of words in a carrier phrase. The test words were a set of 5 triplets contrasting in the position of the stress (e.g. *número* ‘number’, *numéro* ‘I number’, *numeró* ‘s/he numbered’, the complete list is shown in table 1). The test words were randomized. To avoid list effects, a distractor was placed at the beginning of the list and two more at the end. Subjects read the list four times. In all test

items the duration of the vowel of the first syllable was measured from spectrograms and waveforms (using PRAAT). 240 vowels were measured (15 words x 4 repetitions x 4 speakers).

Table 2 contains means and standard deviations for 4 repetitions of each of the test items.

word	Sp1	Sp2	Sp3=JH
<u>cé</u> lebre	54.14 (7.8)	74.27(3.5)	79.42(4.6)
ce <u>l</u> ébre	49.88 (5.6)	64.26(5.2)	75.09(4.7)
ce <u>l</u> ebré	46.69 (3.8)	58.65(3.3)	60.09(3.3)
<u>há</u> bito	111.91(13.4)	63.30(4.8)	78.45(4.3)
h <u>á</u> bito	72.04 (3.3)	49.48(3.0)	65.38(3.0)
h <u>á</u> bitó	69.29(6.3)	44.85(8.5)	54.74(6.6)
<u>lá</u> mina	88.22(7.2)	55.45(3.0)	68.94(7.4)
l <u>á</u> mina	81.13(3.6)	49.70(6.1)	64.29(2.4)
l <u>á</u> miné	74.96(5.5)	45.85(2.0)	50.32(6.6)
<u>lí</u> mite	68.19(4.8)	57.07(0.7)	72.09(11.58)
l <u>í</u> mite	64.83(17)	44.05(4.2)	48.90(3.2)
l <u>í</u> mité	58.68(4.2)	52.11(4.0)	46.81(8.3)
<u>nú</u> mero	69.87(11.3)	93.68(6.8)	75.27(10.6)
nu <u>m</u> éro	60.56(6.4)	76.76(12.5)	64.03(3.8)
nu <u>m</u> eró	46.88(2.9)	59.81(11.0)	60.04(6.4)

Table 2. Duration of first vowel in the word (underlined) in Spanish triplets: Each number is the mean (with std. dev) of 4 tokens, in ms.

For each speaker separately, the data were submitted to an ANOVA with vowel duration as dependent variable and stress class (stressed, pretonic, prepretonic) and triplet (5 levels – one for each minimal triplet) as independent factors. For all 3 speakers, the analysis shows main effects of both stress class and triplet. For Sp1, $F(2,45)=32.1$, $p<.0001$. Post hoc tests give significant results for all three pairwise comparisons (ppton, pton $p=.015$, ppton, strd and pton, strd both $p<.0001$). For Sp2, $F(2, 44)=36.29$, $p<.0001$, pairwise comparisons, ppton, pton $p=.019$, ppton, strd and pton, strd both $p<.0001$. For Sp3, $F(2,45)=50.95$, $p<.0001$, with all three pairwise comparisons $p<.0001$. Word class was also a significant factor for all three speakers, $p<.0001$. There was no significant interaction between the two independent factors for any speaker. Summarizing, we interpret these results as showing that, whereas the main stress effect is that stressed initial syllables are longer than unstressed initial syllables, there is also a tendency for initial syllables immediately before the stressed syllable (pretonic) to be longer than initial syllables further away from the stress (prepretonic).

As before, we ran a parallel experiment for Romanian. 3 Romanian speakers participated in this experiment with similar materials and under similar conditions as in the Spanish part of the experiment. The Romanian experimental items included 6 triplets. A total of 216 vowels were measured (18 words x 4 repetitions x 3 speakers). Results are reported in Table 3.

Word	R1	R2	R3
<u>p</u> átima	115.03 (3.1)	109.5 (7.8)	109.42 (11)
pa <u>t</u> ína	95.96 (8.5)	100 (6.8)	101.19 (2.2)
pa <u>t</u> iná	94.81 (2.6)	106.2 (6.2)	106.28 (1.5)
<u>l</u> úmíle	73.15 (7.8)	69.11 (12.7)	78.85 (1.5)
lu <u>m</u> ína	71.17 (6.2)	71.21 (11.3)	63.44 (12.5)
lu <u>m</u> iná	50.82 (4)	58.54 (8.1)	57.69 (12.5)
<u>l</u> úneca	86.13 (4.4)	89.24 (11.8)	74.01 (7.5)
lu <u>n</u> éta	75.79 (4)	91.22 (7.4)	68.99 (5.8)
lu <u>n</u> ecá	62.5 (6.8)	73.7 (7.9)	75.59 (12.3)
<u>m</u> ésteca	81.68 (3.9)	89.77 (3.7)	82.44 (5.7)
me <u>s</u> téce <u>n</u> i	66.57 (5.8)	78.02 (10.3)	74.22 (3.3)
me <u>s</u> te <u>c</u> á	58.24 (5)	77.65 (2.3)	70.28 (5.2)
<u>t</u> érmeni	94.31 (8.3)	122.64(17.8)	81.72 (14)
te <u>r</u> míte	75.13 (2.4)	99.97 (5.6)	76.64 (11.3)
te <u>r</u> miná	63.91 (5.1)	99.67 (6.7)	79.02 (8.3)
<u>r</u> épede	92.96 (6.9)	94.88 (11)	78.36 (7.1)
re <u>p</u> éta	73.34 (4.4)	97.83 (14.2)	83.61 (2)
re <u>p</u> etá	66.54 (4)	88.29 (5.4)	80.34 (9.6)

Table 3. Duration of first vowel in the word (underlined) in Romanian triplets: Each number is the mean (with std. dev) of 4 tokens, in ms.

For all 3 Romanian speakers, an ANOVA shows main effects of both stress and word triplet for all three speakers. Regarding stress, For R1, $F(2,54)=117.961$, $p<.001$; all three pairwise comparisons of stress type are significant in a post hoc LSD test, all $p<.001$. For this speaker only, a significant interaction between stress and word triplet was also found, $F(10,54)=2.254$, $p<.05$. Repeating the analysis with the file split by word triplet shows that within each triplet there is a significant effect of stress. For R2, $F(2,54)=9.234$, $p<.001$, all pairwise comparisons of stress type being significant: strd,pton $p=.03$, strd,ppton $p<.001$, pton,ppton $p<.05$. For R3, $F(2,54)=3.999$, $p<.05$. For this speaker only two pairwise comparisons of stress type are significant: strd,pton $p<.05$ and strd,ppton $p<.05$. Post hoc tests within each triplets show the following duration differences:

R1: *mésteca > mestéceni > mestecá; térmeni > termíte > terminá; lúneca > lunéta > lunecá; répede > repéta, repetá; pátima > patína, patiná; lúmíle, lumína > luminá.*

R2: *mésteca > mestéceni, mestecá; térmeni > termíte, terminá; lúneca, lunéta > lunecá; répede = repéta = repetá; pátima = patína = patiná; lúmíle = lumína = luminá.*

R3: *mésteca > mestéceni, mestecá; térmeni = termíte = terminá; lúneca = lunéta = lunecá; répede = repéta = repetá; pátima = patína = patiná; lúmíle, lumína > luminá.*

These results are all compatible with our hypothesis. It is never the case that unstressed syllables are significantly longer than stressed syllables or that an initial prepretonic syllable is longer than an initial pretonic one. On the contrary, to the extent that significant differences are found, they are in the hypothesized direction: stressed syllables are longest followed by syllables immediately to their left.

5. CONCLUSIONS

The results of our experiments show that in Spanish and Romanian there is an effect of proximity to stress on duration, so that vowels in immediately pretonic tend to be longer than other earlier vowels (in initial syllables), besides stressed vowels being longer than all others (at least in words bearing an intonational pitch accent, which is the condition tested in our experiment). This durational pattern, consistent with findings reported in [7] and [8], is also reminiscent of the situation in Russian, where vowels in immediately pretonic syllables are reported to undergo less reduction than earlier unstressed vowels [9]. Given this, an important aspect of the skewed distribution of exceptional hiatus can be explained by being reduced to a more general rhythmic pattern of the language, affecting other kinds of syllables as well: exceptions to the syllabification of iV sequences as diphthongs are found only in stressed and immediately pretonic syllables because these syllables tend to have greater duration than other syllables. Whereas with single vowels these durational differences remain below the level of awareness, in the case of sequences relative differences in duration contribute to their phonologization as diphthongs or hiatus.

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