PHONETIC CATEGORIES AND PHONOLOGICAL PROCESSES: VOWEL- GLIDE- CONSONANT ALTERNATION IN SPANISH

Lourdes Aguilar
Departament de Filologia Espanyola, Facultat de Lletres,
Universitat Autònoma de Barcelona, Bellaterra 08193, Barcelona, Spain

ABSTRACT

Problems around the interpretation of glides arise in a recurrent way in Spanish phonological descriptions. Nevertheless, phonetic properties are usually neglected: the term "semiconsonant" is based on the syllabicity but the property of syllabicity is not phonetically defined in a precise way. In this study, the aim is to characterise from a phonetic point of view the semiconsonantal elements versus the vocalic and consonantal elements related in the Spanish sound inventory and to observe their manifestation depending on communicative factors. Two groups of data have been used: speech samples excerpted from conversations between two speakers participating in the consecution of the map task and the reading of the same sequences in a neutral way.

The findings suggests that phonetic data obtained from the study of spontaneous speech provide additional information that should be included in the phonological descriptions.

1. INTRODUCTION

Spanish phonetic descriptions allude to different allophonic manifestations of /i, u/ and to some consonantal segments associated to them. With respect to /i, u/, syllabic and nonsyllabic vowels are described, and related to this distinction, differences between vocalic groups in hiatus -vowel+vowel sequences-, diphthongs -glide+vowel and vowel+glide sequences- are stablished. With respect to the consonant, approximant, fricative or affricate realisations of /j/ are found [1].

Nevertheless, phonetic properties are usually denied in the descriptions: the criteria determining the difference between glide and vowel are based in the syllabicity but the property of syllabicity is not phonetically defined in a precise way. The purpose of the present study is to provide additional data for Spanish showing which are the acoustic cues that distinguish between vowel, glide and consonant, and which modifications due to a change in speaking style are found.

2. PROCEDURE

A corpus of bisyllabic words with the combination of interest appearing in the first syllable has been constructed. Two variables have been taken account: the phonetic category -vowel, glide, consonant (only the approximant realisations have been taken into account)-, and the vowel environment. The sequences considered are the following: the syllables ['je, 'ja, 'jo, 'ju, 'wi, 'we, 'wa, 'ao], the hiatuses ['ie, 'ia, 'io, 'iu, 'ui, 'ue, 'ua, 'uo] and the diphthongs ['i̯e, 'i̯a, 'i̯o, 'i̯u, 'u̯i, 'u̯e, 'u̯a, 'u̯o]. All the sequences are stressed. In addition, the stressed vowels [i, u] in a consonantal environment have been included.

The occurrences of the items have been observed in two communicative situations: dialogues and reading.

In order to obtain a group of dialogues large and natural enough, the model of the HCRC corpus has been adopted [3]: speakers are required to collaborate to reproduce in the map of one of the participants a route which is printed in the other participant's map. In the maps, the toponyms correspond to the words of the corpus.

To carry out the reading task, the items of the corpus were inserted into carrier sentences. There are different types of carrier sentences so as to avoid the list effect, and the sentences are presented in separate sheets to regulate the elocution rate of the speaker.

Sixteen male speakers aged between 20 and 30, with medium and high-level studies, participated in the experiment. For each speaker, samples of both speech situations were obtained.

The recording sessions took place in a sound-treated room at the Phonetics Laboratory of the UAB using a Tascam 112 cassette recorder and a Sennheiser MKH20 microphone.

The items of the corpus were analysed by means of the speech analysis software Waves+. Waveform displays and broad-band spectrograms were plotted for each sequence, and the following measurements were taken: duration, F1 and F2 frequency.

Mean and standard deviation for duration and frequency values have been calculated, and significant differences between the conditions have been assessed by means of ANCVA tests.

3. RESULTS

From the obtained data, two questions can be highlighted: on one hand, it is possible to discriminate from an acoustical point of view between vowels, glides and consonants; on the other hand, phonetic reduction phenomena affecting vocalic groups have been found.

3.1. Vowel vs. vowel in hiatus vs. glide vs. consonant

Table II presents the mean values of data duration of a vowel in consonantal environment, a vowel in hiatus, a glide and a consonant in the two types of corpus. Data corresponding to palatal and velar quality have been pooled.

Table II. Number of cases (n), mean values (n) and standard deviation (sd) of data duration of a vowel (V), a vowel in a hiatus (H), a semiconsonant (SC) and a consonant (C) in the corpus of reading and in the dialogues.

	Reading		Dialogues	
	n	x (sd)	n	x (sd)
V	124	78 (16)	103	65 (16)
H	496	104 (27)	306	86 (23)
G	491	76 (22)	374	59 (16)
C	194	72 (23)	212	66 (14)

The glide, the consonant and the vowel in a consonantal environment present similar durations; only the vowel in a hiatus presents a longer duration. A one-way ANOVA analysis shows differences at a level of signification of 5%, in reading and in dialogues.

With respect to the consonant, a difference related to the style have been noted: in the corpus of reading, the consonant is longer than the glide whereas in the corpus of dialogues, it is shorter.

As far as frequential domain is concerned, any differences between the compared categories have been found in the F1 frequency values. On the contrary, the F2 frequency can be considered as an acoustic cue distinguishing the phonetic categories (see Table III).

Table III. Number of cases (n), mean values (x) and standard deviation (sd) of the F2 frequency data of the vowel [i, u], the vowel [i, u] in a hiatus, the semiconsonant [j, u̯] and the consonant [j, w] in the corpus of reading and in dialogues.

	Reading		Dialogues	
	n	x (sd)	n	x (sd)
[i]	62	2216 (108)	54	2104 (129)
[i]V	248	2155 (103)	152	2117 (148)
[i̯]	248	2116 (96)	171	2019 (163)
[j]	71	2124 (130)	137	2001 (190)
[u]	62	808 (92)	49	891 (129)
[u]V	124	875 (205)	154	892 (188)
[u̯]	124	903 (196)	206	872 (191)
[w]	123	739 (93)	116	737 (117)

In the palatal set, the glide and the consonant show frequency values lower than the corresponding to the vowels in a consonantal environment or in a hiatus, in both types of corpus. A one-way ANOVA analysis shows important differences due to a change in the phonetic category (p:.0001).

In the velar set, a difference due to the speaking style can be described. In the corpus of reading, two groups corresponding to vowel and vowel in hiatus, on one hand, and to glide and consonant in the other hand; on the contrary, in the corpus of dialogues, the

glide shows the highest F2 frequency. However, this difference doesn't arise as significative when a two-way ANOVA analysis (category x style) is applied on the data: there are significative variations related to a change in the category (p:.0001) but not to a change of style (p:.1638).

3.2. Phonetic reduction phenomena in vocalic sequences

The main characteristic of a communicative situation such as the participation in the map task, where subjects engaged in the achievement of a common aim lose the attention paid to their discourse, is the presence of segmental reductions.

Three types of phonetic reduction processes can be observed in the data: a) diphthongisation, where a hiatus is pronounced as a diphthong, b) deletion in a hiatus, and c) vocalisation of a diphthong.

From an acoustic point of view, it is considered that a hiatus have become a diphthong when the duration is reduced and the formant frequencies are displaced with respect to the ideal values of a hiatus; deletion and vocalisation is noted by the presence of a single segment.

3.2.1. Reduction of vocalic groups in hiatus

All the sequences observed in the dialogues show at least one case of reduction to a diphthong, as presented in Table IV.

Deletion is a less frequent process and it can affect the first element in the group, as in ['ie] found as [e], the second element in the group, as in ['io] which becomes [i], or it can result in an intermediate segment, as [o] coming from ['ui].

Globally considered, hiatuses are reduced to diphthongs a 9.5% of occurrences whereas the 2% of cases is pronounced as a single vowel.

Table IV. Number of cases analysed in the corpus of dialogues (n tot), number of sequences realised as diphthongs (n dip), number of vocalisations (n vowel) and vowel derived from the reduction process.

	n tot	Red. dipht	Reduction to a vowel	
		n dip	vowel	n vowel
['iu]	31	2		
['io]	28	3	[i]	3
['ia]	34	1	[i]	1
['ie]	20	2	[e]	1
['ui]	29	5	[o]	1
['ue]	31	3		
['ua]	19	3		
['uo]	17	1		

3.2.2. Reduction of diphthongs

Table V presents the number of deletion cases found in the diphthongs analysed in the corpus of dialogues and the adopted solution for each case.

Table V. Number of diphthongs analysed in the corpus of dialogues (n tot), number of cases appearing as a vowel (n) and observed vowel; when several solutions, number of cases of each solution.

	n tot	n red	vowel	n
['i̯u]	30	3	[u]	2
			[i]	1
['i̯o]	39	7	[i]	5
			[o]	1
			[e]	1
['i̯e]	34	8	[i]	6
			[e]	2
['u̯e]	41	14	[o]	6
			[u]	8
['u̯a]	30	4	[a]	1
			[o]	3
['u̯o]	28	1	[u]	

Diphthongs are reduced to a vowel in 18.31% of occurrences and there is not an important difference between the behaviour of palatal groups (17.47%) and velar ones (19.19%).

Focusing on the vowel derived from the reduction process, it has been observed a strong tendency to preserve the first element in the group: the 56.75 % of diphthongs shows an ellision of the final element in front of the 16.21% where deletion affects the initial element.

Table VI . Number of diphthongs reduced to a vowel in the corpus of dialogues (n red), number of cases of deletion of the first element (% first), number of cases of deletion of the second element (n second), number of cases in which the solution is a new element (% vow).

	n red.	Del. init. element	Del. final element	New element
['i̯u]	3	2	1	
['i̯o]	7	1	5	1
['i̯e]	8	2	6	
['u̯e]	14		8	6
['u̯a]	4	1		3
['u̯o]	1	1		

4. DISCUSSION

The analysis of speech samples obtained from different communicative situations provide data about the acoustic cues of the segments and about the modifications dues to a change in speaking style. The experiment presented here have shown that both in reading and in dialogues, duration and F2 are the primary acoustic cues distinguishing between the phonetic categories of vowel, glide and consonant. These properties shapes the minimal but sufficient contrast for the identification of the categories.

The duration of the vowel in hiatus, different in a large degree from the duration of the rest of segments, suggests the presence of a process of strenghthening of the vocalic quality that preserves the group as hiatus, stopping the diphthongisation, usual in Spanish.

The main acoustic cues are the same in reading and in dialogues, but some questions referred to the processes observed in relaxed speech should be taken into account. The behaviour of phonetic reduction processes -when they are applied, which are the affected elements- can provide additional data in the description of the segments.

Observing the solution adopted in a majority of cases as a result of the vocalisation of a diphthong, a clash between phonological intuitions and phonetic behaviour is found.

If phonetic reduction was related to a hierarchy of strengthness of the elements [4], a higher percentage of deletion of the glide would be expected.

On the other hand, if we focus on syllabic role, the result is similar: given that the vowel occupies the position of the nucleus, the element more susceptible to undergo a phonetic change should be the glide.

On the contrary, in presence of phonetic reestructurations, a strong trend to delete the vocalic element has been found. It could be hypothesized then that the position in the syllabic group exerts a stronger influence than the phonological nature of the element.

These findings suggests that information coming from phonetic analysis of speaking styles provide additional data in the phonetic and phonological description of the linguistic systems and should be integrated in the theoretical accounts [5].

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