Perception and Production of Spanish /f/: the role of the listener

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1. FIRST STEP
This research focuses on the perceptual effects of acoustic variation of the voiceless labiodental fricative /f/ in spontaneous speech in Spanish. The starting point of this study are the results from a first analysis of the acoustic nature of this sound (Blecua & Rost, 2011).

For that analysis, 6 male subjects were interviewed and recorded. 421 labiodental fricative consonants were extracted from this sample of spontaneous speech. The variables taken into account using Praat and then classified into four categories, regarding presence or absence of voicing and formants. Duration was also measured.

The results obtained prove that /f/ has indeed four possible allophones: a labiodental voiceless fricative /f/ (as expected), a labiodental voiced fricative /v/ labiodental partially voiced fricative /v/ and an approximant one (which we transcribe as [β]). Notice that three of them are voiced solutions.

Results

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The perception of the fricative /f/ was analyzed in three tests.

2. GOALS
1. To check if listeners perceive differences among the aforementioned acoustic realizations of /f/ by means of perception tests.
2. To test if the listener can classify any realization of /f/ as an allophone of a different phoneme, and therefore variation would have consequences at a phonological level.
3. To investigate if speakers of a Romance language with a phonological system containing both /f/ and /v/ classify the realizations in the same way as Spanish listeners do.

3. HYPOTHESES
1. Perceptually, phonetic variation can entail certain confusion when interpreting the realizations.
2. The most relaxed allophones (voiced fricatives and approximants) could be identified as a voiced phoneme other than /f/.
3. Voiced labiodental fricative realization is identified as the expected allophone for /v/ in those systems that have such phoneme.

4. EXPERIMENTAL DESIGN

The perception of /f/ was tested in three different tests:

Test 1: Identification task.
- 3 possible categories
- E.g. /v/ [β] [v]/
- 60% of /v/ and /β/ were /f/.
- 100 samples from 5 male speakers.
- Listeners heard 3 repetitions of each stimulus in a row.
- Number of answers: 750

Test 2: Identification task.
- 2 possible categories
- E.g. /v/ [β]/
- 60% of /v/ and /β/ were /f/. In this case, /f/ was balanced.
- 100 samples from 5 male speakers.
- Listeners heard 3 repetitions of each stimulus in a row.
- Number of answers: 750

Test 3: Perceived production test.
- Listeners were asked to produce /f/.
- Listeners heard 3 repetitions of each stimulus in a row.
- Number of answers: 750

5. RESULTS

5.1 Perception test 1

Analysis of listener’s categorization show that voiced realizations of /f/ are not mostly identified with a voiceless labiodental fricative, but rather with either a voiced fricative or an approximant.

Thus, acoustic variation has a clear effect on the perception of these sounds. These results reveal confusion across categories, because the approximant is an allophone of /v/ in Spanish. We have to check if stimuli classified as [v] are interpreted as allophones of /v/ or of /f/, but it has already been confirmed that listeners perceive something different from /f/.

5.2 Perception test 2

The main purpose of this test is to check with which phoneme are listeners identifed /f/ stimuli identified; since there is no voiced labiodental phoneme, listeners had to chose between /f/ and /v/.

6. CONCLUSIONS

- There is a systematic and significant variation of /f/ in Spanish, at least in spontaneous speech, which has important effects at a perceptual level: it give rise to perceptual variation.
- There is not a univocal correspondence between allophone and phoneme: one realization can correspond to different phonemes. An approximant realization, for instance, might be an allophone of both /v/ and /β/.
- The results of these tests show that a significant variation of /f/ is mainly associated to /v/ (97.6% of the approximant realizations and 44.2% of the [β] ones).
- Results in Balcanic Catalan speakers’ test allow us to support the existence of a voiced labiodental allophone in Spanish even in interlocutor’s position, since it has been clearly recognized as the phonetic realization of /v/.
- Acoustic variation entails the interlocutor’s reanalyzing the signal and relating it to a phonological category different from the speaker’s. This would somehow explain the phonological change from Latin /β/ to Spanish [β] (Blecua & Rost, 2010; Sánchez, 2013). Therefore, listeners can interpret this sound as a phoneme different from what the speaker meant.

REFERENCES


Results of this test are certainly conclusive for /f/, [β] and [v] acoustic realizations. The first two were always identified with /v/; as expected. The approximant was interpreted as /v/, although the speaker produced this sound meaning /f/.

When referring to the voiced labiodental realization, confusion arises: it can be categorized either as /f/ or /v/, and it shows high perceptual variation. In fact, there is almost an evenness between the two possible options. Therefore, listeners can interpret this sound as a phoneme different from what the speaker meant.