Acoustic Properties of Foreign Accent : VOT variations in Moroccan-accented Italian

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Abstract

The present study investigates the temporal parameter of VOT from a cross-language perspective, as far as native Moroccan, native Italian and Moroccan-accented Italian are concerned. The comparative analysis carried out underlines a language effect on the VOT duration across the three language varieties. The statistical test points out VOT as one of the acoustic properties that characterize the foreign accent, being the long-lag /t/ and the long-lag aspirated /k/ interlanguage markers due to L1 phonetic interference.

1. VOT and cross-language variation

VOT (*Voice Onset Time*) is the term coined by Lisker and Abramson [1] to refer to *"the time interval between the burst that marks the release of the stop closure and the onset of quasi-periodicity that reflects laryngeal vibration" (*1964: 422). This temporal parameter varies according with articulatory and aero-dynamic features: as far as the place of articulation is concerned, posterior consonants have longer VOT compared to front consonants; voiced consonants have short-lag VOT since sonority precedes the release or it coincides with it. In the world's languages three phonological contrasts may exist: voiced stops, voiceless unaspirated stops and voiceless aspirated stops marked by a long-lag VOT since *"the feature of aspiration is directly related to the timing of voice onset"* [2]. VOT may be assumed as a language-dependent parameter both for typological investigation [3] and cross-language studies [4-10]: there is *continuum* of possible VOTs from which languages may choose and empirical observation reveals unpredictable variations between languages.Second-language acquisition studies revealed the existence of phonetic interference whereas similar phonemes in L1 and L2 are categorized as having the same acoustic properties and prevent speakers from the acquisition of the target categories (i.e. *Speech Learning Model* in 11). Our objective is to investigate VOT in Italian and Moroccan Arabic in order to check the hypothesis of phonetic interference in Moroccan-accented Italian. Therefore a comparative VOT analysis of three semi-spontaneous speech *corpora* was led: 24 male speakers (8 per language, i.e. native Italian, native Moroccan and Moroccan-accented Italian) were analysed for a total amount of 2083 consonants. Cross-language variations were evaluated by means of a statistical analysis.

2. VOT duration in native *vs.* non-native production

Native Moroccan Arabic speakers realize stops that have longer VOTs as compared to native Italian speakers. As for Moroccan-accented Italian, intermediate values are noticed (figure 1).

3. Statistical analyses

In order to see whether the differences observed in VOT duration between native and non-native productions are linked to the

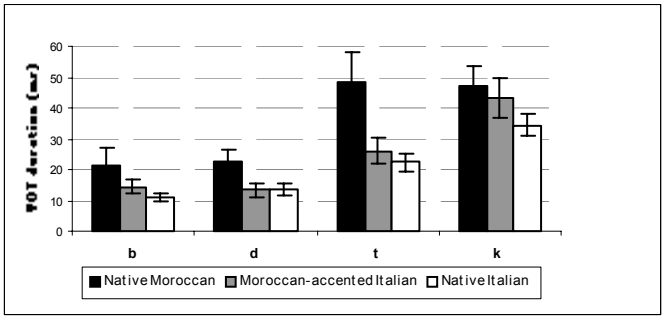

Figure 1 : VOT duration for [b] [d] [t] and [k] in each linguistic variety

linguistic background of the speaker we conducted statistical analysis ─ i.e., ANOVAs and T-tests ─ using Statview© software. The statistical threshold was 5% and 2 parameters were controlled : (i) *' the native language'* of the speakers (native Italian, vs. native Moroccan vs. Moroccan-accented Italian corresponding to native Moroccan subjects speaking Italian with the foreign accent to be studied). ; (ii) *'the nature of the consonant'* (we retained four stops [b][d][t] and [k] that are common to the three language varieties. Results reveal a significant interaction between the factor *'native language*' and the duration of the VOT. This is true for the four stops: mean VOT duration is significantly higher in native Moroccan Arabic than in native Italian and the duration values observed for Moroccan-accented Italian are lower than in Moroccan Arabic but higher than in native Italian [$F_{(6,84)}$=2.55, p= .025]. Then we applied T-tests so as to see whether there is significant differences in the duration of the VOT for each consonant across the different linguistic varieties. Results show that the mean duration of the VOT for [b] is significantly higher when produced in Arabic by native Moroccan speakers than when it is produced by the same type of subjects (i.e. Moroccan) when they are speaking in Italian or when the same consonant is realized in Italian by native Italians.[$t_{(2,28)}$=7.44, p= .002]. The same tendency is observed for the dental stop [d] [$t_{(2,82)}$=13.6, p<.0001] (figures 2a and 2b). As for [t] and [k], statistical analyses reveal significant differences between the different language varieties: in native Moroccan, VOT is always much longer than in Moroccan-accented Italian as well as in native Italian. When comparing Moroccan-accented Italian with native Italian, VOT duration appears to be significantly higher in Moroccan-accented Italian than in native Italian [$t_{(2,383)}$=124.5, p<.0001] for [t] and [$t_{(2,526)}$=64.24, p<.0001] for [k] (figures 2c and 2d).

3. VOT and the degree of aspiration

This result led us to characterize more precisely the acoustic properties of unvoiced stops in each linguistic context since their realization may be regarded as a reliable cue for the identification of Moroccan-accented Italian. Indeed, knowing that a positive VOT results into aspiration, we draw the hypothesis

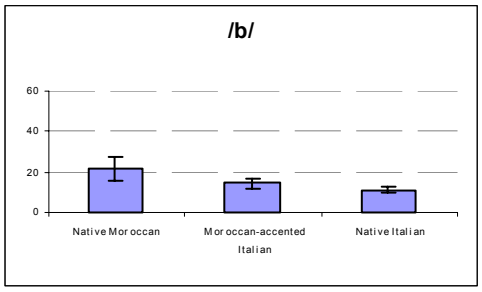

Figure 2a : VOT duration for [b]

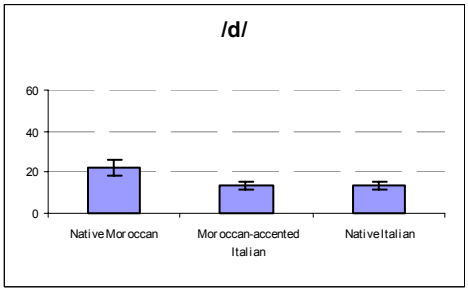

Figure 2b : VOT duration for [d]

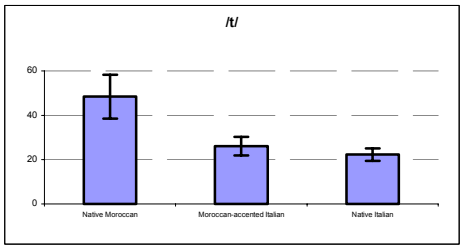

Figure 2c : VOT duration for [t]

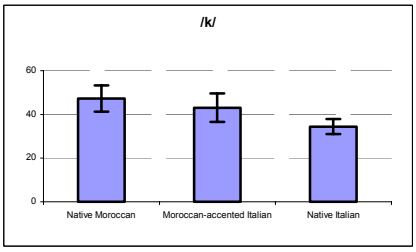

Figure 2d : VOT duration for [k]

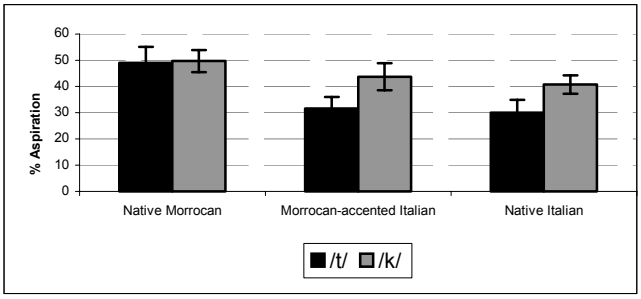

Figure 3 : Degree of aspiration (in percentage of the whole consonant duration) for [t] and [k] in the different linguistic varieties

that an important degree of aspiration for [t] and [k] is archetypal of Moroccan-accented Italian. This aspiration may be interpreted as a phonetic interference from native Moroccan to Italian as a Second Language since unvoiced stops have been characterized as highly aspirated in the subjects' mother tongue. Indeed, since "*languages differ in the values of VOT that they choose as the basic value for an unaspirated or an aspirated stop*" (Cho & Ladefoged, 1999:223), we decided to classify stops as aspirated or unaspirated applying a relative criterion [12]: consonants are aspirated if VOT is equal to or exceeds the 50% of the consonant total length. In order to evaluate the aspiration degree of the three languages under analysis we fulfilled a statistical analysis of the relationship between VOT and consonant total length (VOT/C). Results show a global effect of language variety on the degree of aspiration for [t] and [k] : unvoiced consonants being significantly more aspirated in native Moroccan than in native Italian; Moroccan-accented attesting intermediate values ($F_{(2,388)}$=125.42, p<.0001) (figure 3). We also noticed an effect of the nature of the consonant on the degree of aspiration: the velar stop being significantly more aspirated than its dental counterpart. This is the case for the three linguistic contexts ($F_{(1,388)}$=128.25, p<.0001). The comparison of the degree of aspiration of the velar unvoiced consonant between pairs of languages reveals that the difference is significant for [k] across all language varieties (i.e., native Moroccan ~ native Italian ; native Moroccan ~ Moroccan-accented Italian ; native Italian ~ Moroccan-accented Italian). We observe the same tendency for [t] except between native Italian and Moroccan-accented Italian, where the difference observed is not significant. This enables us to consider the hypothesis of phonological interference as valid for the velar stop only.

4. Conclusions

Our cross-language analysis reveals that Italian stop consonants (/b/ /d/ /t/ and /k/) are characterized by greater VOT values when produced by Moroccan subjects. From a cross-language viewpoint it is interesting to remark that VOT for /t/ and /k/ differs significantly in native Italian and Moroccan-accented Italian, the values being greater in the contact variety. As far as the aspiration degree is concerned, our statistical test pointed out a global language effect for /t/ and /k/: this phenomenon being more relevant in native Moroccan than in native Italian and Moroccan-accented Italian. The interlanguage shows a more important aspiration compared to native Italian, although the difference is statistically significant only for the velar stop. Summing up we may conclude that the presence of long lag-VOT for /k/ and /t/ in Italian spoken by Moroccans may be interpreted as a phonetic marker of foreign origin due to the mother tongue interference. For the phoneme /k/ this interpretation is significant as far as VOT duration and consonant degree of aspiration are concerned.

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