MUSIC AND HUMAN MOBILITY
REDEFINING COMMUNITY IN INTERCULTURAL CONTEXT 2016
Guest edited by Maria de São José Côrte-Real & Pedro Moreira
"Henri Coandă" Air Force Academy Publishing House

SOUNDS MAKE THE DIFFERENCE

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Abstract: *Interdental fricatives stand for an area of conflict between English and Romanian. Determining factors such as age, register, typological markedness, developmental effects and universal constraints are also looked into within various L-2 phonology based models such as the Speech Learning Model (Flege 1986), the Ontogeny Phylogeny Model (Major: 2001) and the Markedness Differential Hypothesis (Eckman 1977). Both the collection and the analysis of the data obtained are entirely my original contribution to the scientific study under consideration. Spectrographic and statistical analyses are mainly employed throughout the current article to substantiate the soundness of all the three theoretical frameworks reference was made to.*

Keywords*: spectrographic analysis, interdental fricatives, register, typological markedness, L2 phonology*

1. INTRODUCTION

According to Yavaş (2006:177), interdental fricative production is problematic across languages. The overlay of the native phonemes on the target English inventory gives us an overall picture of the ticklish status such target sounds have in the literature. Thus, I will go briefly over Yavaş's (2006: 198) findings and, subsequently, I will proceed to Romanian utterances of English interdental fricatives. It seems that in Portuguese interdental fricatives are missing from the consonantal inventory. The same goes in French, Spanish, Turkish, German, Russian, Korean and Persian. It is in French and German that interdental fricatives are substituted with /s/, /z/ respectively and /t/, /d/ in the other previously-mentioned languages. In this sense, Romanian patterns both categories of languages, that is German and French on the one hand, and Portuguese, Spanish, Turkish, Russian, Korean and Persian on the other hand, with greater tendency towards stopping which is consistent with Portuguese, Spanish, Turkish, Russian, Korean and Persian.

1.1 The Speech Learning Model (henceforth SLM). The process of acquisition of an L2 sound is triggered by the degree of phonetic similarity the particular L2 sound bears to an L1. Linguists employ the term *new* versus *similar* sounds when making this assumption. New sounds designate the L2 sounds which are not found in the phonological inventory of L1, whereas the L2 sounds which bear some degree of phonetic similarity to L1 sounds are considered similar to them. Flege (1986, 1987) deals extensively with the *new* versus *similar* sounds in his SLM. *Equivalence classification* is the notion that stands for the key concept of his framework. Equivalence classification is defined as a mechanism which may cause L2 learners to merge the acoustic characteristics of similar L1 and L2 sounds; therefore, this mechanism may hinder or even prevent the establishment of phonetic categories for *similar* sounds. This means that L2 learners can produce and perceive new sounds faster and more accurately than sounds similar to L1 sounds. As for the age of acquisition, the SLM suggests that phonetic categories both for new and similar sounds can be added until the age of 5-6; after that age phonetic categories can be added only for new and not for similar sounds.

1.2 The Ontogeny Phylogeny Model (henceforth OPM) captures the basic patterns of interlanguage, the relationships between L1 and L2 as well as universals. "As L2 increases, L1 decreases, and U [universals] increases and then decreases" (Major, 2001:82). The frame OPM postulates accounts for how developmental and transfer effects interact in the process of L2 phonological acquisition. It is thereby claimed that transfer effects predominate in the early stages of L2

phonological acquisition, and then gradually decrease, while developmental effects increase in the middle stages of acquisition, and then gradually decrease. In terms of phonological similarity of the L1 and L2, Major (1997:2001) postulates that for similar phenomena, transfer effects will be more common but for phenomena that are dissimilar, developmental effects may play a greater role in acquisition and production. Besides, Major further hypothesizes that production in different speaking styles is worth taking into consideration. Thus, as the formality of the style increases, there is a decrease in errors due to transfer, whereas errors due to developmental effects increase and then decrease. Major (1987:1995) tested his model by investigating data collected from beginner and advanced Brazilian Portuguese speakers' acquisition of final consonants across three tasks designed to elicit different styles showing different levels of formality. His findings indicate a trend, which was not statistically sizeable, of advanced learners producing more instances of errors due to developmental effects and beginner learners producing more instances of errors due to transfer effects.

Another test Major (1994) applied in order to support the OPM examined the data belonging to native Portuguese speaking Brazilians. The aim of the test was the production of English L2 double consonant onsets and codas in monosyllabic words. The subjects were examined over an extended period of four weeks. Major's (1994) findings provided some support for the model in the sense that transfer effects decreased over time, and a higher frequency of correct production was achieved. Nevertheless, developmental effects remained stable instead of increasing when transfer effects decreased, and style had no effect. Since the study lasted no more than four weeks (a short limited period of time), it is far from straightforward to consider the data relevant to illustrate change between the effects of transfer and developmental constraints.

On the whole, the literature (Flege & Davidian 1984, Hancin-Bhatt & Bhatt 1997, Hecht & Mulford 1987, Major 1987, Mulford & Hecht 1982) indicates that transfer and developmental effects may interact in L2 acquisition, with L1 prevailing in the early stages of acquisition and developmental effects increasing as L1 transfer effects decrease. It seems that both influence the production and acquisition of a single segment. Furthermore, it has also been found that developmental effects are predicted to affect substitutions.

1.3 The Markedness Differential Hypothesis. (Eckman 1977: 321):

a. Those areas of the TL which differ from the NL and are more marked than the NL will be difficult.

b. The relative degree of difficulty of the areas of difference of the TL which are more marked than the NL will correspond to the relative degree of markedness.

c. Those areas of the TL which are different from the NL, but are more marked than the NL will not be difficult.

2. METHODOLOGY AND TESTING

2.1 Informants. I selected four distinct categories of subjects according to their level of English. Nevertheless, the participants in this study had to meet the following criteria: their speech and language developed at a normal pace, and they had no siblings in speech therapy. It is worth mentioning that all the selected subjects speak Romanian as their mother tongue and learn English as a second language. They all started studying English when they were around four/five years old, therefore before the critical period. The subjects belonging to the second graders' category and sixth graders' category were recorded over a period of two years being tested in accordance with eight experiments I conducted. There were two distinct subgroups within the kindergarten category and the FCE category that were recorded over a period of one year only. With the view to avoiding any discrepancy in their performance due to different subjects as well as to a different input and intake (Piske & Young-Scholten, 2009), the subjects underwent different experiments within the same category. Given the fact that the number of students slightly differs from one experiment to another because of the subjects' availability or lack of it, and that in time the category changed (i.e. the second graders' category turned into the third graders' category) I consider it crucial to specify both the number of subjects, their age (where necessary), and the category involved when I move on to the section concerning the experiments.

The kindergarten category includes children of age 4 and 5 who have been studying English for three years. This category is exposed to a number of seven English classes per week consisting of 5 regular classes and 2 English club sessions. The teaching methods are interactive and student-centered. All pupils belonging to this category get audio and visual input. The two subgroups within the kindergarten category belong to two different private institutions: Aricel kindergarten and Just4Kids kindergarten in Bucharest.

The second graders' category, also referred to as the third graders category in some experiments conducted within the second year of recordings, includes eight and nine year-old young learners

who have been studying English for four and five years respectively. The subjects are prepared to sit for the Cambridge YLE-exam, level: Starters and Movers. All students belonging to this class attend 3 English classes every week. All the primary pupils within this category attend the public lower secondary school no. 149 in Bucharest.

The sixth graders' category, also referred to as the seventh graders' category in the experiments I carried out within the second year of recordings, includes twelve and thirteen year-olds who have been studying English for eight and nine years resectively. They attend a number of five English classes. All subjects are prepared to sit for the PET Cambridge exam which is assigned level B1 according to the Common European Framework. All the students within this category attend the public lower secondary school no. 149 in Bucharest.

The FCE category comprises young adults of age 17, 18, 20, 21, 22 who have been studying English for eleven years and thirteen years respectively. The seventeen-year-olds and the eighteen-year-olds were attending a training program in order to sit for The Cambridge FCE exam which is assigned level B2 according to the Common European Framework. With respect to the twenty-year-olds, twenty-one-year olds and twenty-two-year olds, it is to note that they have already sat for the FCE exam and have had an upper-intermediate level at the time I examined and recorded them. The subjects belonging to this category attend 4 English classes per week and get audio and visual input. The two subgroups within the larger FCE category study in two different institutions: a private one and a public one. The private institution I cooperated with is Road Language Centre and the public one is my institutional affiliation, the Military Technical Academy in Bucharest. With respect to the English fricatives, I conducted a production experiment on a total of 36 informants. Thus, 7 pupils were queried in the kindergarten category (source: Aricel kindergarten in Bucharest), 11 Romanian learners of English were examined in the second graders' category (source: School no. 149 in Bucharest), 7 lower students were investigated in the sixth graders' category (source: School no. 149 in Bucharest), and 11 subjects were tested in the FCE category (source: Road Language Centre in Bucharest). The main question which guided this experiment is formulated in (1) What kind of phenomena (i.e. stopping, fronting) occur when Romanian learners of English produce the interdental fricatives?

2.2 Recordings and procedure. I used a laptop Dell Vostro1310 make, series: 5Q1864J. Besides, a Canyon outer microphone CNR-MIC2 was required as well as speakers Logitech make, series: 3L0288. All the target words were digitized onto the Praat speech analysis software at a sampling rate of 44100 Hz. I have used Praat − a program designed by Boersma and Weenink (2010) at the Department of Phonetics of the University of Amsterdam − to conduct the phonetic speech analysis since it is constantly being improved and a new build, featuring extra options, is published almost every week. More precisely, Praat provides objective and precise data (spectrograms, formants etc.) concerning the acoustic parameters of phonemes. In my dissertation I have used version 5.2.03 as well as the edition for Windows XP. Furthermore, it is worth mentioning that Praat is restricted to processing mono signals in mono files. I have worked only with WAV format and measured the mean values of the required formants with the formant tracker function. After saving all speech samples as WAV files, I assigned a directory for each type of test. It is mandatory for the formants to be set to a value suitable for the speaker. Thus, the standard value of 5500 Hz is suitable for females and children, whereas the value of 5000 Hz is strongly recommended for males. Following Boersma and Weenink (2010), if the value 5500 Hz is used for an adult male, two few formants are obtained in the low frequency region. Nonetheless my main concern had always been that all recordings should take place in as quiet a place as possible. As a result, I conducted the experiments individually, within the school building, in the library or in classrooms, attempting to avoid as much as possible the occasional background noise that interfered with the speech samples I obtained from the selected subjects. Since all the recordings I made didn't take place in a soundproof booth in phonetics laboratories, I considered it necessary to filter the data before analyzing it in order to get accurate mean values for the formants.

3. SPECTROGRAPHIC ANALYSIS

3.1. The acoustics of interdental fricatives. Fricatives are acoustically and aerodynamically complex. Fricatives, by definition, involve an occlusion or obstruction in the vocal tract great enough to produce noise (frication). Frication noise is generated in two ways, either by blowing air against an object (obstacle frication) or moving air through a narrow channel into a relatively more open space (channel frication) (Hagiwara: 2009). The noise component (the continuous distribution of energy over a range of frequencies) is crucial to

identify interdental fricatives. This is specified by the effective frequency range and general level of intensity together with any peaks of intensity, also the speed with which the general intensity of the sounds builds up at particular frequencies (O'Connor, 1973:92). Furthermore, fricatives are consistent with random noise pattern, especially in higher frequency regions (Ladefoged, 1982:185).

3.2 Collected Corpora. Figure 1 clearly indicates that the substitution belonging to Subject MS is of different nature. Therefore, both the manner and place of articulation change. Thus, Subject MS realizes an alveolar stop instead of an interdental fricative in the onset of the syllable. Consider the selected portion on the spectrogram in Figure 1 which shows that an alveolar stop was realized instead of an interdental fricative. No random noise can be associated with the realization of the alveolar stop [t] since there is no friction to identify. There are several dimensions in the acoustic identification of stops. First of all, I would like to take note of the formant transition.

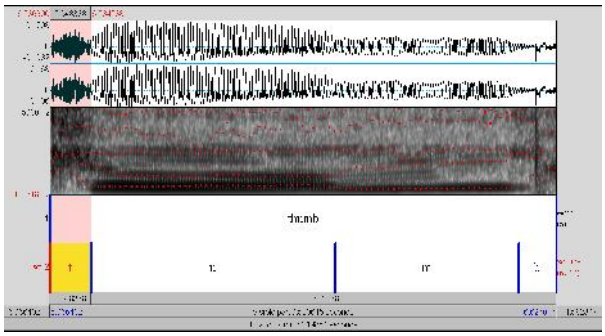

Figure 1: *thumb* (Subject MS. The second graders' category).Word list

As pointed out in the literature (Yavaş, 2006:105), formant shifts in CV sequences reflect changes in vocal tract shaping during stop-to-vowel transition. As shown in Figure 2, there is a downward transition to a vowel with low F2 in CV. When it comes to the release burst, alveolar bursts generally have a center frequency that is higher than the F2 of the vowel (above 2000 Hz). My measurements indicate that F2 measures 2019 Hz. This brings phonetic evidence in favor of the realization of the alveolar stop [t]. Moreover, the pattern is diffuse and strong and there are no scattered marks after the release before vowel formants begin, in initial [t] of the given stressed syllable. All of the above make me claim that aspiration is not present in the current utterance.

I will proceed now to the accurate realization of the interdental fricative in the seventh graders category. I will thus discuss the rendition of [ɵ] in two different distributional positions: in the onset, on the one hand, and in coda, on the other hand.

Figure 2 is a spectrogram of an accurate utterance of the word *healthy*. The random noise can easily be observed on the messy faint formant structure. Recall that the lower the intensity (amplitude) of the sound energy present at a given time of frequency, the fainter will be the mark at the corresponding point on the printout. My measurements indicate appropriate high-frequency values as follows: F1 measures 996 Hz, F2 is 2480 Hz, F3 equals 2905 Hz and F4 measures 3844 Hz. All these figures are consistent with the elicited realization of the interdental fricatives.

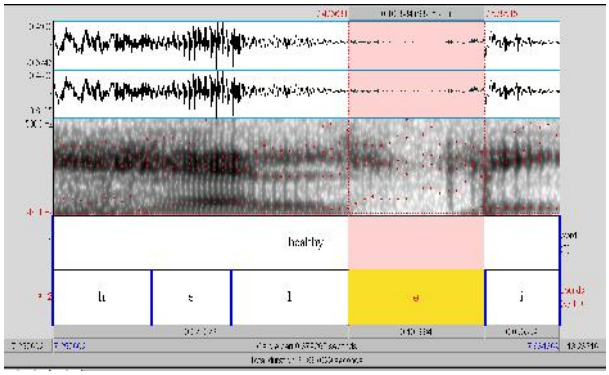

Figure 2: *healthy* (Subject CL. The seventh graders' category). Text reading (Constantin: 2013)

Figure 3 shows a scribbly pattern of [s] without regular horizontal or vertical lines. The subject's airstream is funneled smoothly through the groove formed in the surface of the tongue blade and tip. As the air picks up speed it begins to tumble noisily.

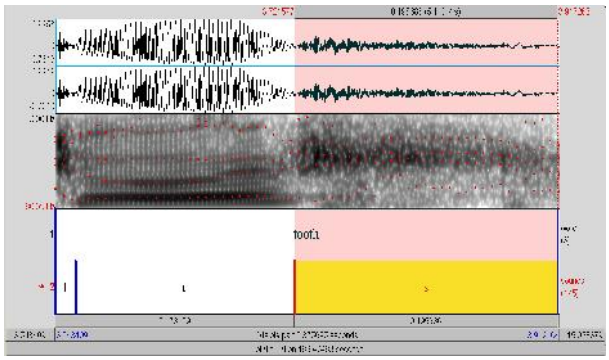

Figure 3: *tooth* (Subject OL. The kindergarten category). Picture labeling (Constantin: 2013)

The tumbling noisy air jet generally strikes the edge of the upper incisor, or edge of the lower lip, and creates additional edge or spoiler turbulence noise. These noises produced by the sibilant [s] are long, strong in amplitude, only o few decibels less than that of the neighboring vowel [u:], and marked by a rich, high frequency noise spectrum

(Yavaş 2006: 107) ranging between 1028 Hz (the mean value consistent with F1) and 3517 Hz (the mean value obtained for F4). The two remaining formants indicate the following mean values: F2 is 2323 Hz and F3 is 2828 Hz. Still referring to the present spectrum, I would also like to clarify whether the spectrogram indicates that Subject OL realized a voiceless sibilant and not a voiced one. In his studies, Yavaş (2006:108) makes the clear-cut distinction between voiced and voiceless sibilants in terms of acoustic parameters. Therefore, voiceless fricatives have longer noise segment duration, and higher frication noise than their voiced counterparts. The lower frication noise of the voiced fricatives is explained as a result of the total airflow available for producing turbulence at the constriction. Since the glottis opens and closes for vocal cord vibration, the airstream is interrupted, and the friction noise is not as loud in voiced fricatives. Furthermore, voiced fricatives have formants produced by pulses from the vocal cords as well as more random energy, produced by forcing air through a narrow gap. Since the airstream loses some of the kinetic energy to the vocal cord vibration, the frication noise in these sounds is not as loud in their voiceless counterparts. As a result, they have fainter formants. Given all these subsequent comments (especially the ones regarding the dark formant structure), I will safely conclude that there is no doubt that Subject OL realized a voiceless sibilant and not a voiced one.

4. CONCLUSIONS

In summary, SLM receives support from the experiment on the acquisition of the interdental fricatives. Romanian learners of English turned out to be accurate when producing the English interdental fricative targets. Since they do not have such counterparts (exhibiting the same phonological matrix) in the Romanian consonantal system, Romanian learners are prone to create new categories for these phonemes perceiving them as distinct underlying representations. In conclusion, when phonemic substitutions occurred, they were triggered by the assimilatory power that the similar sounds in Romanian (the other types of fricatives and stops) exerted over the English fricatives.

Furthermore, the register factor as treated within the OPM context is not supported by the current data as shown by the phonetic evidence obtained. The tokens in the less formal types of tests were felicitously uttered unlike the targets in citation forms. Accordingly, it is not transfer which is overridden by developmental effects, but the other way round. The less felicitous methodology and procedure employed also account for the oddity of the results. Additional support for the limitation of the experiment also comes from the types of tokens required. I noticed that the lexical word *thumb* I used in the testing samples really created pronunciation problems when the interdental fricative in onset position was elicited from the Romanian informants. Instead of urging students to produce this word across the three types of tests, I used it only in word lists, as a citation form. Consequently, the informants' rendition of fricatives was less accurate in word lists where more difficult words were asked from the subjects. Therefore, putting together the difficulty of tokens required and the reversed order in which the three types of tests were dealt with, I will conclude that the analysis needs further investigation to be reliable.

One counterargument against MDH may be the acquisition of the interdental fricatives. Even if they are marked segments, Romanian learners of English employed them successfully. However, MDH does account for those cases where substitutions to [t] [d], [f] occurred. I concur with Lombardi (2003) who claims that the foreign speakers' tendency of substituting the interdental fricative [θ] with the dental stop [t] is triggered by the fact that dental stops are less marked than fricatives. As pointed out hitherto, stops are the first type of consonants sounded out by children when they acquire their mother tongue and they tend to replace the interdental fricatives with stops. Still, with respect to the other types of substitutions, it is to note that articulatory reasons should also be mentioned. In other words, those particular subjects that replaced the interdental fricative [θ] with another type of fricative tended to keep the same articulators whenever they replaced the target sound with a similar one. As for deletion which occurred in coda position, sonority reasons may be one possibility to account for this phonological process.

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