PRODUCTION OF A "NEW" PHONE : THE VOCALIC GESTURE

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ABSTRACT

The phonetic performance of an adult learner in L2 is marked by the use of L1 units. It has been said that the production of a "new" phone of L2, i.e. having no corresponding sound in L1, may be eventually mastered. The production of a "similar" phone, i.e. having a corresponding sound in L1, may be blocked by the perceptual mechanism of equivalence classification. This paper observes [u] in General American English (GAE) and in French (F), and GAE[ju] and F[y] in L1 and L2. We invalidate conclusions based on static data which maintain that English speakers better master F[y] as a "new" phone, than F[u] as a "similar" phone. Dynamic data show the importance of taking the entire gesture into consideration.

1. INTRODUCTION

Studies of phonetic performance in L2 of adult learners often refer to Evgenij Polivanov (1931) and especially to Nicolas Troubetzkoy (1939) as founders of the notion of "phonologic sieve". Polivanov defines qualitative divergences (i.e. concerning the nature of phonemes) and goes on to say that almost all concrete cases of contact of two linguistic systems can provide such examples.

Troubetzkoy (1939) defines the "phonologic sieve", established by the mother tongue. He explains "foreign accents" as confrontation of two phonologic systems, first in perception, then in production.

Lado (1957) introduces the contrastive analysis with the comparison of L1 and L2 phonetic systems to predict the problems eventually encountered by the learner. Widely developed and criticized, contrastive analysis predictions remain the more valid in the field of phonetics. In the first stages of learning, most of the learners show a very weak phonetic competence in L2. L1 features and patterns are usually easy to identify in L2 pronunciation of beginners. The original hypothesis works : the more phonetic differences between the two languages, the more problems in the learning. But empiric studies have shown that the problem is unfortunately more complex. It is the whole set of phonological rules, at the segmental and the suprasegmental level of L1 and L2 which are in contact (units and features distribution, syllable structure, rhythm, intonation, stress, vocal gesture, vocal settings...).

In a number of articles, James Flege has detailed transfer hypothesis within development of phonetic categories in L2 learning. He made the hypothesis that L2 learners may eventually add new phonetic categories to the L1 set, in particular for phones that differ notably from those of L1. In short, the production of a "new" phone of L2, i.e. having no corresponding sound in L1, may be eventually mastered. The production of a "similar" phone, i.e. having a corresponding sound in L1, may be blocked by the perceptual mechanism of equivalence classification.

French [u] is a "similar" phone for Native English speakers and French [y] is a "new" phone for Native English speakers. Teaching observations in vivo show that Anglo-american speakers in French produce :

- often [u] instead of [y] : "Dans la rue" ("In the street") [δA∃λαℜψ] pronounced [δA∃λ×ℜυ] ("In the wheel"),
- but also often [u] which sound like [y] to french ears. "Pas du tout" [παδψτυ] ("Not at all") pronounced [παδ×τψ] which is often justified as a case of hypercorrection.

We compare in this paper [u] and [y] in French (F) and [u] in General American English (GAE) by native speakers of both languages and in French by Anglo-american speakers following two approaches : a static one, and a dynamic one.

2. STATIC COMPARISON OF BOTH VOCALIC SYSTEMS

We use a part of the famous corpus of Peterson et Barney (1952), which is still often used for phonetic studies of the vocalic system for GAE. This corpus consists in measures of the three first formants of 10 vowels recorded by 76 Native English speakers (female, male, chidren), in words like "heed", "hid", "head", etc. Left context is considered as neutral ([h]), right context is dental ([d]). Formants have been measured in the steady state of the vowel. We kept the data concerning male voices (33 speakers) whose formant values are given in Ferrari-Disner (1983) for 10 monophthongs of GAE ([e] et [o] considered as diphthongs are not included in the corpus).

We compare this part of the Peterson and Barney's corpus with an equivalent one we established for French (33 male speakers). For French, vowels were presented in a frame sentence : «Je répète DOUX puis le son --» ("I repeat SOFT then the sound --"). Speakers had to replace dashes with the vowel pronunced in the word (here [u]). This final vowel, produced as a monosyllable can be considered as not submited to any strong coarticulatory influence. We measured the two vowels, both in the words with a dental left context ([s, d, n]), and as monosyllables.

Figure 1 presents on the F1/F2 axes the mean ± 2 standard deviations of formant measurements in the steady state of the vowel (monophthongs of Peterson and Barney's corpus, and oral vowels of French).

Concerning [u], GAE [u] appears to be more fronted than F[u]. F[u] has to maximise the distinction with F[y] ; usually GAE [ju] is not considered to be an obstacle to the front shift of GAE [u] (see below).

3. DYNAMIC COMPARISON OF GAE [u] AND F[u], GAE [ju] AND F[y]

To observe the vocalic gesture in its globality, we use dynamic measurements with data from 6 speakers in both languages, producing 3 utterances (18 items). Formant frequencies were measured along the vowels with a 12,8 ms. step (we used this kind of measure in Clements, 1995). The superposition of the 18 productions offers an illustration of the vocalic gestures in their evolution as a function of time. We present the measurements of formant frequencies in words with consonantal left context (Figures 2 and 3).

These formant values for GAE [u] are consistent with other recent studies of [u] in English. For example, William Labov (1994) showed the following measurements for [u] : F1= 480 to 540 Hz ; F2= 1300 to 1700 Hz for 116 speakers of the Philadelphia area. Ash (1996) in a study of anteriorisation of /uw/ in the Midwest area concludes : "In the case of /uw/, there is no pressure for it to move front, as there is no back vowel which is moving in its direction and threatening a merger. There is also no pressure for it to stay high and back, since there are no other high central or high non peripheral front vowels."

We compare, in Figure 2, the formant evolution of :
a) GAE[u] in words ("Sue", "do", "new") by Native English speakers (NE) ;
b) French [u] in words ("sous", "doux", "nous") by Native English speakers (NE) ;
c) French [u] in words ("sous", "doux", "nous") by Native French speakers (NF).

In Figure 3, we compare the formant evolution of :
a) French [y] in words ("su", "du", "nu") by Native French speakers (NF) ;
b) French [y] in words ("su", "du", "nu") by Native English speakers (NE) ;
c) GAE[ju] as a monosyllable illustating the vowel of the words "cue", "music", "beauty".
Formant measurements started at the beginning of the vocalic periodicity.

A long influence of the dental locus occurs in the productions of English speakers in GAE. The offset of GAE[u] is often much higher than F[u] (2a, 2c). In French, English speakers transfer the L1 vocalic gesture but attempt to accelerate the F2 glide (2b). The diphthongization of GAE [u] (2a) and [ju] (3c), enhanced by the dental context, is obvious. The transfer of this diptongization gesture in French is obvious as well. F[u] pronounced by French speakers is stable, but influenced by the dental context : after a short transition (about 50 ms.) from dental locus, F[u] shows stable formant values.

James Flege (1987) has observed productions of 42 female speakers in 6 groups :
- 2 monolingual groups : for English, American speakers in Chicago (#1), for French, French speakers in Paris (#6) ;
- 3 groups of American speakers more or less experienced in French : American students (#2), American professors (#3), Americans living in Paris (#4) ;
- 1 group of French speakers living in Chicago (#5).
The corpus consists in 7 repetitions by each speaker :
a) [u] in dental left context in English and in French ("two" /"tous") ;
b) [y] in dental left context in French ("tu").

F1, F2 and F3 were measured on one point at the beginning of the vocalic periodicity. Formant values at that point are maximally influenced by the dental context (with a locus at about 1600-1800 Hz). Results of Flege's study are summarized in Figure 4.

In 4a, for [u], French speakers show lower F2 values than the English speakers in French. The more the English speakers are experimented in French, the closer the F2 values become to those of the French speakers.

In 4b, English speakers show a better performance to produce a "new" phone (like French [y] for english speakers) than a "similar" one (like French [u] for english speakers). This confirm Flege's hypothesis that a speaker is less performant in producing acoustic characteristics of a "similar" L2 phone (i.e. which can be perceived as a realisation of a L1 category) than producing a "new" phone (i.e. which can not be perceived as a realisation of L1 category).

The data obtained above is consistent with Flege's data, but our additional dynamic data enables to provide new elements for interpretation.

4. DISCUSSION

The dental context enhances the anteriority of articulation, resulting in higher F2 values at the beginning of the vocalic periodicity. This context influences strongly the vowel identity.

As shown in the dynamic representation (Figure 2), GAE [u] presents much higher F2 values than French [u]. If the IPA symbol used in the two languages is the same but it covers different acoustic realities.

Third, the begining of utterances of GAE [u] and French [y] shows a suprising similarity (2a, 3a), giving an acoustic explanation of the auditory effect : F[u] produced by english speakers in a dental context often sounds like F[y] to french ears.

5. CONCLUSION

The results invalidate Flege's conclusion, but illustrate the fact that GAE [u], particularly following a dental consonant, shows acoustic characteristics close to those of French [y] especially at the onset.

The main characteristic of GAE [u] and GAE [ju] is their formant evolution in comparison with the stability of the french vowels. The onset of French [y] pronounced by english speakers is actually similar to french speakers, but in fact, this onset is also similar to GAE [u].

Comparison of vowels of two languages such as English and French which differ by the status accorded to vowels and by the nature of the vocalic gestures is not effective if based on static data. However, if the comparison considers the entire gesture, the transfer from L1 to L2 is quite clear.

REFERENCES

[1] ASH, S. (1996), Freedom of Movement : /uw/-fronting in the Midwest, in ARNOLD, J., BLAKE, R., DAVIDSON, B., SCHWENTER, S., SOLOMON, J., *Sociolinguistic Variation : Data, Theory, and Analysis ; Selected Papers from NWAV 23 at Stanford*, Stanford CA : Center for the Study of Language and Information Publications, p. 3-25.
[2] CLEMENTS, N., HERTZ, S., LAURET, B. (1995), A representional basis for modelling English vowel duration, *Proceedings. of the XIIIth International Congress of Phonetic Sciences*, Stockholm, August 13-19, vol. 1 p.46-49, éditeurs : ELENIUS, K., BRANDERUD, P., KTH (Royal Institute of Technology), Stockholm University, Department of Linguistics.
[3] FERRARI DISNER, S. (1983), Vowel quality : the relation between universal and language-specific factors, *UCLA Working Papers in Phonetics*, vol. 58.
[4] FLEGE, JE., HILLENBRAND, J. (1984), Limits on phonetic accuracy in foreign language speech production, *Journal of Acoustical Society of America*, vol. 76, no. 3, p. 708-721.
[5] FLEGE, JE. (1987), The production of "new" and "similar" phones in a foreign language : evidence for the effect of equivalence classification, *Journal of Phonetics*, vol. 15, p. 47-65.
[6] LABOV, W. (1994), *Principles of Linguistic Change : Internal Factors*, Cambridge, MA : Blackwell, 641 p.
[7] LADO, R. (1957), *Linguistics across cultures : applied linguistics for language teachers*, Ann Arbor, The University of Michigan Press, MI.
[8] PETERSON, GE., BARNEY, HL. (1952), Control Methods used in a Study of vowels, *Journal of Acoustical Society of America*, vol. 24, no. 2, p.175-184.

[9] POLIVANOV, E. (1931), La perception des sons d'une langue étrangère, *Travaux du Cercle de Linguistique de Prague, IV*, Réunion phonologique internationale tenue à Prague (18-21/XII 1930), Prague : Kraus Reprint, p. 79-96.

[10] TROUBETZKOY, NS. (1939), Grundzüge der Phonologie, *Travaux du Cercle de Linguistique de Prague*, VII, Prague.
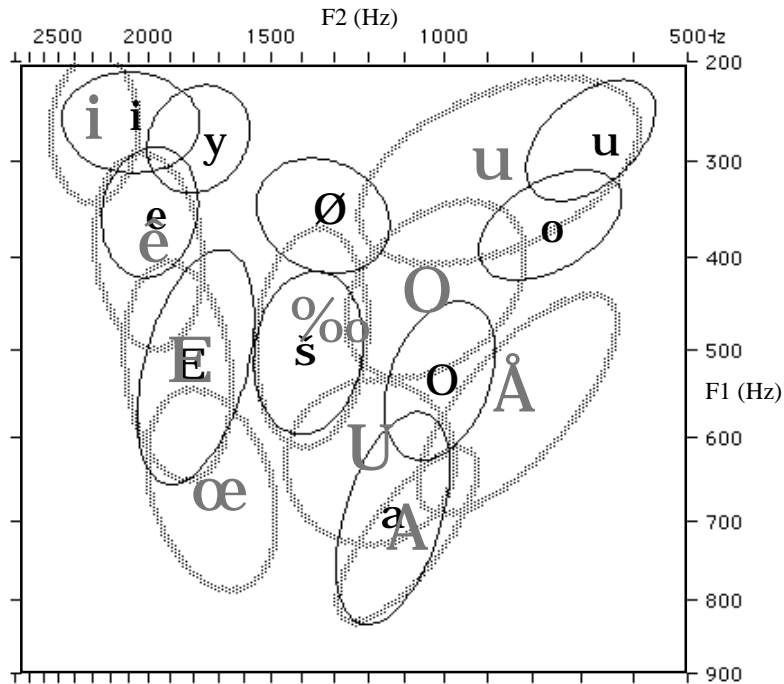
Figure 1 - Static approach : French oral vowels, 33 male speakers, (thin black) and
GAE monophtongs vowels, 33 male speakers[PETERSON & BARNEY, 1952] (bold grey),
F1, F2 ; elipse=mean ±2 standard deviations ;
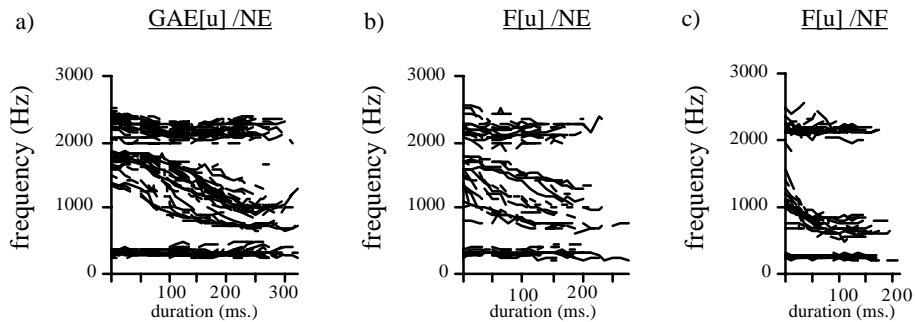GAE [e] and GAE [o] considered as diphthongs are not presented.

Figure 2 - Dynamic approach : a) GAE[u] by Native English speakers (NE) ; b) F[u] by Native English speakers (NE) ;
c) Native French speakers (NF) in words, following a dental consonant ;
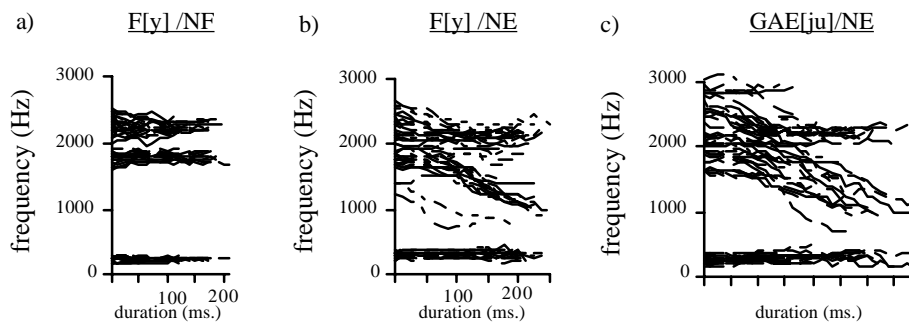18 utterances of each vowel (6 speakers x 3 repetitions)

Figure 3 - Dynamic approach : a) F[y] by Native French speakers (NF) ; b) F[y] by Native English speakers (NE) ;
c) GAE[ju] by Native English speakers (NE) in words, following a dental consonant ;
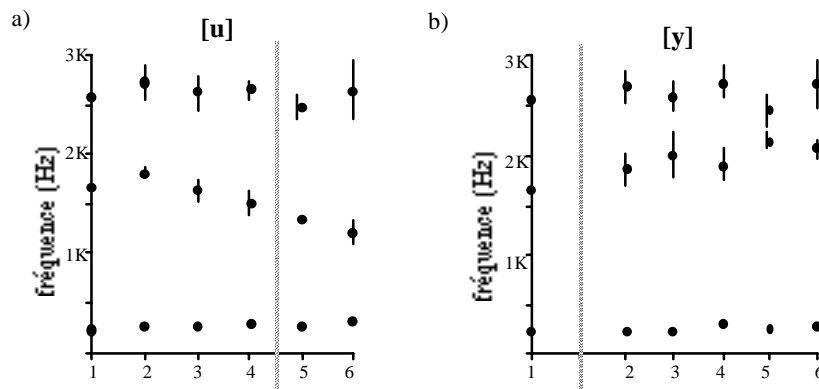18 utterances of each vowel (6 speakers x 3 repetitions)

Figure 4 - Flege's results (1987)
1 : Monolingual English ; 2 : American students ; 3 : American professors
4 : American in Paris ; 5 : French in Chicago ; 6 : Monolingual French
F1, F2, F3 ; Mean (•) ± 1 standard deviation (|)
a) GAE [u] (1) and French [u] (2, 3, 4, 5, 6)
b) GAE [u] (1) and French [y] (2, 3, 4, 5, 6)