Assessing Non-native Speakers' Production of French Nasal Vowels: a Multitask Corpus-based Study

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Abstract

This article presents a multitask corpus-based study on the production of French nasal vowels by Japanese and Spanish learners of French. In the past, few studies have investigated the production of French nasal vowels by non-native speakers, and none – to our knowledge – have used a multitask corpus such as the one currently being built in the IPFC project (InterPhonology of Contemporary French). In this paper, non-native productions have been perceptually and acoustically assessed, and the results are discussed in light of the psycholinguistically distinct processes involved in the different tasks.

1. Introduction[1]

In the field of corpus linguistics, the need for sound data (Durand, 2009), either from a methodological or a comparativist viewpoint, still drives researchers to launch large-scale projects to set up *ad hoc* databases. In the case of French, this is particularly true for oral data: see for example the two recent projects *Corpus International et Ecologique de la Langue Française* (International and Ecological Corpus of French Language) and *Français Contemporain en Afrique et dans l'Océan Indien* (Contemporary French in Africa and in the Indian Ocean) (Dister, Gadet, Ludwig, Lyche, Mondada, Pfänder, Simon & Skattum, 2008), as well as *ESLO2* (Sociolinguistic Survey in Orléans 2) (Abouda & Baude, 2006). Even though existing corpora have been used to re-examine classical linguistic analyses (see for example the work of Durand & Lyche, 2008, on the French sandhi *liaison*), relatively few oral corpus studies have been devoted to analyses of the

[1] This work could not have been possible without the precious help of Françoise Zay, Nathalie Bühler and Sandra Schwab, particularly in the experimental part of the study. We would also like to thank Naoki Marushima for his help with the acoustic measures. All errors are ours.

phonetico-phonological systems of non-native speakers. In the past twenty years, non-native oral corpora have been put to use in the field of second language (L2) acquisition (e.g. *ESF* (Noyau & Deulofeu, 1986; Perdue, 1993), *LANCOM* (Debrock & Flament-Boistrancourt, 1996) and *FLLOC* (Rule, Marsden, Myles & Mitchell, 2003; Myles & Mitchell, 2007)), but mainly to examine lexical and morphosyntactical properties of the learner's interlanguage (Vogel, 1995). It is only recently that L2 oral corpora have been created to study L2 phonetics and phonology (with or without applied goals such as ASR (Automatic Speech Recognition) based CAPT (Computer-Assisted Pronunciation Training) systems) both on the segmental and supra-segmental levels (Trouvain & Gut, 2007; Meng, Tseng, Kondo, Harrison & Viscelgia, 2009): in L2 Dutch (Neri, Cucchiarini & Strik, 2006), Polish (Cylwik, Wagner & Demenko, 2009), German, and English in Europe (Gut, 2009) and Asia (Visceglia, Tseng, Kondo, Meng & Sagisaka, 2009). Most studies conducted over the past forty years in L2 phonetics and phonology have been carried out without the use of a corpus. According to Gut's literature review (2009: 50-51) the main limits of these studies can be summarized as such: 1) limited number of structures under scrutiny; 2) few studies on the interrelations between the different structures of the system; 3) few studies on the impact of non-linguistic factors and their interrelations; 4) limited number of speakers; 5) data limited mostly to laboratory settings; 6) focus on English as a target language.

The project *InterPhonologie du Français Contemporain* (IPFC) (Interphonology of Contemporary French) (Detey & Kawaguchi, 2008; Racine, Detey, Zay & Kawaguchi, 2009; Detey, Racine, Kawaguchi, Zay, Buehler & Schwab, 2009), from which the data used in this study are drawn, tackles problems 1, 2, 4 and 6 mentioned above. IPFC aims to build a large multitask phonological corpus of French as a foreign language (FLE)[2], which can be used for both linguistic and pedagogical purposes and consists of data collected from speakers of various L1s using a single methodological protocol (Gut, 2009; Neri, Cucchiarini & Strik, 2006). The protocol is based on the one used for French native speakers in the project *Phonologie du Français Contemporain: usages, variétés et structure* (Phonology of Contemporary French: usages, varieties and structure) (Durand, Laks & Lyche, 2002a, 2002b, 2005, 2009, http://www.projet-pfc.net) and includes five tasks: reading aloud and repetition of a word list, text reading, a formal interview with a native speaker, and semi-formal interaction between two learners.

In this article, we present the first study based on the IPFC corpus and devoted to the French nasal vowels. The data were collected from Japanese and Spanish advanced learners of French and analysed from both phonetico-phonological and psycholinguistic viewpoints.

2. The French nasal vowels: a perceptive and acoustic assessment

Among the phonological characteristics of French that non-native speakers have to learn are the

[2] Depending on the context, French can be either a second (L2) or a third (L3) foreign language.

nasal vowels (not to be confused with nasalised vowels). Nasal vowels can be found in several Sino-Tibetan and African languages, but they are less common among Indo-European languages (e.g. Portuguese, Polish, Hindi and Breton)[3]. Some phonologists even consider nasal vowels to be biphonemic instead of monophonemic (Paradis & Prunet, 2000).

Even though the nasal feature [+nasal] can be found in the consonantal systems of Japanese and Spanish, and despite the existence of nasal spreading through phonetic coarticulation and assimilation processes in both languages, nasal vowels are always difficult to learn for Japanese and Spanish learners of French. So far, few studies have tackled the issue of nasal vowel learning in FLE: see for example Takeuchi & Arai (2009) for Japanese learners and Montagu (2002) or Garrott (2006) for American learners. This apparent lack of interest may partly be explained by the complexity of the relationship between the articulatory, acoustic and auditory properties of nasal vowels in French (Delvaux, Metens & Soquet, 2002; Delvaux, Demolin, Soquet & Kingston, 2004; Montagu, 2007).

In our study, the analysis of nasal vowels was performed according to a three-step procedure – these are the three steps usually taken, independently or not, in L2 speech studies (Munro, 2008: 200). The first step consists of a non-expert (i.e. non-linguist) perceptive assessment through both a lexical identification task (Bradlow & Bent, 2008) with confidence rating and a task of vowel representativeness (Miller, 1994). The second step consists of an expert perceptive assessment of a) vowel quality, b) postvocalic excrescence (degree of presence of a postvocalic consonant (Johnson, DiCanio & MacKenzie, 2007)), and c) global lexical quality (global quality of the realisation of the lexical unit). The third step consists of an acoustic analysis of postvocalic excrescences. In this article, we concentrate on one aspect of each assessment, namely non-expert vowel identification and expert postvocalic excrescences analyses. Given the variation between the 3- and 4-nasal vowels systems in contemporary French (especially between /ɛ̃/ and /œ̃/), we opted to concentrate on the modern mainstream 3-vowel system in metropolitan France: /ɛ̃/, /ɔ̃/, /ɑ̃/. The general purpose of our study is to assess the *quality of realisation*[4] of the French nasal vowels produced by non-native speakers.

2.1. Non-expert perceptive identification of the nasal vowels

As is pointed out by Munro (2008), the assessment of non-native speaker production by non-experts is important overall, since it sheds light on the degree of intelligibility for other members of the linguistic native community. We selected a lexical identification task for two main reasons: 1) the frequent spectral confusions made by learners, partially linked to the inconsistency of

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[3] According to the UCLA Phonological Standard Inventory Data (UPSID), phones corresponding to nasalised vowels are found in 102 languages, i.e. 22.62% of the languages in the inventory (Dec. 29, 2009 <http://web.phonetik.uni-frankfurt.de/upsid_find.html>).

[4] This notion must not be confused with *intelligibility* or *accentedness*, or even *comprehensibility* or *acceptability*, especially for international languages such as English or French, which encompass nativized varieties in which the distinction between *accentedness* and *nativelikeness* can sometimes be blurred (Munro, 2008).

phonographemic correspondences in French, and 2) its comparability with tasks designed for native (Grosjean, Carrard, Godio, Grosjean & Dommergues, 2007) and non-native speakers (Bradlow & Bent, 2008; Derwing & Munro, 1997; Munro, Derwing & Morton, 2006).

Method

Participants

Speakers: The participants were 5 Japanese learners of French (3 male and 2 female; all were students at Tokyo University of Foreign Studies and came from the Tokyo metropolitan area) and 5 Spanish learners of French (2 male and 3 female; all were students at the University of Geneva and came from Spain). They were selected from the IPFC corpus on the basis of their proficiency level in French (B2-C1 according to the Common European Framework of Reference for Languages (CEFRL)) and on the acoustic quality of their recordings.

Listeners: Sixteen native speakers were used in this study. All were students at the University of Geneva.

Material

Nine monosyllabic words from the word lists used in the IPFC protocol were used in this study: 3 containing the vowel /ɛ̃/, 3 containing the vowel /ɑ̃/ and 3 containing the vowel /ɔ̃/. Each vowel appeared in three different contexts: word initial (*Inde* "India", *anse* "handle", *once* "ounce") (closed syllable VC), between two consonants (*teinte* "shade", *tante* "aunt", *ponce* "sand") (closed syllable CVC), and word final (*teint* "complexion", *tant* "so much", *pont* "bridge") (open syllable CV). Each of the 9 words was produced twice by each learner: the first time in a repetition task in which the learner repeated a word after hearing it produced twice by a native speaker and the second time in a reading out task in which the learner read aloud each word that was presented in its written form on a computer. The final stimulus set consisted of 180 words (90 for each population of learners). For each learner, 18 productions (half repeated and half read) were assessed.

Procedure

Participants were instructed to listen to individual words and write them down. In case of hesitation (with heterographic homophones, i.e. *pense* "think" for *panse* "belly", or *paon* "peacock" for *pan* "piece"), they were asked to write the first word that occurred to them. For each answer participants had to give a confidence rating on a scale of 1 to 5 (1 = not sure; 5 = very sure)[5]. Each word was presented twice. If they were not able to identify a French word, they were asked to indicate it by checking an appropriate field. The study took place in a language laboratory and answers were collected in an Excel sheet.

[5] In their study, Grosjean et al. (2007) used a 7-point scale. We reduced it to a 5-point scale to be consistent with the scale we used in the expert perceptive evaluation (vowel quality and global lexical quality). Moreover, in the L2 literature, a 5-point scale (1 = native-like, no foreign accent; 5 = non-native, strong foreign accent) is often used to assess advanced L2 learner productions (e.g. Birdsong, 2007; Bongaerts, 1999; Ingram & Nguyen, 2007; Gut, 2009).

Data analysis

A correct nasal vowel identification rate[6] was calculated as a function of the learners' population (Japanese *vs* Spanish), the nasal vowel (/ɛ̃/, /ɑ̃/, /ɔ̃/) and the task (repetition *vs* reading). We considered correct all answers in which the nasal vowel matched the one produced by the learner, no matter which written form was used. For example, if the word /tɛ̃/ was written *thym* ("thyme") or *tain* ("silvering") instead of *teint* ("complexion"), we considered the answer correct. The correct vowel identification rate was calculated based on the number of answers excluding those that indicated "Unknown word".

Results

As can been seen in Figure 1, which presents the mean correct nasal vowel identification rate (in percentage) for productions by Spanish and Japanese learners as a function of nasal vowel (/ɑ̃/, /ɛ̃/ and /ɔ̃/) and task (repetition and reading), the correct identification rate is higher for Japanese learner productions (64.50%) than for Spanish learner productions (50.72%). The analyses of variance confirm this pattern. There is a main effect of population (by participants: F1 (1, 15) = 71.03, $p<0.001$; by items: F2 (1, 6) = 6.83, $p<0.05$). There is also a main effect of task: the correct identification rate is higher for words produced in the reading task (60.42%) than for those produced in the repetition task (54.78%) (by participants only: F1 (1, 15) = 17.43, $p<0.001$[7]). There is also a main effect of nasal vowel: /ɔ̃/ is better identified (67.02%) than /ɑ̃/ (54.53%) and /ɛ̃/ (51.27%) (by participants only: F1 (2, 30) = 7.16, $p<0.01$). And finally, there are two interactions, the first between the vowel and the population (by participants only: F1 (2, 30) = 67.36, $p<0.001$), and the second between the vowel and the task (by participants only: F1 (2, 30) = 36.57, $p<0.001$). Both interactions show that the identification rate for each vowel varies as a function of both the population and the task, and they underline the complexity of the system. In order to interpret them, further analyses are required.

[6] This was preferred to the more traditional correct lexical identification rate because it focuses on nasal vowel recognition and does not count errors of identification triggered by other factors such as surrounding consonants (e.g. *once* "ounce" identified as *onze* "eleven").

[7] The absence of a main effect by items in the analyses of variance may partly be explained by the small number of items we had in each category (only three).

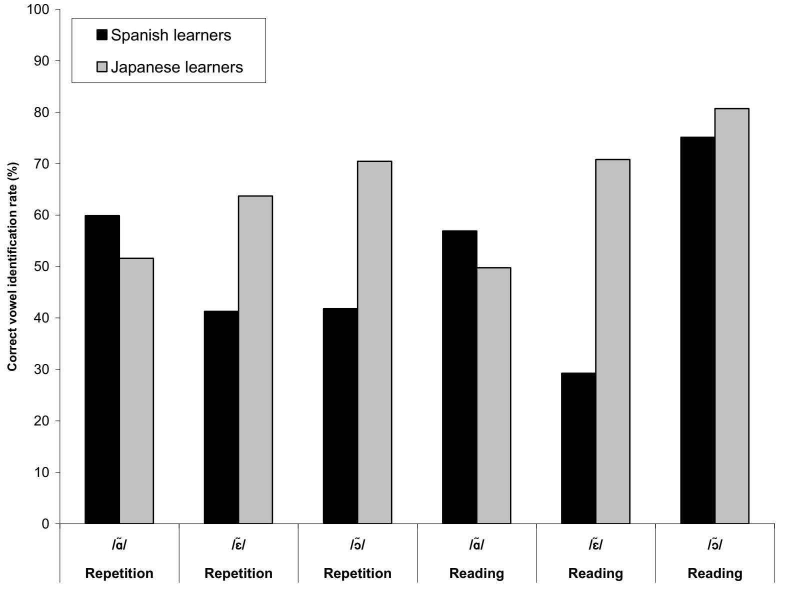

Figure 1: Mean correct nasal vowel identification rate (in percentage) for productions by Spanish learners (in black) and Japanese learners (in grey) as a function of nasal vowel (/ɑ̃/, /ɛ̃/ and /ɔ̃/) and task (repetition on the left and reading on the right).

Thus three tendencies seem to emerge from this first evaluation centred on the vocalic quality of the French nasal vowels as perceived by non-expert native listeners. First, there is an important difference between the two learner populations: Japanese learner productions are easier to identify than Spanish learner productions. Second, the results show an impact of the task on the identification of the nasal vowels. For the two groups of learners, the identification rate is higher for vowels produced in the reading task compared to the repetition task. Third, the vowel /ɔ̃/ seems to be the least difficult of the three for all learners. Before interpreting these results, we will first examine a second important criterion for the evaluation of the global lexical quality of these vowels: the degree of *postvocalic excrescence* which corresponds to the degree of presence of a postvocalic nasal consonant.

2.2. Expert perceptive evaluation and acoustic analysis of postvocalic excrescences

In this section, we present the analysis of learner productions in terms of the degree of postvocalic excrescence. This assessment was performed through an evaluation task carried out by expert native listeners, which is a method commonly used in L2 pronunciation studies (Mich, Neri & Giuliani, 2006).

Method

Participants

Speakers: The participants were 11 Japanese learners of French (3 male and 8 female; all were students at Tokyo University of Foreign Studies and came from the Tokyo metropolitan area) and 8 Spanish learners of French (2 male and 6 female; all were students at the University of Geneva and came from Spain). All learners had the same proficiency level in French (B2-C1 according to the CEFRL)[8].

Listeners: The listeners were 4 linguists who were native speakers of French and were working in Japan or Switzerland as teachers of FLE.

Material

Twelve monosyllabic words from the word lists used in the IPFC protocol were used in this study, each of them containing a nasal vowel (/ɛ̃/, /ɑ̃/ or /ɔ̃/). Each vowel appeared in three different contexts: word initial (*Andes* "Andes", *anse* "handle", *Inde* "India", *once* "ounce") (closed syllable VC), between two consonants (*tante* "aunt", *panse* "belly", *teinte* "shade", *ponce* "sand") (closed syllable CVC), and word final (*tant* "so much", *pan* "piece", *teint* "complexion", *pont* "bridge") (open syllable CV). Each word was produced twice by each learner: the first time in a repetition task and the second time in a reading out task. The final stimulus set consisted of 456 words (192 for the Spanish learners and 264 for the Japanese learners). For each learner, 24 productions (half repeated and half read) were assessed.

Procedure

The degree of postvocalic excrescence was assessed by the experts using a 3-point scale (1 = absence of postvocalic excrescence; 3 = clear evidence of postvocalic excrescence). Words produced in the repetition task were assessed first, followed by words produced in the reading task. If a word was produced twice with self-correction, only the second production was taken into account.

Data analysis

The experts' scores were first analysed to determine inter-rater reliability. The computation of inter-rater reliability was based on 1368 scores from each rater (456 scores given for vowel quality, 456 for postvocalic excrescence and 456 for global lexical quality), which means that it was based on the complete evaluation procedure described above. The inter-rater reliability coefficient measures the consistency between the assessments of the four raters and varies between 0 and 1 (1 indicates a perfect consistency between the raters). An ICC coefficient of 0.72 ($p<0.001$) was obtained, which indicates high reliability. We then calculated a mean degree of postvocalic excrescence as a function of learner population, nasal vowel (/ɛ̃/, /ɑ̃/, /ɔ̃/) and task (repetition and reading).

[8] For the expert assessment we kept all B2-C1 learners, whereas for the non-expert assessment we carried out a selection in order to have the same number of speakers in both learner populations.

Results

As can been seen in Figure 2, which presents the mean degree of postvocalic excrescence in the productions of Spanish and Japanese learners as a function of nasal vowel (/ɑ̃/, /ɛ̃/ and /ɔ̃/) and task (repetition and reading), the degree of postvocalic excrescence is higher for Spanish learner productions (1.69) than for Japanese learner productions (1.34). The analyses of variance confirm this pattern. There is a main effect of population (by participants: F1 (1, 17) = 10.10, $p<0.01$; by items: F2 (1, 9) = 17.34, $p<0.01$). There is also a main effect of task: the degree of postvocalic excrescence is higher for the words produced in the reading task (1.69) than for those produced in the repetition task (1.44) (by participants: F1 (1, 17) = 7.75, $p<0.05$); by items: F2 (1, 9) = 5.14, $p<0.05$). There is also a main effect of nasal vowel: the degree of postvocalic excrescence is lower for /ɔ̃/ (1.29) than for the two other vowels (/ɑ̃/: 1.55 and /ɛ̃/: 1.72) (by participants only: F1 (2, 34) = 23.52, $p<0.001$). And finally, there is an interaction between the vowel and the task (by participants only: F1 (2, 34) = 3.67, $p<0.05$). This interaction shows that postvocalic excrescence varies as a function of the task and underlines that the variables examined are linked together. Further analyses are required to examine these interrelations.

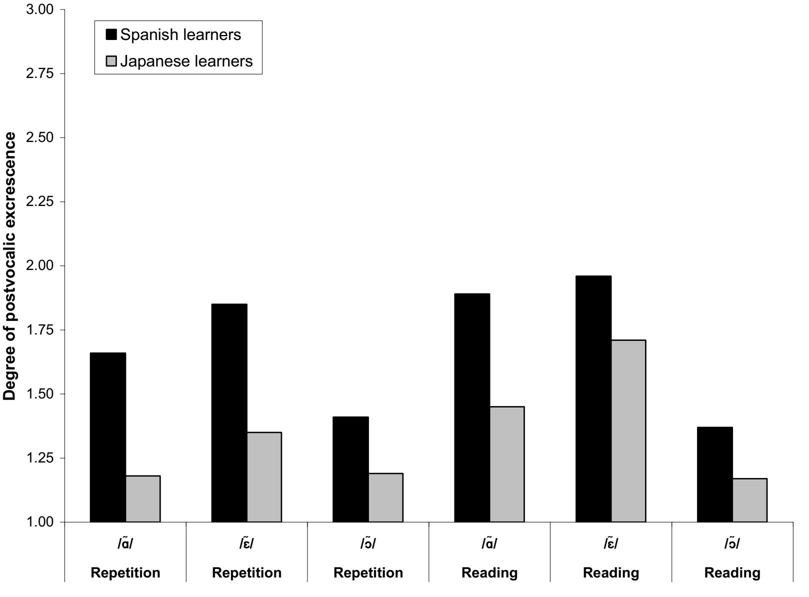

Figure 2: Mean degree of postvocalic excrescence (on a scale of 1 (= absence of a postvocalic consonant) to 3 (= clear evidence of a postvocalic consonant)) in the productions of Spanish learners (in black) and Japanese learners (in grey) as a function of nasal vowel (/ɑ̃/, /ɛ̃/ and /ɔ̃/) and task (repetition on the left and reading on the right).

In order to check the reliability of the perceptual analysis, we carried out an acoustic analysis on two items (38 productions of the word *tant* ("so much") and 38 productions of the word *tante* ("aunt")). Acoustic measures were performed by two phoneticians using Praat (Boersma & Weenink, 2009), on the basis of spectrograms. Acoustic cues used to determine the presence of a postvocalic consonant in *tant* and *tante* were the following: 1) discontinuities in the formants after the vocalic nucleus [ɑ̃] or [ɑ]; 2) weak energy of the first formant (about 250-300 Hz regarding the vocalic nucleus); 3) measure of antiresonance frequencies (third formant) at about 800-1000 Hz; 4) very weak amplitude regarding the vocalic nucleus, i.e. a difference of 9 to 15dB for most of the productions we analysed (Hardcastle & Laver, 1997: 488; Ladefoged, 2001: 54). Thus the acoustic analysis procedure was performed without previous categorization, and the occurrences with and without postvocalic consonant were counted after examination of the formant configuration, formant values and amplitude difference. In 8 cases out of 76, which represent 10.53% of the data, the presence/absence of a postvocalic consonant could not be determined. The principal reason was a too high value for F1.

Results for the evaluation performed by experts and for acoustic analysis are convergent and show two tendencies that seem to be shared by the two learner populations for the words *tant* and *tante*. First, the degree of postvocalic excrescence is higher for the words produced in the reading task than for those produced in the repetition task. Thus, in the expert evaluation, the two words obtained a degree of postvocalic excrescence of 1.88 for the reading task *vs* 1.43 for the repetition task ($t(37) = 3.97$, $p<0.001$). Acoustic analyses show a similar effect: if we take into account the totality of the values ($n = 68$), a postvocalic consonant was more often present for words produced in the reading task ($n = 24$) than for words produced in the repetition task ($n = 15$) ($\chi^2 = 4.87$, $p<0.05$). Second, a postvocalic consonant was more often present for *tante* than for *tant*. Thus, in the expert evaluation *tante* obtained a degree of postvocalic excrescence of 1.94 *vs* 1.37 for *tant* ($t(74) = 3.77$, $p<0.001$). Acoustic analysis shows the same pattern: if we take into account the totality of the values ($n = 68$), a postvocalic consonant was more often present for *tante* ($n = 26$) than for *tant* ($n = 13$) ($\chi^2 = 8.47$, $p<0.05$).

Figure 3 presents the mean degree of postvocalic excrescence for each word in the expert evaluation. Words are classified from left to right as a function of both populations' mean. It shows that the pattern observed for *tant* and *tante* can be generalized: CV words (i.e. *pont* "bridge", *pan* "piece") obtain the lowest degree of postvocalic excrescence. These are followed by VC or CVC words in which the last consonant is [s] (i.e. *once* "ounce", *ponce* "sand", *anse* "handle", *panse* "belly"). And finally, words that obtain the highest degree of postvocalic consonant are CV or CVC words in which the last consonant is a plosive (voiced or voiceless) with the same place of articulation as that of the postvocalic consonant (i.e. *Andes* "Andes", *Inde* "India", *teinte* "shade" and *tante* "aunt").

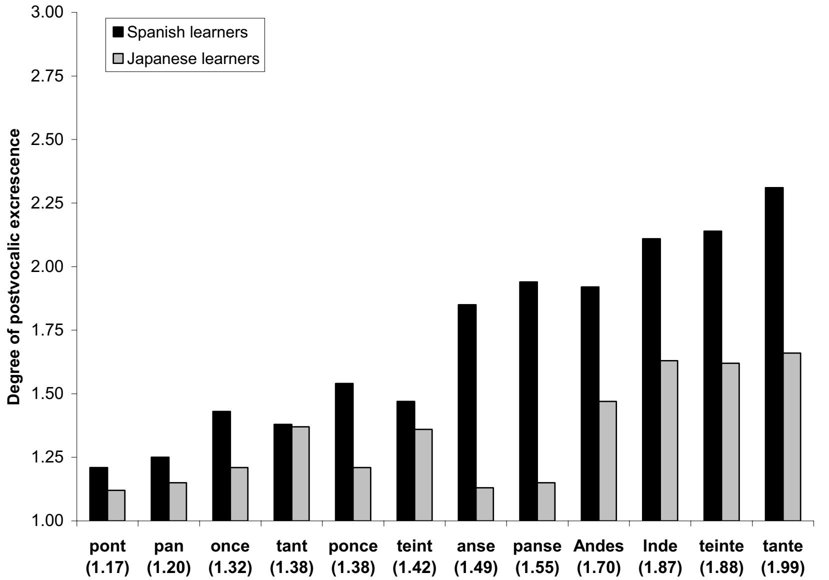

Figure 3: Mean degree of postvocalic excrescence (on a scale of 1 (= absence of a postvocalic consonant) to 3 (= clear evidence of a postvocalic consonant)) in the productions of Japanese learners (in grey) and Spanish learners (in black) as a function of words. For each word, the global mean of both types of learners is indicated between brackets).

3. General discussion

In order to interpret the population effect (Japanese > Spanish), we have to remember that the two populations were evaluated as quite similar in terms of their linguistic levels (according to the descriptors of the CEFRL[9]) and have similar phonological vocalic inventories in their L1 (/a, i, u, e, o/). One differentiating factor that needs to be considered from a psycholinguistic viewpoint is the degree of *focus-on-form* or *focus-on-forms*[10]. Given the interlinguistic distance between each L1 and the French language, not only on a strictly linguistic level but also considering their phonographemic realisations, it is possible to hypothesise that the Japanese learners might have paid, willingly or unwillingly, more attention to formal linguistic aspects of their learning than the Spanish learners. It must be borne in mind that French and Spanish, which are both Romance languages with complex syllabic structures, differ from Japanese not only linguistically (Japanese is usually described as an Altaic-type language with a moraic system in which complex syllables are globally illicit), but also in their graphemic systems. The Spanish system is an alphabetic one with

[9] It must be noted, however, that two learners of a seemingly similar CEFRL level can vary greatly in terms of skills, depending on individual linguistic and pedagogical biographies.
[10] In our case, the distinction does not matter so much (Ellis, Basturkman & Loewen, 2002; Trofimovich & Gatbonton, 2006).

Roman script and rather shallow orthography, whereas the Japanese system is partly deep and non-alphabetic (essentially with a morphophonic – *kanji* – and a two-script moraic – *kana* – component). This interlinguistic distance bears strong psycholinguistic implications for the learning process (e.g. new reading procedures[11] and new syllabic types for the Japanese learners). Therefore, at an equal linguistic level, the attentional load or focus may be different for the two populations: with better results for the Spanish learners on both formal and communicative dimensions in the initial stages but better results for the Japanese learners on the formal level at a latter stage (given a similar and constant attentional focus), as seems to be the case in our results. Such strong hypotheses must be tested longitudinally and the results are bound to fluctuate according to inter- and intra-learner variation. Yet, given the profile of our populations (Spanish learners in linguistic immersion in Geneva *vs* Japanese learners specialising in French in Tokyo), they provide initial psycholinguistic elements of interpretation for the global inter-population differences.

The task effect identified in our results must be interpreted from a psycholinguistic viewpoint, since both the initial physical stimuli and the cognitive process involved in the reading and repetition tasks are not identical. On the one hand, in the repetition task, the linguistic input can be perceptually altered twice: once by the learners and once by the native listeners. On the other hand, in the reading task, given the inherent physical characteristics of the stimulus, it is only the second perceptual stage that really matters (except in the case of pathological or attentional disorders). In the case of vowel quality for example, even though correct graphemic identification does not guarantee the production of a phonetically correct unit in the target language system, it seems plausible to state that the reading task is more favourable to input faithfulness than the repetition task. This position is motivated by psychophysic reasons (low or even zero noise in visual modality as opposed to auditory modality) and psycholinguistic arguments (graphemic categories identification is possibly more robust than phonological categories identification). In that case, the orthographic input would play a positive role in the identification of certain phonemic categories (Steele, 2005). In terms of postvocalic excrescence on the other hand, the opposite results (better scores in the repetition task) serve as a reminder that orthography can have an effect – a negative one here – on both suprasegmental (Detey & Nespoulous, 2008) and segmental levels (Detey, Durand & Nespoulous, 2005): erroneous graphemic segmentation for the first level and automatic graphophonemic activation for the second (Dijkstra, Frauenfelder & Schreuder, 1993). In the repetition task, the degree of presence of an epenthetic consonant – absent from the initial input – is thus unsurprisingly lower than in the reading task. If we put aside performance errors, three arguments can be put forward: on a psychoacoustic or phonological level by a perceptual or interphonological reinterpretation of the nasal vowel; on a psycholinguistic level by the activation of a phonological or orthographic lexical representation with a lexicalized epenthetic consonant; and on an articulatory level by automatic coarticulation mechanisms either universal or transferred from

[11] Despite their general knowledge of English.

the L1. If we take into account the differences between the three phonographemic systems, we can consider that Japanese learners (or at least our subjects) benefit in that instance from the interlinguistic distance. For both populations, learning French involves a process of linguistic abstraction partly linked to the depth of the French orthography ("mute" letters, complex graphemes, distinct morphophonological oral and written forms, etc.). Even though reading aloud in French would a priori be cognitively less demanding in the initial stages for Spanish learners given the similarities mentioned above between the two writing systems, it seems possible that, given their L1 system (with the kana[12] and even more so with the kanji), the Japanese learners might be able to set up graphophonemic correspondences for non-lexical route in the reading process with graphemic units larger than single letters more easily – or at least in a more robust mode – than our Spanish subjects. Such hypotheses must be thoroughly tested before further interpretation, but they may partly explain why the presence of a consonant letter has a lower impact on the Japanese subjects in the reading task than on the Spanish learners (at least at such an advanced level of learning).

Our results of the correct vowel identification rate lead to the following ranking: /ɔ̃/ > /ɑ̃/ > /ɛ̃/. If we follow the hypothesis of Paradis and Prunet (2000), according to which nasal vowels should be considered Oral vowel + Nasal consonant sequences, we must take into account the recent work of Montagu (2002, 2007), which shows that corresponding oral vowels in contemporary French are respectively /o/, /ɔ/, and /a/. This points to the fact that /ɑ̃/ is the only vowel without an equivalent category in the L1 (Japanese or Spanish) which could have been positively transferred into the target language. Yet, when we take into account the graphemic dimension, it is /ɛ̃/ that seems to be the most costly in terms of cognitive processing, as it has the highest number of graphic variants in French (as compared to /ɑ̃/ and /ɔ̃/)[13]: /ɛ̃/ was actually the only one to be represented as a trigram in the reading task (*teinte* and *teint*), and the results for /ɛ̃/ in the reading task concur with those in Garrott's work (2006). Finally, it should be noted that the standard French contemporary vocalic nasal system has been undergoing a progressive phonetic change (Hansen, 2001) which could entail a higher degree of perceptual confusion for non-native speakers between /ɑ̃/ and /ɛ̃/ because of low aperture, making /ɔ̃/ perceptually more salient in terms of lip rounding and closure. Therefore, according to our global results, /ɔ̃/ seems to be the easiest category to learn and to identify.

Lastly, the interpretation of the excrescence rates in the CV (*tant)* and (C)VC (*tante)* structures draws a distinction between the two populations, despite general convergences: it is a well-known fact that such excrescences can be found in southern varieties of French in metropolitan France, especially the dorsal [ŋ] (Johnson, DiCanio & McKenzie, 2007). This partly illustrates the process that Paradis and Prunet (2000) call *unpacking*, according to which a nasal vowel turns into the sequence Oral Vowel + Nasal Consonant – the opposite direction of the historical evolution of

[12] The case of the nasal segment /N/, transcribed as < ん > in hiragana and < ン > in katakana, is special.
[13] According to Sylvain Lavoie's analysis of the French dictionary *Petit Robert* (2004) available in the *Lexique* database, there are 41 *graphic* forms for /ɛ̃/, 36 for /ɑ̃/ and 23 for /ɔ̃/. These figures are merely informative and have no explanatory purpose. Dec. 29, 2009 <http://www.lexique.org/public/graphemes-phonemes.php>.

standard French. Thus, the excrescences can be viewed as reflecting a relatively universal process, possibly towards less marked structures. However, we must not overlook the distinct features of the two L1s. Unlike Spanish, Japanese does not tolerate consonantal codas, and a word such as « tante », if it were borrowed or adapted in Japanese, would turn into a trimoraic sequence such as /ta.N.to/, with the underspecified moraic segment /N/. Therefore, in the analysis of our results, it is of great importance to take into account both segmental and metrical distinctions: whereas the Spanish learner must process a segmental adaptation (the nasal vowel, either as a mono- or biphonemic unit), the Japanese learner must also process a suprasegmental adaptation (consonantal coda).

4. Conclusion

In this study, we assessed the quality of realisation of French nasal vowels produced by Japanese and Spanish learners in two tasks: repeating and reading aloud the same word list. The assessment was carried out by non-experts in a vowel identification task and by experts in an excrescence evaluation task. Four global trends emerged from our results: 1) better performance by Japanese learners as compared to Spanish learners; 2) better results in the reading task as compared to the repetition task in terms of vocalic quality, but opposite results in terms of postvocalic excrescences; 3) better results for /ɔ̃/ as compared to /ɛ̃/ and /ɑ̃/; 4) a higher degree of postvocalic excrescences in closed syllables.

The task effect brought to light in our results has direct implications, both on a methodological level for research in the field of L2 – and maybe even L1 – phonology, and on a pedagogical level for oral language education. On a methodological level, it seems necessary to include different types of tasks in oral corpus protocols. If this is already true for native speakers (see for example the PFC protocol with two reading tasks and two conversation tasks), it is all the more true with non-native speakers, since the developing interphonological (and interphonetic) system of each learner is even more heavily influenced by the psycholinguistic characteristics of each task. Both modalities (auditory and visual) should be involved, as well as both the perceptive and the productive side of the learner's interphonological system. On a pedagogical level, our results point to the necessity of providing a well-balanced task-rich learning environment in which both phonetico-phonological and phonographemic competences can develop simultaneously (Detey, 2005).

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