

Characterization of Mandarin-accented French across three different speaking styles: a corpus-based study

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ABSTRACT

This paper investigates the production of oral vowels and voiced fricatives in Mandarin L2 French across different speaking styles. We analyzed a corpus of 5 hours' speech from fifteen Mandarin learners of French performing three different production tasks of increasing complexity: isolated word reading, text reading and spontaneous conversations. Similar data from one hour's recording of five French natives were used for comparison. Results show that rounded vowels, although part of the Mandarin inventory, tend to be less rounded than those of natives, whereas voiced fricatives are poorly voiced due to their absence from the Mandarin system. Results also reveal challenges in the continuous speech task, highlighting the importance of specific training for L2 learners. The main differences found between natives and L2 speakers lay in the amount of vowel reduction and the degree of voicing of the voiced fricatives as speech changes from reading to spontaneous speaking style.

Keywords: Mandarin learners, L2 French, vowel reduction, fricatives, speaking styles.

1. INTRODUCTION

1.1 Variation and reduction in spoken languages

It is well established that the quality of foreign accent highly depends on the learner's native language. It is therefore important for L2 teachers to put much emphasis on those sounds that are different from the L1 language. However, it is not enough to be able to pronounce L2 sounds correctly only in the base form of the word; after all, seldom do we speak in the same way as does an electronic dictionary. Variation and reduction are omnipresent in spoken language production and highly dependent on factors such as speaking style, environment, social context and the relationship between the speaker and the listener [1].

While a native speaker usually switches between different degrees of variation and reduction

without effort, it can be challenging for L2 learners to produce the reduced forms of the target language appropriately [2]. For instance, Gut [3] showed a lack of sufficient vowel reduction in German by English learners. Meanwhile, variation and reduction are often related to the rate of speech and the duration of segments, and L2 learners are known to have a slower speech rate in general.

Recently, more L2 oral corpora have been created for studying L2 phonetics and phonology, together with thorough annotations, permitting a more comprehensive description of L2 learners' pronunciation and accent. Aside from its linguistic purpose, the study of L2 oral corpora can serve as a valuable reference for the design of specific pronunciation training programs. L2 pronunciation training is supposed to be most effective when conducted with material appropriately adapted to the specific L1 difficulties. In our study, we have based our analyses on a newly collected oral corpus, which includes the reading of word lists, the reading of texts and spontaneous conversations by Mandarin learners of French (ChiLFreSC).

1.2. Some differences between the French and Mandarin phonological systems

One of the most notable differences between the Mandarin and French phonological systems is the occurrence of voiced occlusive and fricative consonants. Although rich in both fricatives and affricates, Mandarin possesses only one *voiced* fricative /ʒ/, and the main opposition for the occlusives is made by the distinctive feature of aspiration rather than voicing. While previous studies [4, 5, 6] investigated the problems of Mandarin learners of French when producing voiced occlusives, the production of voiced fricatives has not yet been studied extensively.

The presence and frequency of nasal and rounded oral vowels are further distinguishing features of the French phonological system when compared with the Mandarin inventory. In French, six out of ten oral vowels (excluding the central vowel /ə/) and all of the back vowels /u, o, ɔ/ are rounded

vowels. In Mandarin, there are two confirmed rounded vowels /y/ and /u/. The roundedness of the middle vowels is as debatable as the inventory of the middle vowels themselves. Five variants of mid-vowels have been noted by Xu [7], namely [o], [E], [ɤ], [e] et [ə]. The author believes at the same time that [o], in the syllable [wo], is not completely rounded, and according to Duanmu [8] the unrounded [ɤ] is the most spoken variant in Mandarin, a vowel which is basically distinguished from [ə] more by its duration than by its quality. The mid rounded vowels in French /ø, œ/ are therefore challenging for Mandarin learners for they are not only constantly rounded but also different from each other with respect to the degree of tongue aperture, as shown in the study of Wang [9].

2. OBJECTIVES AND HYPOTHESES

The present study wants to gain a more comprehensive understanding of the production strategies of Mandarin learners of French on the segmental level. In order to do so, our corpus includes all the oral vowels (excluding schwa) and all the fricatives of the French system. Moreover, we aim to describe the variation and reduction of the L2 speech in comparison to the L1 speech across three speaking styles, namely, isolated word reading, text reading and spontaneous conversations. We hypothesize the degree of vowel centralization and reduction to be smaller in L2 than in L1 speakers. With respect to the production of the fricatives /v, z, ʒ/, less voicing should be found in L2 speech, and depending on the position of the fricative and the speaking style, the quality of voicing might be different. The overall results of the study will serve as the main reference for an on-going pronunciation training program targeted at Mandarin learners of French from the Beijing Language and Culture University.

3. METHODS

2.1. Participants and recordings

Fifteen female Mandarin learners of French (mean age 22, SD: 2.1) participated in the experiment that consisted of reading 50 isolated words, then reading three different texts corresponding to the level between B1 and B2 of the CEFR [10], and two short conversations with the investigator. At the moment of recording, all Mandarin participants had learned French for at least one and a half years with a level between B1 and C1 based on the results from standard tests such as DELF and DALF [11]. According to their auto evaluations, 8

participants believed that they had a strong to very strong foreign accent. Five French female native speakers from the Parisian region (mean age 23, SD: 1.4) completed the same tasks.

2.2. Data processing

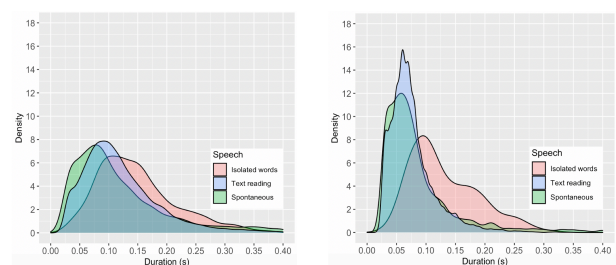
All data were processed with the help of the LIMSI forced alignment system [12] before a manual correction. The acoustic parameters were extracted using Praat [13]. For each parameter, a single value was obtained by averaging measurements made at 1/3, 1/2, and 2/3 of the segment. 70647 and 25498 segments were collected from the L2 and L1 speech respectively, among which 24531 and 8809 are oral vowels, 3233 and 1330 are voiced fricatives. The duration and the first three formants were analyzed for oral vowels. The analysis of the voiced fricatives was based on the f0 ratio.

4. RESULTS

4.1. Oral vowels

4.1.1. Duration

While the mean duration of vowels is shortest in text reading for both groups (L2: mean=123 ms, SD=76 ms; L1: mean=76 ms, SD=40 ms), L2 learners show longer vowel durations in each of the three speaking styles, in particular in text reading (L2:L1=1:0.61) and spontaneous speech (L2:L1=1:0.68). For both L1 and L2 speakers, the highest variability of vowel duration occurs in spontaneous speech, which explains its longer mean duration in comparison to text reading, even though more short vowels (duration < 50ms) occur in spontaneous speech.



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4.1.2. F1/F2 space

Figure 2 shows that Mandarin learners occupy a larger F1/F2 space compared to the L1 speakers, and that less vowel centralization can be observed from isolated word reading to spontaneous speech for L2 than for L1. The two-way ANOVA with

independent factors *Speaker* and *Phoneme* shows a significant difference between L1 and L2 for F1 ($p < 0.001$) but not F2. The higher F1 suggests that L2 learners produced French oral vowels with a lower tongue position and a more open mouth.

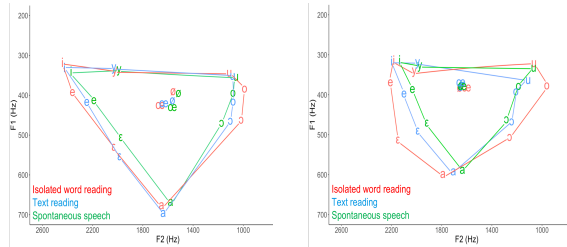


Figure 2: F1/F2 plot of French oral vowels produced by Mandarin learners (left) and French natives (right) by speaking style.

4.1.3. Roundedness

We grouped the oral vowels into rounded vowels /u, o, ɔ, ø, œ, y/ and unrounded vowels /i, e, ε, a/. Figure 3 compares the difference between F3 and F2 (F3-F2) according to the roundedness of the vowels. The F3-F2 difference value for rounded vowels is much higher for Mandarin learners than for native speakers, while the value for unrounded vowels is rather similar for the two groups. Since a lower F3 is associated with more roundedness, the results suggest that the Mandarin learners produced the French rounded vowels with less lip rounding in all three speaking styles.

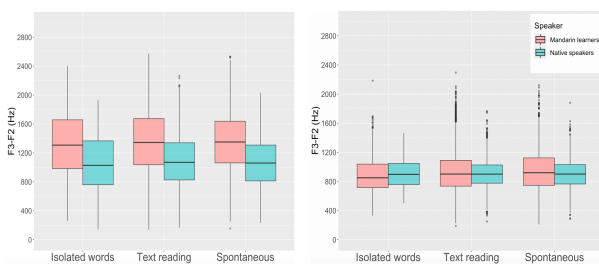


Figure 3: Difference between F3 and F2 in Hz for the rounded vowels /u, o, ɔ, ø, œ, y/ (left) and the unrounded vowels /i, e, ε, a/ (right) for Mandarin learners (red) and French natives (green).

The rounded vowels /u, y, o, ɔ/ occur in the Mandarin vowel inventory (though /o, ɔ/ are questionable). However, Figure 4 shows that F3-F2 difference for these four vowels is even larger between the two groups of the speakers ($p < 0.001$), suggesting that in Mandarin the rounded vowels are less rounded as compared to the French vowels of

the same category. The largest F3-F2 variability is found in text reading for the Mandarin learners (mean = 1432; $\sigma = 566$), while for French speakers, no significant F3-F2 differences have been observed.

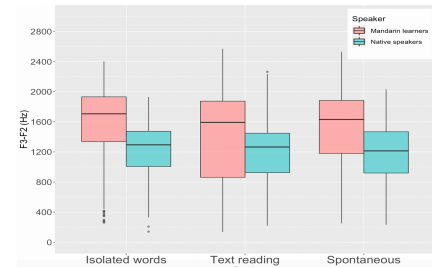


Figure 4: Difference between F3 and F2 in Hz for the rounded vowels /u, o, ɔ, y/ for Mandarin learners (red) and French natives (green).

4.1.4. Diffusion

/i, y, e, ε/ are intrinsically diffuse vowels as the distance between F2 and F1 (F2-F1) is larger compared to the compact vowels /u, o, ɔ, a/. For Mandarin learners, the compact vowels are more compact ($p < 0.001$), and the diffuse vowels are more diffuse ($p < 0.001$) in comparison to French natives in the three speaking styles (see Figure 5). For Mandarin learners there is no significant difference of the diffusion in the compact vowels between the three speaking styles, and the significant difference of the diffusion in the diffuse vowels is only found between isolated word reading and spontaneous speech ($p < 0.001$). The French native speakers, however, show a clear distinction in the diffusion of the diffuse vowels for the three speaking styles ($p < 0.001$), with the mean value of F2-F1 being 1789 Hz in isolated word reading, 1681 Hz in text reading and 1629 Hz in spontaneous speech.

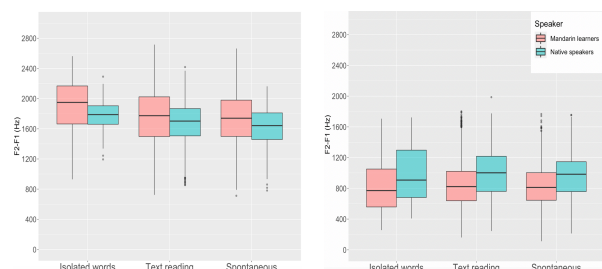


Figure 5: Difference between F2 and F1 in Hz for the diffuse vowels /i, y, e, ε/ (left) and compact vowels /u, o, ɔ, a/ (right) for Mandarin learners (red) and French natives (green).

4.2. Voiced fricatives

Among 11624 fricatives collected in both L1 and L2 speech, 4563 were the voiced fricatives /v, z, ʒ/. 1410 were positioned at the beginning of words, 2146 in the middle, and 1000 at the end. Overall, the t-test shows significant differences of f0 ratio ($p < 0.001$) between the Mandarin learners and the French native speakers in all positions. As shown in Table 1, the mean f0 ratio of the voiced fricatives produced by the Mandarin learners is systematically lower when compared to native speakers. The largest difference occurs in spontaneous speech, in which the mean f0 ratio is 0.83 for the native speakers and only 0.59 for the Mandarin learners. No significant effect of speaking style on the f0 ratio is revealed for Mandarin learners, while French speakers show a significant difference between word reading and spontaneous speech ($p < 0.05$). Both groups voiced the fricatives the most when they occurred inter-vocally; the vowels may have facilitated the voicing of the embedded fricatives. With respect to position, the most significant difference between the two groups is found in word-final position, with on average, less than half of the segments being voiced for the Mandarin learners. The French subjects have approximately the same voicing ratio in word-initial and word-final position.

	Mandarin learners			French native speakers		
	Beginning	Center	Final	Beginning	Center	Final
Total	0.65 (0.35)	0.77 (0.32)	0.49 (0.37)	0.79 (0.31)	0.95 (0.16)	0.81 (0.31)
Word reading	0.48 (0.30)	0.70 (0.36)	0.31 (0.30)	0.58 (0.26)	0.90 (0.17)	0.50 (0.31)
Text reading	0.67 (0.34)	0.79 (0.32)	0.53 (0.37)	0.81 (0.31)	0.97 (0.14)	0.83 (0.31)
Spontaneous	0.62 (0.37)	0.71 (0.34)	0.42 (0.34)	0.80 (0.31)	0.91 (0.22)	0.78 (0.31)

Table 1: Mean f0 ratio (SD) of the voiced fricatives /v, z, ʒ/ by speaking style.

Looking at the consonants individually, Figure 6 shows that for French natives, /z/ is the fricative with the strongest voicing. This may be partially explained by the much higher rate of produced liaisons when compared to the Mandarin learners. Most of /ʒ/ occurrences in final position feature an f0 ratio of around 20% for the Mandarin learners, while for the natives more /ʒ/ occurrences are found with higher f0 ratios.

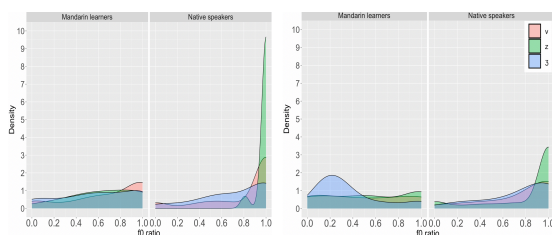


Figure 6: The density of f0 ratio of the voiced fricatives in initial (left) and final position (right).

5. DISCUSSION AND CONCLUSION

Our study confirmed the difficulties of pronouncing rounded vowels and voiced fricatives for Mandarin learners of French in all three examined speaking styles. Interestingly, compared to the rounded vowels which were unknown and new to the Mandarin learners, those present in the Mandarin inventory were not necessarily produced better; rounded vowels in French are likely to be more rounded than the rounded vowels in Mandarin. In addition, the commonly studied F1/F2 dimension may not be sufficient to measure the degree of foreign accent during French vowel productions, and the analysis of F3 should be considered for lip rounding. The examination of the F1/F2 space nevertheless revealed the varying degrees of centralization between L1 and L2 speakers with a decrease in formality. For the Mandarin speakers, the difficulty lies particularly in continuous speech where natives realize shorter vowel durations and larger degrees of reduction.

Though Mandarin learners showed a larger voicing ratio for the voiced fricatives in text reading and spontaneous speech than isolated word reading, the difference of the voicing ratio between the two groups is also larger in the two types of continuous speech. This phenomenon again confirms the major challenge that continuous speech presents for L2 learners. It also should be noted that while for the French speakers centralization and reduction seem the most important characteristics of vowel production in continuous speech, a continuous increase, rather than weakening, of the voicing feature occurred during the production of voiced fricatives. Therefore, continuous speech may not only be marked by “reduction”, and more studies should be devoted to language-specific rules of connected speech production for the L2 learners. Meanwhile, since our study has been purely based on the analyses of acoustic parameters, future research could involve perception tests of native speakers to evaluate whether the difficulties encountered by Mandarin learners in continuous speech are associated with a more noticeable foreign accent.

6. REFERENCES

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