The strategy for the production of French nasal vowel in Japanese students

Observation of the articulation which brings F1 change

Kyoko Takeuchi, University of Tokyo
Takayuki Arai, Sophia University

1 Introduction How does the student who doesn't know "certain vowel is a nasal", when they imitate the native speaker's model sound? It is possible to use some strategy except for lowering the uvula and obtaining the resonance of a nasal cavity: compensation for the general articulation in nasals. Precedence research indicated that when we considered the acoustic feature of nasals, F1 falls and approaches N1 (the first Formant of nasal), the grade of nasalization goes up (Maeda 1993). Japanese French students may also use this strategy to say nasals. Especially in French nasal vowel [ɑ̃], instead of getting the real resonance of a nasal cavity, they may use...
(1) mouth closing,
(2) lip rounding and lips pushing to lower F1.
In order to verify these methods, we conducted two experiments: 1) we made French beginners hear French native speaker's model sound and we measured the position of articulation in image data of video (from the subject's front and side), 2) the result was compared with the result of another experiment (evaluation of articulation of the French native speaker's model sound by Japanese students).

**2 Experiment 1 (Observation of Articulation of French Nasal Vowel)**

2.1: Method
Subjects are Japanese high school students (two females) who have never learned French, high school students with one year of study background (three females) and received French lessons 2 hours for a week, and high school student with one year and 3 months of study background (one male, two females) who received the French lessons of 2 hours for a week. They heard French model sound by using headphones and repeated them. Stimulus sound is made by two French native speakers (one male, one female). 3 French nasal vowels [ɛ̃] [õ][ɑ̃],French 5 oral vowels ([ɛ], [o], [ɑ] which correspond with the 3 nasal vowels and [a], [ɔ] for comparison) were uttered randomly by each native speaker, and they were heard 3 times respectively (total of 48 stimuli). We used only isolated vowels because it is easier to see the speaker's mouth movement. We separated the nasal vowel's test and the oral vowel's test, but we made them heard at random within the model speakers. The interval between stimuli is 6 seconds. We recorded the sounds to DAT and we took two video tapes from front and side. We made subject's head at fixed position. 1cm section paper was projected in side of the subject and middle of the subject's nose. We use this section paper for standard scale for analysis. This time, we use only the data of nasal vowel [ɑ̃] (which has the large mouth opening) and oral vowels [ɑ], [a] for analysis.
First, we checked that the perpendicular line (nose line) was not shifted. Second, we measured the rest position of the lips. (Therefore, this fiducial point change by subject).
<Measurement from side>

(1) Distance of upper lip and lower lip……Length from the top of lower lip and the top of upper lip and taking the perpendicular line. (v in Figure 1)

(2) lips pushing……maximum length of h in Figure 1.

top of upper lip↓

↑
v
↓

top of lower lip↑ ←h→
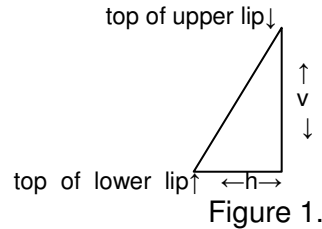
Figure 1.

<Measurement from front>
The degree of lips rounding and lips pushing .(We measured the lip length)

2.2: Result
Figure 1 shows the measurement from the side. The result of the subject of some subject was shown in Figure 2. In each subject, it is clear that the nasal vowel [ã]and the oral vowel [ɑ] are different in degree of mouth opening. With the nasal vowel, the mouth was almost closed. However, pushing the lips didn't present too much change. Moreover, especially in the nasal vowel, the subjects didn't push the lips but closed them in many cases.
The horizontal axis of Figure 2 and Figure 3 correspond to each stimulus sound, and "f" and "m" indicates female and male. "a" indicates [ɑ], "a2" to be [a], "an" to be [ã .]The units are mm(s). 6cm in the video was 10cm in actual measurement of h and v from side. 7cm in the video was 10cm in actual measurement from front. Since this time we observed relative value, conversion has not done. According to Figure 3, the pulling lips of the nasal vowel was almost same as that of the oral vowel.

2.3: Discussion
When the subject repeated the nasal vowel of the model, there was a tendency to pronounce with closing and spreading lips. They used almost the same degree of lips pushing in the nasal vowel and in the oral vowel. They also used the spreading lips and closing mouth for this nasal vowel.
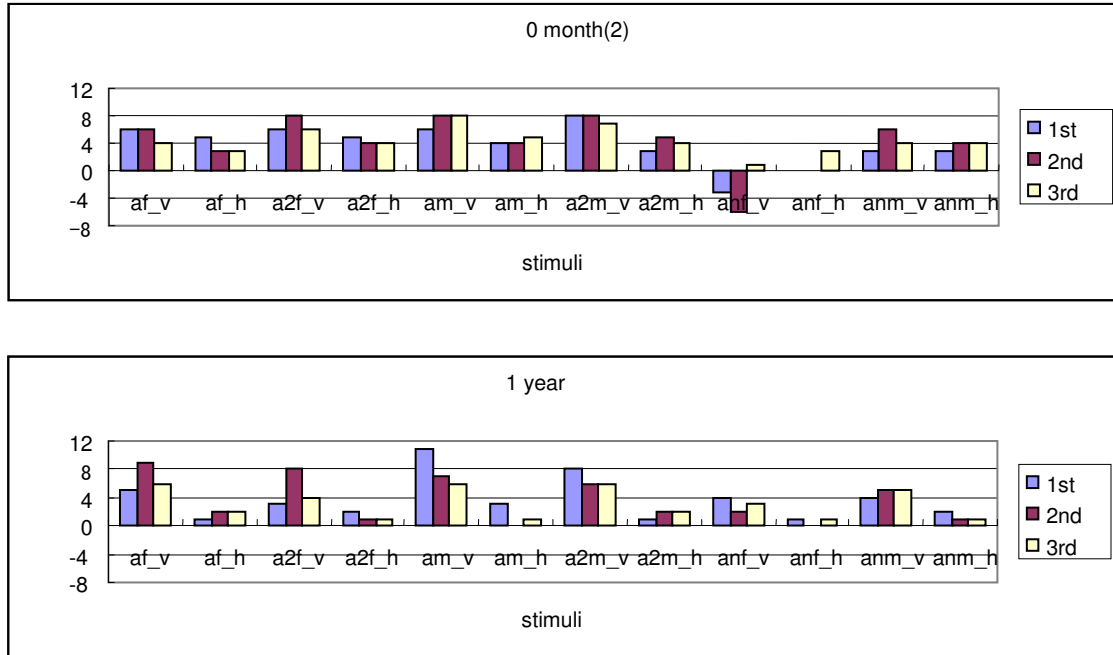

0 month(1)
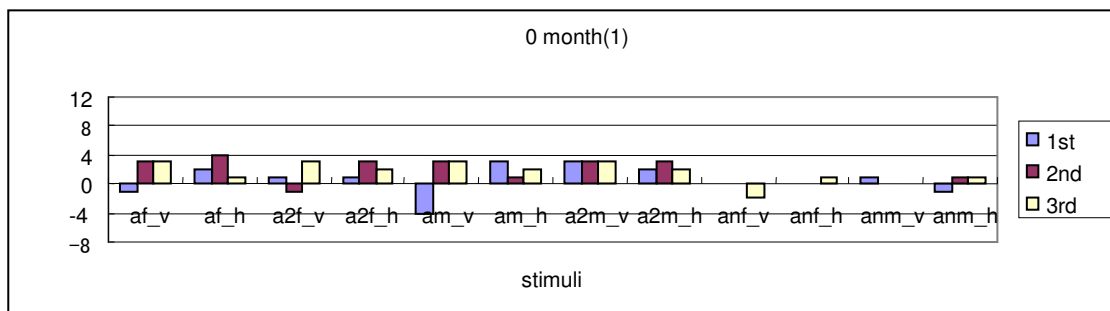
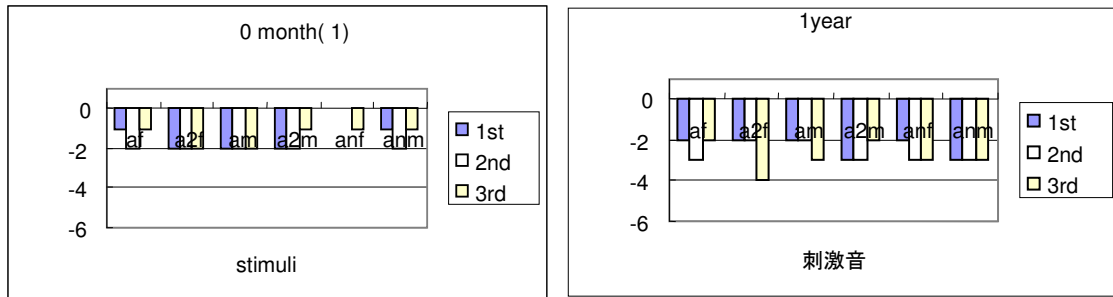Figure 2. result of French oral vowel and nasal vowel (side)

Figure 3. result of French oral vowel and nasal vowel (front)

3 Experiment 2 (Comparison with Evaluation of Articulation of French Nasal Vowel)

3.1: Method

Subjects choose how they believe the speaker's mouth moved based on the scale of the answer sheet.

The highest position of the tongue

1 front 2 central 3 back

mouth opening

1
2
3
4
5

front   back

←lip pushing
2 big   1 small   0

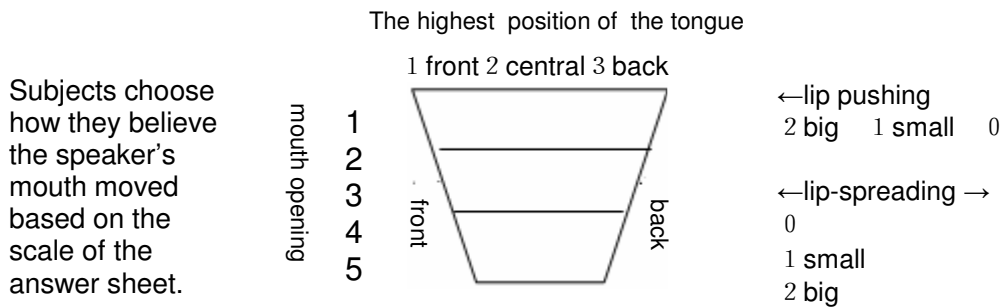←lip-spreading →
0
1 small
2 big

Figure 4

We compared the result of the Experiment 1 and that of the perception test by the subjects with one year of study background, and with one year and 3 months. They heard the sound of the French native speaker, and evaluate native speaker's articulation. The result of actual articulation measurement of Experiment 1 is performed. We used the sound of 3 French nasal vowels [ɛ̃] [õ] [ɑ̃] *4 speakers *2 times. The subjects imagined and evaluated the native speaker's articulation using an answer sheet (Figure 4).

3.2: Result

The result of the evaluation test is in Figure 5. In [ɑ̃] (an1), the evaluation of the lips opening is not so wide. The standard value (value 5 of the line graph of Figure) of the textbook for pronunciation was very different from the result of this evaluation.
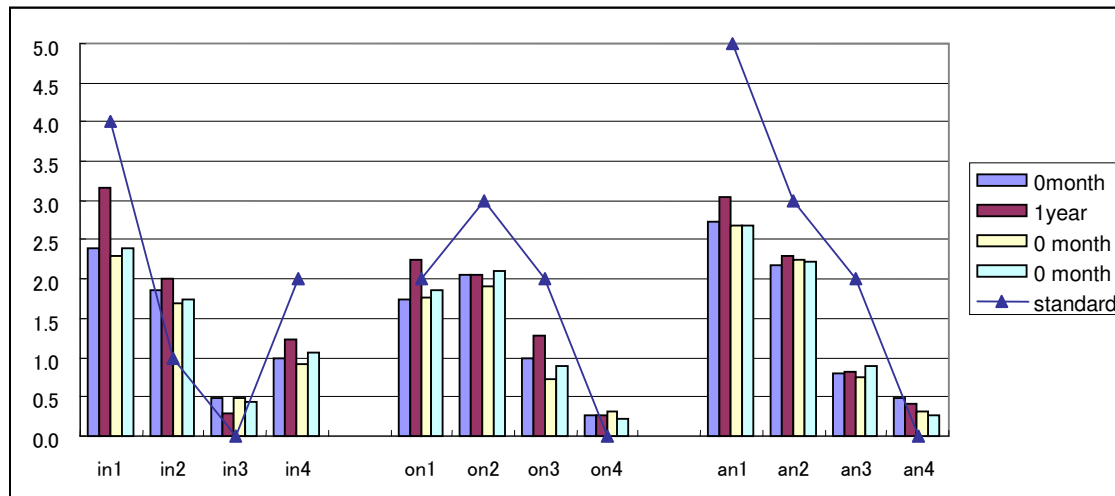

Figure 5 Result of French nasal vowel evaluation test

3.3: Discussion

The degree of lowering the jaw in actual articulation, and the evaluation of articulation of model sound are very different. We can consider two possibilities; 1) the subjects sometime do not catch up with the own evaluation of model's articulation or 2) the maximum degree of lip opening was narrowly assumed on the whole.

4 Conclusion In this research, we investigated some strategies to articulate French nasal vowel [ɑ̃] in Japanese students. The strategy of pushing lips is seldom seen in these subjects, but the strategy of closing lips was observed frequently.

5 Future work In this experiment, we measured the articulation only using the video. Probably, the motion of the tongue in the mouth by other methods will be required. We must conduct the experiment with more subjects, and examine the experiment method itself.

6 References

Maeda, Shinji. (1993) Acoustics of Vowel Nasalization and Articulatory Shifts in French Nasal Vowels? *Phonetics and Phonology,* 5: 147-167. :Academic Press