Place Assimilation of Chinese (L1) and Japanese (L2) Coda Nasals by Speakers of Standard Chinese

Ai Mizoguchi[1,2], Maho Morimoto[3,4], Weiyu Li[4], Takayuki Arai[4]

[1]Maebashi Institute of Technology, [2]NINJAL, [3]Chuo University, [4]Sophia University

[1]aimizoguchi@maebashi-it.ac.jp, [2]maho.morimoto.jp@gmail.com

[3]4w-li-5x4@eagle.sophia.ac.jp, [4]arai@sophia.ac.jp

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Introduction

Japanese moraic nasal /N/ is often transcribed as a uvular nasal [ɴ] in the utterance-final position although speaker-specific variations in the place of articulation have been reported [1]. In the utterance-medial position, the place of articulation of /N/ assimilates to the following consonant obligatorily and categorically [2], [3]. However, native English speakers learning Japanese showed gradient assimilation for Japanese /N/, transferring their L1 assimilation process [4]. Standard Chinese has two coda nasals, /n/ and /ŋ/, and it is reported that there is complete assimilation for /n/ and gradient assimilation for /ŋ/ [5], although little articulatory research seems to have been done. This study investigated the tongue contours of Chinese and Japanese nasal consonants uttered by Standard Chinese speakers to assess the assimilation process of Standard Chinese speakers, whose L1 is said to have two different assimilation processes for coda nasals.

Methods

Articulatory data from four native Standard Chinese speakers (2 female, 2 male) were analyzed in this study. Two were advanced learners at the highest level (N1) on the Japanese-Language Proficiency Test (ACF02 and ACM02), whereas the other two self-reported as basic-level learners (ACF03 and ACM03).

Table 1 lists the speech materials used in this study. Words with Chinese coda /n/, /ŋ/ or Japanese coda /N/ followed by a bilabial, alveolar, or velar consonant were analyzed. Words with utterance-final /n/, /ŋ/, or /N/ and words with onset /b/, /d/, or /g/ for both languages were also included for comparison. The words were randomized, and the participants read each word aloud 10 times.

Table 1: Speech materials. Target phonemes are underlined.

Chinese	/à<u>n</u>.bà/ 暗坝 ‘underwater dam’ /ā<u>n</u>.dǎ/ 安打 ‘a hit’ /ā<u>n</u>.kāŋ/ 安康 ‘well-being’ /àn.à<u>n</u>/ 暗暗 ‘secretly’ /ha<u>ŋ</u>.bān/ 航班 ‘flight’ /ha<u>ŋ</u>.dàŋ/ 行当 ‘occupation’ /kā<u>n</u>.kǎi/ 慷慨 ‘generous’ /áŋ.á<u>ŋ</u>/ 昂昂 ‘brave-looking’	/ā.<u>b</u>à/ 阿爸 ‘dad’ /ā.<u>d</u>à/ 阿大 ‘older brother (familiar form)’ /ā.<u>g</u>aŋ/ 阿刚 ‘Ms./Mr. Gang’
Japanese	/a<u>N</u>ba/ 鞍馬 ‘pommel horse’ /a<u>N</u>da/ 安打 ‘a hit’ /a<u>N</u>ga/ 安臥 ‘lay down’ /kaNa<u>N</u>/ 勘案 ‘consideration’	/a<u>b</u>ata/ あばた ‘pockmark’ /ha<u>d</u>aka/ 裸 ‘naked’ /ha<u>g</u>ata/ 歯形 ‘teeth mark’

The audio signal and real-time mid-sagittal images of the oral cavity were recorded simultaneously using an ultrasound system (MicrUs, EXT-1H). A microconvex probe (MC10-5R10S-3) was placed under the participant's chin using an UltraFit Headset [6]. The video frame rate was 113 fps. The audio and ultrasound video were recorded and synchronized using AAA software [7]. Nine tokens were excluded from the analysis because of synchronization errors. 51 tokens, including all tokens for /aNga/ and /hagata/ for ACF02 and ACM03, were excluded from the analysis due to poor ultrasound image quality. As a result, 660 tokens were analyzed. The tongue contours at the acoustic midpoint of the target phoneme were traced using GetContours [8]. The tongue contours predicted from the repetitions were plotted by the speaker for each phoneme using a generalized additive model (GAM) [9] with 95% confidence intervals.

Results

As a result, three out of the four speakers showed partial assimilation for Chinese coda /n/ (Figure 1a), and all three speakers with sufficient velar data showed partial assimilation for Chinese coda /ŋ/ (Figure 1b).

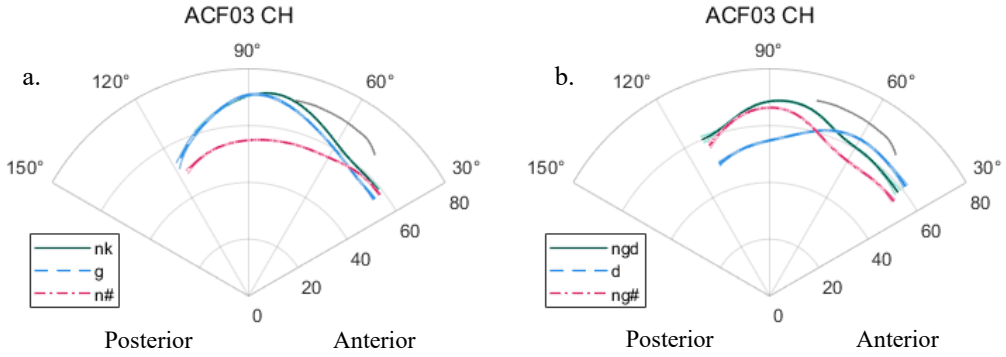

Figure 1: Tongue contours for Chinese words by speaker ACF03. The gray line shows the palate.

For the Japanese coda /N/, three out of the four speakers showed partial assimilation, transferring their L1 assimilation process (Figure 2a). However, one speaker (ACF02) showed partial assimilation for the Chinese /n/ and complete assimilation for the Japanese /N/ (Figure 2b).

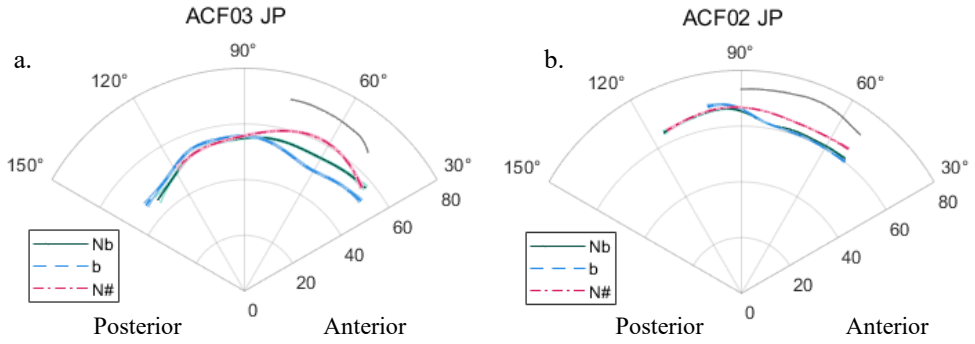

Figure 2: Tongue contours for Japanese words by speakers ACF03 and ACF02. The gray line shows the palate.

Conclusion

This study investigated the assimilation of Chinese and Japanese coda nasals by native Standard Chinese speakers learning Japanese. Ultrasound tongue imaging revealed that most speakers showed an overlapping gesture for coda /n/ or /ŋ/ and the following consonant, indicating the gradient assimilation for Chinese coda nasals. This gradient assimilation was transferred to L2 Japanese, in which most native Japanese speakers showed complete assimilation, except for one advanced learner. Further research is required to confirm whether this is due to the proficiency effect.

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References

[1] Mizoguchi, A., Tiede, M. K., Whalen, D. H. 2022. Inter-speaker variability of articulation for the Japanese moraic nasal: An ultrasound study. *Phonological Studies* 25, 121–132.

[2] Mizoguchi, A. 2019. *Articulation of the Japanese Moraic Nasal: Place of Articulation, Assimilation, and L2 Transfer*, Doctoral dissertation. New York: The Graduate Center of the City University of New York.

[3] Vance, T. J. 2008. *The Sounds of Japanese*. Cambridge: Cambridge University Press.

[4] Mizoguchi, A., Tiede, M. K., Whalen, D. H. 2019. Production of the Japanese moraic nasal /N/ by speakers of English: An ultrasound study. *Proc. 19th International Congress of Phonetic Sciences*, Melbourne, 3493–3497.

[5] Luo, M. 2022. Mandarin nasal place assimilation revisited: An acoustic study. *Interspeech*, Incheon, Korea, 5228–5232.

[6] Spreafico, L., Pucher, M., Matosova, A. 2018. UltraFit: A speaker-friendly headset for ultrasound recordings in speech science. *Interspeech 2018,* Hyderabad, India*,* 1517–1520.

[7] Articulate Instruments Ltd. 2022. Articulate Assistant Advanced (AAA). *http://www.articulateinstruments.com/downloads/*

[8] Tiede, M. K. 2022. GetContours. GitHub repository. *https://github.com/mktiede/GetContours*.

[9] Wood, S. N. 2006. *Generalized Additive Models: An Introduction with R*. London: CRC Press.