Emphatic Gemination of Nasals in Japanese Reduplicative Mimetics: Preliminary Ultrasound Tongue Observations

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Background

In Japanese, consonant gemination can be used to express emphatic meanings (e.g., /pika-pika/ 'shiny' → /pikːa-pika/ 'very shiny') [1, 2, 3]. While the addition of the mora(s) is most common before obstruents [1, 2], it can also occur for nasals (e.g., /guɲa-guɲa/ 'floppy' → /guɲːa-guɲa/ 'very floppy'). However, the articulatory implementation of emphatically geminated nasals is not as clear as in the case of obstruents, which have been shown through an EPG study [4] to involve longer and more extended lingual contact. While emphatically geminated nasals could simply be nasals with longer constriction duration (e.g., [omːoʃiɽoi] 'lots of fun'), there is also the possibility that a glottal stop is inserted, as described in Aizawa [1]: [oˀmoʃiɽoi]. In this study, we report observations from a pilot production experiment to investigate the articulatory characteristics of geminated nasals in reduplicative mimetics.

Methods

Three female native speakers of Japanese were asked to emphasize reduplicative mimetics of the form C^1VC^2V-C^1VC^2V with nasal consonants as C^2: /wana-wana/ 'shaking (of anger)' and /guɲa-guɲa/ 'floppy'. The linguistic background of the speakers is provided in Table 1. The speakers were presented with the regular forms in katakana and were asked to read them aloud in the first round, and then to produce the emphasized version of each item in the second round. To avoid the effect of orthography, no written stimuli were provided for the emphatic forms, but they were given the /pika-pika/~/pikːa-pika/ pair as an example of emphasis. Audio and ultrasound recordings (at 22,050 Hz and around 113 fps, respectively) were obtained simultaneously using AAA [5]. The probe was stabilized using a headset [6]. We used the DeepLabCut (DLC) plug-in [7] on AAA to automatically estimate the tongue contours in each ultrasound frame. We segmented the utterances manually using Praat [8] and extracted the tongue contour data as 11 x/y coordinates at 5 equidistant time points during the target nasal segments (the first occurrence of C^2). The coordinates were then normalized and plotted using R [9].

Table 1: Linguistic background of the speakers.

Speaker ID	Age	Region
BJF21	20	Kanagawa/Shizuoka (2years)
BJF22	20	Tokyo
BJF23	20	Kanagawa

Results & Discussion

Among the two pairs of mimetics produced by three speakers (n = 12), all the emphatic mimetics were produced with fully sonorant long nasals except for one. Waveforms and spectrograms in Figure 1 (left) illustrate a representative sonorant production of the geminated nasal in /wanːa-wana/. Figure 1 (right) shows the same item produced by speaker BJF23, with a bipartite structure for the geminated nasal.

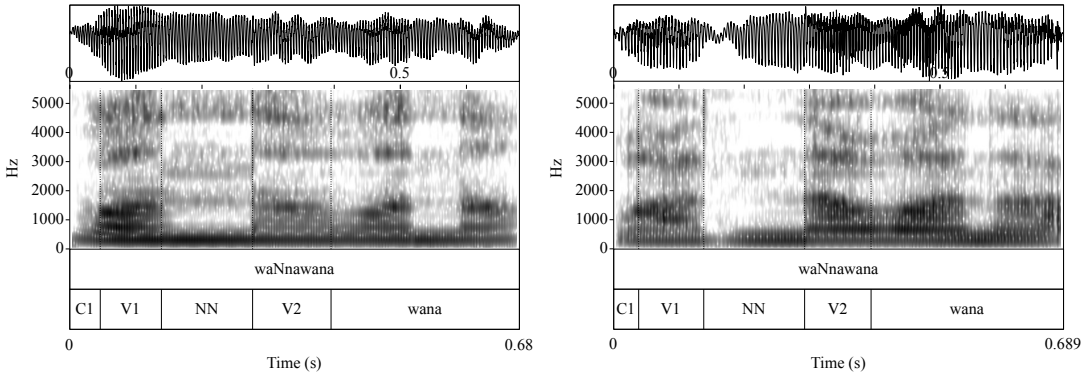

Figure 1: Sample waveforms and spectrograms of the emphatic productions of /wan:a-wana/ produced by BJF22 (left panel) and BJF23 (right panel).

Tongue contours in Figure 2 suggest that overall, nasals with emphatic gemination are produced with a stable place of articulation. It is worth noting that we do not see evidence of uvular constriction often associated with moraic nasals. Furthermore, for the acoustically bipartite geminated nasal, the lingual articulation does not seem to differ drastically from the other utterances or vary across time during the nasal consonant interval (Figure 2, left panel, bottom row). Therefore, it is likely that a non-lingual gesture, such as laryngeal gesture, is responsible for the less sonorous portion at the onset of the geminated nasal in /wan:a-wana/ produced by BJF23. Whether the articulation of Japanese geminates involves laryngealization or not is an outstanding issue [3], which needs to be addressed in future studies.

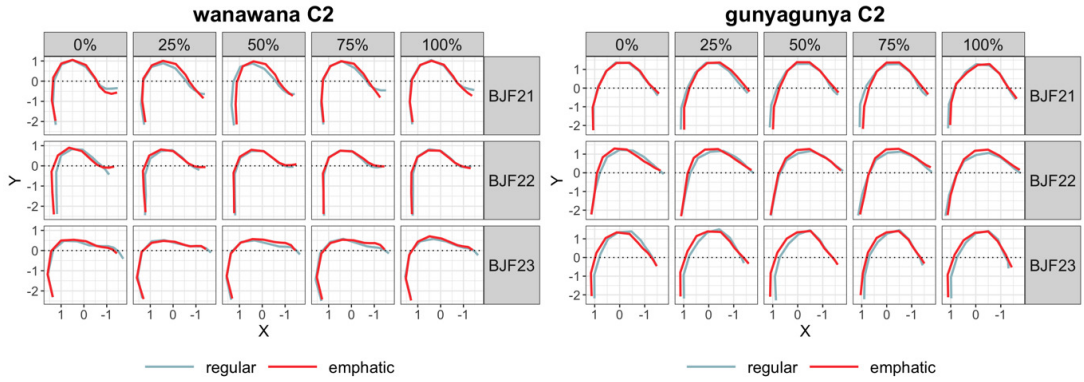

Figure 2: Midsagittal tongue contours (tongue tip points to the right) at 5 equidistant points in the target nasals for /wana-wana/ (regular) ~ /wan:a-wana/ (emphatic) in the left panel and /guŋa-guŋa/ (regular) ~ /guŋ:a-guŋa/ (emphatic) in the right panel, for each speaker.

Conclusion

The current pilot study suggests that there may be individual variations in the production of nasals with emphatic gemination. While the predominant pattern for emphatically geminated nasals in reduplicative mimetics conforms to the general description of moraic nasals that assimilate completely to the place of articulation of the following consonant [10, 11], which was a nasal in this case, one exceptional production is in line with Aizawa's [1] description that emphatic geminates have "glottal tension besides lengthening of the consonant." A more systematic and quantifiable investigation is needed to better understand the process of emphatic gemination of nasals, and to obtain further insights as to the nature of emphatic gemination and geminates in general.

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