Taps vs. Palatalized Taps in Japanese

Noriko Yamane & Phil Howson

University of British Columbia & University of Toronto

This paper examines the dynamic mid-sagittal lingual contrast between the plain and palatalized taps in Japanese. Japanese taps are basically same as English flap such as in 'ladder' (Vance 1997), but the kinematics of the movement hasn't been paid much attention. Although Japanese tap allows allophonic/sociophonetic variants such as apico-alveolar lateral [l̺], voiced alveolar lateral fricative [ɮ], Retroflex [ɽ], and apical trills [r] in adults (Magnuson 2010, Labrune 2012), the canonical Japanese taps are challenging even for native speakers of Japanese (e.g, Ueda 1996). Japanese taps are challenging for English speakers as well, although English taps also allow variants such as alveolar/postalveolar taps and down/up flaps (Derrick & Gick 2011). Japanese palatalized taps seem more challenging (Tsurutani 2004), which is likely related to the cross-linguistic rarity of palatalized tap (Hall 2000). This paper explores why these sounds are challenging from the viewpoint of articulatory kinematics, using ultrasound. Taps in Japanese have not been well research using articulatory methods; therefore, the primary goal of this paper is to reveal the articulatory dynamics of taps in Japanese. Palatalized taps are also typologically rare, as are any palatalized rhotics.

Six native speakers of Japanese participated in ultrasound experiment, and produced nonsense words containing /ɾ/ and /ɾʲ/ in a carrier sentence. The mid-sagittal contours of the taps were compared in three intervocalic contexts: a_a, o_o, u_u. Static measures at the point of contact were compared as dynamic measures of the movements over time. For the static measure, images were extracted at the point of tongue tip contact, which was determined by a spectral occlusion in the spectrogram. The dynamic measures were taken from the spectral occlusion: 4 frames before the occlusion, on the spectral occlusion, and 5 frames after the occlusion, for a total of 10 images. Due to the frame rate of the ultrasound, images are approximately 33 ms apart. Results were compared in R (R Core Development Team 2015) using an SSANOVA (Davidson 2006).

The results indicate that /ɾʲ/ is more resistant to coarticulatory effects of adjacent vowels compared to /ɾ/. Both the apical gesture and the tongue body gesture were invariable regardless of vocalic environment. /ɾ/ was articulated with a very brief occlusion by tongue tip (Figure 1), while /ɾʲ/ was articulated with tongue tip raising followed by tongue body raising and fronting (Figure 2). However, unlike palatalized trills, there doesn't seem to be a coarticulatory conflict between the tongue dorsum and palatalization. This is largely because the tongue dorsum for /ɾ/, showed a high degree of coarticulatory variability with the surrounding vocalic environment, suggesting that there is no tongue dorsum gesture involved in taps, similar to Catalan (Recasens & Espinosa 2007). The resistance of the marked counterpart of the tap against conflicting vowel context is also similar to Catalan (Recasens and Pallarès 1999).

The results also suggest that an inconsistency between palatalization and rhotics cannot be related to the constraints on the dorsal gesture as Kavitskaya et al. (2009) suggest, because the dorsal gesture seems to be inert for the taps. Rather phonological contrast within liquids (e.g., Scobbie et al. 2013, Proctor 2009) should be considered.

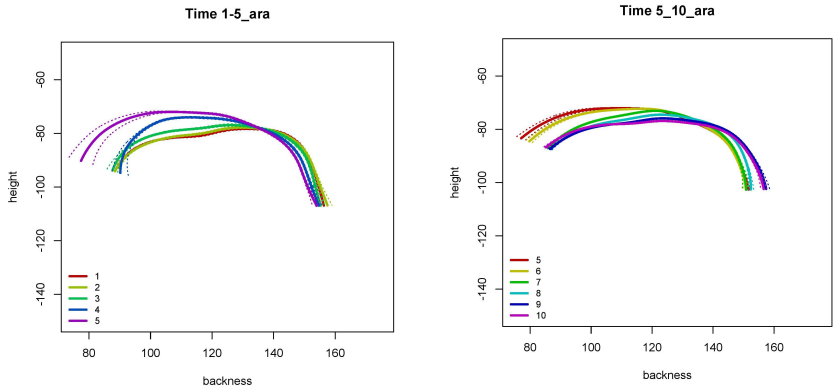

Figure 1. Left: closing gesture from /a1/ to tap. Right: opening gesture from tap to /a2/. SSANOVAs from 12 tokens for each time frame from one female speaker. Tongue tip is on the left side of the images.

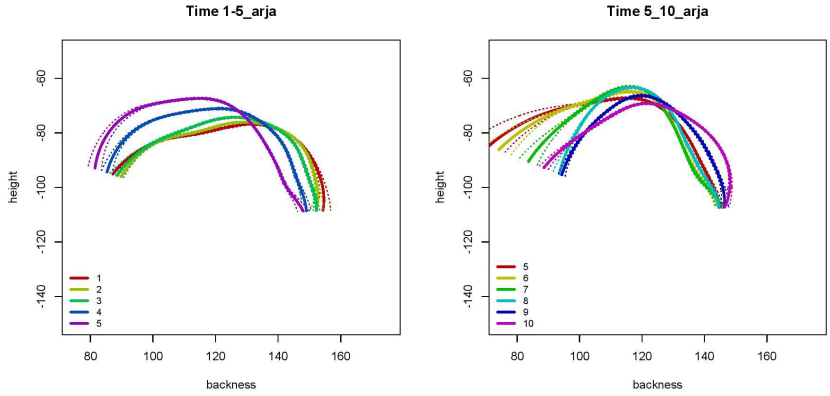

Figure 2. Left: closing gesture from /a1/ to palatalized tap. Right: opening gesture from palatalized tap to /a2/. SSANOVAs from 12 tokens for each time frame from one female speaker. Tongue tip is on the left side of the images.

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References

Davidson, L. (2006). Comparing tongue shapes from ultrasound imaging using smoothing spline analysis of variance). *The Journal of the Acoustical Society of America*, *120*(1), 407-415.

Derrick, D., & Gick, B. (2011). Individual variation in English flaps and taps: A case of categorical phonetics. *The Canadian Journal of Linguistics/La revue canadienne de linguistique*, *56*(3), 307-319.

Hall, T. A. (2000). Typological generalizations concerning secondary palatalization.Lingua 110, 1-25.

Labrune, L. (2014). The phonology of Japanese/r: a panchronic account.*Journal of East Asian Linguistics*, *23*(1), 1-25.

Proctor, M. 2009. *Gestural characterization of a phonological class: the liquids*. New Haven, CT: Unpublished Ph.D. dissertation. Yale University, New Haven.

Recasens, D., & Espinosa, A. (2007). Phonetic typology and positional allophones for alveolar rhotics in Catalan. *Phonetica*, *64*(1), 1-28.

Recasens, D., & Pallarès, M. D. (1999). A study of /r/ and /ɾ/ in the light of the DAC coarticulation model. *Journal of Phonetics*, *27*(2), 143-169.

Ueda, I (1996). Segmental acquisition and feature specification in Japanese. (eds.) B.Bernhardt, J. Gilbert and D. Ingram Proceedings of the UBC.

International Conference on Phonological Acquisition, 15-24. Somerville, MA.:Cascadilla Press.

Magnuson, T. (2010). A Look into the Plosive Characteristics of Japanese/r/and/d. *Canadian Acoustics*, *38*(3), 130-131.

Tsurutani, C. (2004). Acquisition of Yo-on (Japanese contracted sounds) in L1 and L2 phonology. *Second Language*, *3*, 27-47.

Kavitskaya, D., Iskarous, K., Noiray, A., & Proctor, M. (2009). Trills and palatalization: Consequences for sound change. *Proceedings of the formal approaches to slavic linguistics*, *17*, 97-110.

Scobbie, J. M., Punnoose, R., & Khattab, G. (2013). Articulating five liquids: A single speaker ultrasound study of Malayalam.

Vance, T. J. (1997). *An introduction to Japanese phonology*. SUNY Press.