When dynamics conflict: Flap dynamics and palatalization in Japanese

Noriko Yamane,1 Phil Howson,2 Masaki Noguchi,3 and Bryan Gick,3,4
1Kobe University, 2University of Toronto, 3University of British Columbia, 4Haskins Laboratory

Introduction

• Palatalized taps (and rhotics) are cross-linguistically avoided [1].
• Avoidance may be related to place constraints [2].
• Tongue dorsum retraction for rhotics, but fronting for palatalization [3].
• Issue: taps do not appear to have tongue dorsum gesture [4, 5].
• Taps also have multiple subphonemic categories [6].
• Direction of dynamic gestures varies greatly over contexts in English taps.

Research Questions:

How do the temporal dynamics for /ɾ/ unfold?
Does it fit into specific dynamic trajectories, alveolar, up-flap, or down-flap [5]?

Methods

Dynamic Measures
• 10 frames in succession extracted, frame 5 was contact point.
• Frames 1-5 designated closing gesture (frames 1-5).
• Frames 5-10 designated opening gesture (frames 5-10).
• 6 Japanese speakers (AT, CL, KH, MD, MF, YT).
• Tokens: /ara, ari, oro, oron, uru, ura/ 12 repetitions.

TIME LAG COMPARISON:
• Duration between contact point and point of maximum constriction measured in Praat [7].
• Comparison made for palatalized geminates /ɾɾ/.
• 1 Japanese speaker (MN)

Results

• /ɾ/ opening and closure gesture categorized as tongue tip gesture towards and away the alveolar ridge.
• Two distinct articulatory patterns observed.
• Slow (3 frames) tongue tip contact at the alveolar ridge (Figure 1).
• Quick (1 frame) tongue tip and blade contact in post alveolar region (Figure 2).
• Tongue dorsum is highly susceptible to vocalic environments (Figure 3).
• Suggests lack of a tongue dorsum component.

Figure 1. Alveolar tap – Only tongue tip is mainly active.

Figure 2. Postalveolar tap – The tongue tip/blade is raised and lowered.

Figure 3. Down-flap (MF): (Impossible to trace in Edgetrak) In comparison to stop sound /ŋ/ (right). A down-flap: tongue moves from above the alveolar ridge, makes contact, and continues downwards below the alveolar ridge [6] Similar to English down-flap, it involves in a preparatory raising and retraction of the tongue.

• Tongue body raises prior to tongue-palate contact.
• Full achievement of palatalization 2 frames (frame 7) after contact.
• Three types of palatalized tap:
  • Strong raising and fronting (Figure 4).
  • Light raising and fronting with shortened palatalization gesture (Figure 5).
  • Strong raising and fronting, with increased duration of offglide (Figure 6).

Figure 4. Dorsoalveolar tapping.

Figure 5. Minimal tongue dorsum fronting and tongue body raising.

Figure 6. Stronger palatalization and increase duration of offglide.

• /ɾ/ had a significantly delayed point of maximum constriction, compared to /ɾɾ/ and (Figure 7).
• speakers avoid producing (or are unable to produce) the tap and the palatalization gestures simultaneously.
• May be related to the bombastic nature of taps.

Figure 7. The timing of the maximum constriction of palatalization gesture during the linguo-palatal contact, where the starting point is 0, and the endpoint is 100.
Palatalization occurs later in /an/ and /ən/.

Conclusions

• /ɾ/ is composed of simple tongue tip gesture.
• /ɾɾ/: complex interaction between tongue tip and the secondary palatalization.
• Delay may be related to short, bombastic nature of tap.
• Highlights importance of dynamic temporal studies for phonology.

Bibliography