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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 /r/ 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, aria, oro, orio, uru, uriu/, 12 repetitions.

TIME LAG COMPARISON:

- Duration between contact point and point of maximum constriction measured in Praat [7].
 - Comparison made for palatalized geminates /n:i:/, /r:i:/.
 - 1 Japanese speaker (MN)

Results

- /r/ 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.

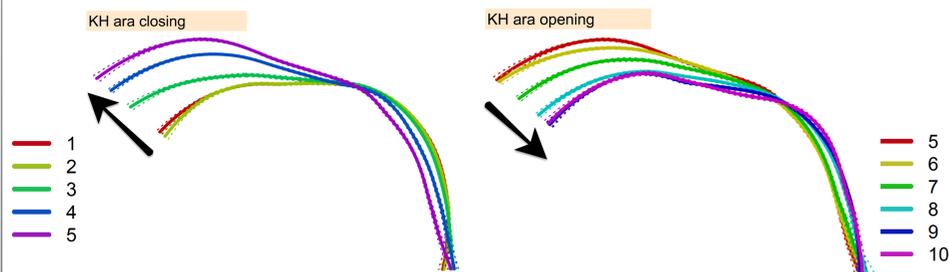


Figure 1. Alveolar tap – Only tongue tip is mainly active.

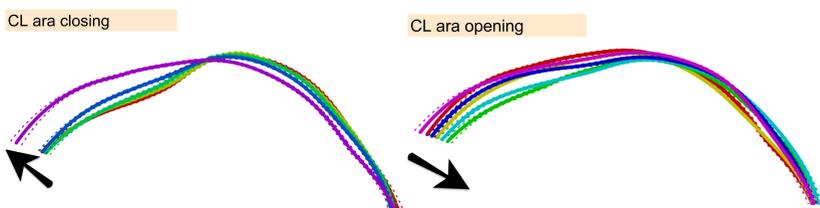


Figure 2. Postalveolar tap – The tongue tip/blade is raised and lowered.

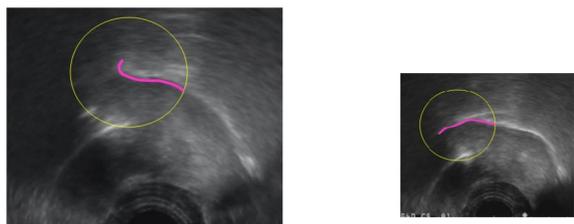


Figure 3. **Down-flap (MF)**: (Impossible to trace in Edgetrak) In comparison to stop sound 't' (right). A down-flap: tongue moves from above the alveolar ridge, makes contact, and continues downwards below the alveolar ridge [6] Similar to English down-flap, it involves in a preparatory raising and 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).

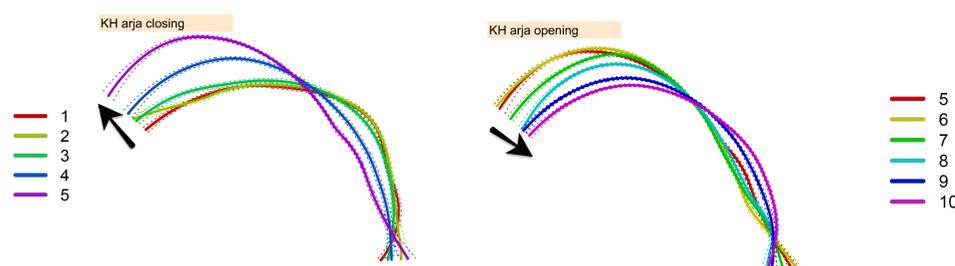


Figure 4. Dorsum raising/fronting.

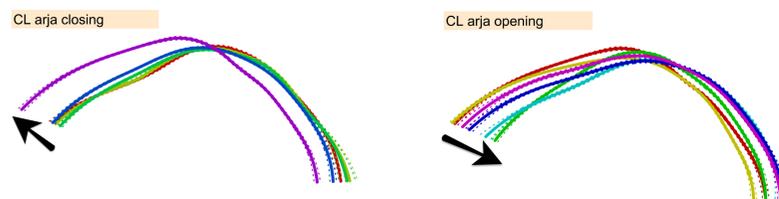


Figure 5. Minimal tongue dorsum fronting and tongue body raising.

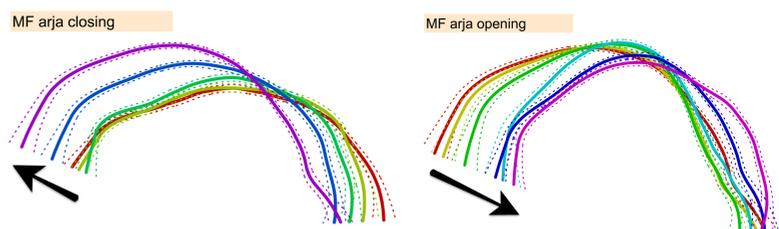


Figure 6. Stronger palatalization and increase duration of offglide.

- /r:i:/ had a significantly delayed point of maximum constriction, compared to /n:i:/ 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.

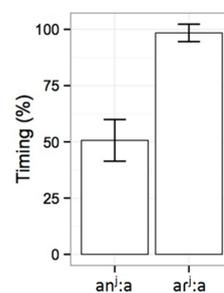


Figure 7. The timing of the maximum constriction of palatalization gesture during the linguo-palatal contact, where the starting point is 0, and the endpoint is 100. Palatalization occurs later in /an:a/, /ar:a/.

Conclusions

- /r/ is composed of simple tongue tip gesture.
- /r:i/: 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.

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