Automatic Analysis of Singleton and Geminate Consonant Articulation using Real-time Magnetic Resonance Imaging

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Motivation
How do singletons and geminates of Italian differ in terms of the gestural control that underlies their production?

Overview
Investigating production of Italian singleton (C) and geminate (CC) consonants (e.g., ‘bacco’ [bakko] – ‘bacco’ [bakko]) using Real-time MRI.

If control is primarily temporal, then:
• Constriction duration should differ for C and CC;
• Constriction location should be invariant for C and CC;
• Constriction degree may differ for C and CC; (due to undershoot)

→ Tested using novel automatic techniques

Background

Real-time MRI
Provides dynamic information about all components of the vocal tract
Analyses performed directly on time functions of pixel intensities, not segmented regions [1]

Italian length contrast
• Italian differs both temporally and spatially
• Italian length contrast intensities, not segmented regions [1]
• Analyses performed directly on time functions of pixel vocal tract

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Constriction Degree
• High peak intensity: compression and movement
• Cohort of pixels: falls within radius of 3 pixels from optimal pixel of maximum dynamic intensity

Conclusion
• rmfMRI and analytical methods evaluated are capable of capturing and quantifying
• Constriction location
• Constriction degree (compression)
• Salient kinematic events

Future work
• Investigate possible differences in stiffness (measured by time to peak velocity)
• Stiffness differences could account for differences in peak velocity despite singletons and geminates having the same virtual target.

Selected References

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