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Model-based investigation of the activation patterns of the tongue muscles in articulation

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Muscle activations during speech production are important for understanding how speech is controlled. However they are difficult to be observed directly and accurately estimated form the observed articulatory gestures. In this study, we estimate the muscle activations during producing 5 sustained Japanese vowels using a three-dimensional (3D) physiological articulatory model. To reduce the model dependent factors that influence the result, the rest configuration of the model is carefully chosen to be that for vowel /e/. It is found that: Genioglossus Anterior (GGA), Hyoglosuss (HG), Styloglossus (SG) and Transversus&Verticalis (T&V) ?are activated for vowel /a/; GGA, Genioglossus Posterior (GGP), SG, and T&V are activated for vowel /i/; GGA, SG and T&V are activated for vowel /u/; GGA, GGP and SG are activated vowel /e/; GGA, HG, SG and T&V are activated for vowel /o/, which are consistent with the observation obtained by Electromyography (EMG). In addition, the muscle Styloglossus should be separately controlled for anterior portion and posterior portion in vowel production.

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