Patterns of Brain Activity Associated with Formant Stability During Vowel Production

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Vowels provide the acoustic foundation of speech, but little is known about how the brain orchestrates their production. Functional imaging is a potentially valuable tool for understanding how coordinated regional brain activity plays a role in vowel production. Thirteen, normal, right-handed, native speakers of American English participated in a positron emission tomography (PET) study of regional cerebral blood flow (rCBF) during sustained production of /a/. A performance-based analysis identified a linear combination of brain regions that predicted stability of F1 and F2 (coefficients of variation). Increased stability of F1 was associated with increased rCBF in the right thalamus [$F(1,50) = 6.87$; $p = 0.012$]. The pattern associated with F2 stability was more complicated. A linear combination of activity in the inferior cerebellum and putamen on the left, the superior cerebellum and sensori-motor strip on the right, and the transverse temporal region, bilaterally, was associated with F2 stability, which increased with increased activity in left sided regions and decreased activity in right sided regions [$F(6,45) = 15.05$; $p > 0.001$]. Conveying more speech information, F2 appears to have a more complex control system. Further, left-right lateral asymmetries are present at this level of control. Supported by NIDCD R01 DC007658.