A 3-parameter model for fitting and interpreting speech sensorimotor adaptation data

Frank H. Guenther, Elaine Kearney, Ayoub Daliri, and Alfonso Nieto-Castanon

Speech sensorimotor adaptation paradigms have become an important experimental technique for probing the neural control mechanisms underlying normal and disordered speech production. Here we describe a simple 3-parameter mathematical model for fitting the results of speech sensorimotor adaptation experiments. The three fitting parameters are associated with the three key subsystems involved in speech motor control; specifically, they characterize the gains of the auditory and somatosensory feedback control subsystems and the trial-to-trial adaptation rate of the feedforward control system. The model provides close fits to data from prior sensorimotor adaptation experiments involving pitch or formant perturbations in healthy control populations

(Abur et al., 2018; Ballard et al., 2018; Daliri, Wieland, Cai, Guenther, & Chang, 2018; Haenchen, 2017) , with an average Pearson?s correlation coefficient of .94 across the four prior studies investigated here. In studies involving two subject populations (e.g., clinical vs. control or neurostimulation versus no stimulation), model parameters derived from the data of the two populations provide a mechanistic account of differences in the underlying speech motor systems of the two populations.