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Empirical and computational findings converge in support of the Hierarchical State Feedback Control theory

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Munding, Dubarry, and Alario provide a helpful meta-analysis of the MEG evidence regarding the cortical substrates for overt speech production during the first 1000 ms following stimulus presentation. The 14 reviewed studies used a wide variety of behavioral contrasts and signal processing methods to examine speech production in healthy subjects, and Munding et al. impressively organize the 142 significant activations with respect to temporal, anatomical, and functional frameworks. For brevity, we restrict our response to the discussion of the results in light of the Hickok (2012) HSFC framework.

The HSFC framework is characterized by Munding et al. as a parallel processing model, although it retains some sequential (or cascading) characteristics. The parallel aspects refer specifically to the dual representation of linguistic constructs in sensory and motor cortices, which are activated in parallel during production: At roughly the syllable level, STG provides auditory targets for motor planning in IFG, coordinated via TPJ—specifically, functional area Spt, which acts as an auditory-motor transformation hub (Hickok et al., 2011; Hickok et al., 2009). According to HSFC, this interaction of higher-order sensory and motor cortices occurs prior to overt articulation. Consistent with the theory, Munding et al. present evidence that the predicted regions are activated concurrently, after visual-semantic processing and prior to articulation. Munding et al. note that there is a tendency for STG and TPJ to activate before IFG, and they suggest that this is potentially problematic for conceptions of IFG's role in motor planning. On the contrary, we believe these results support our most recent description of this sensorimotor circuit (Walker & Hickok, in press). We formalized the separation of auditory-phonological and motor-phonological representations in a new computational model, the semantic-lexical-auditory-motor model (SLAM), and we explored the consequences of this architectural assumption for explaining picture naming responses in the context of aphasia. We found that this sensorimotor circuit must be activated primarily via the auditory route to account for the deficits observed in conduction aphasia without sacrificing explanatory power for healthy individuals or other aphasia types.

The lack of somatosensory cortex activation during articulation is not predicted. But perhaps this is more a question of sensitivity as the close proximity of M1 and S1 may make these regions indistinguishable with MEG. The inability to make inferences about cerebellum

activity is a drawback of the current analysis, as this structure plays an important role in learned fine-motor skills such as speech articulation.

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