

Feedforward and feedback control in patients with cerebellar degeneration

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Both predictive, feedforward and reactive, feedback control have been suggested to play a role in speech production. In both speech and other motor domains, the cerebellum has been suggested as a critical component of the feedforward control network. The role of the cerebellum in feedback control is more controversial?increased cerebellar activity is often seen functional imaging studies in response to unexpected sensory perturbations, yet patients with cerebellar damage retain the ability to use feedback control in response to perturbations in both reaching and walking.

Here, I present the results of a series of studies conducted on patients with cerebellar degeneration due to spinocerebellar ataxia (SCA) assessing both feedforward and feedback control systems in speech. These results suggest that cerebellar degeneration leads to a specific impairment in predictive, feedforward control, but spares feedback control. In fact, patients show an increased use of feedback control in both formant and fundamental frequency control. Additionally, this response is not specific to external/experimental perturbations of feedback but can be seen in their online corrective responses to self-produced variability. Together, these studies suggest a critical role for the cerebellum in feedforward control of speech, but not in feedback control.

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