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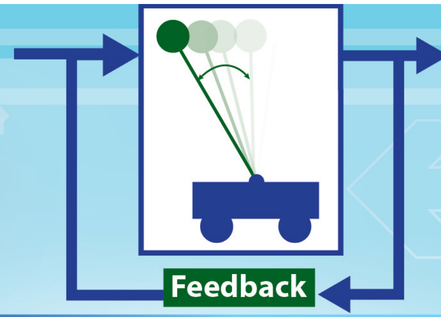
Control Seminar



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Cerebellar Patients Have Intact Feedback Control That Can Be Leveraged to Improve Reaching

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3:30 – 4:30 pm • 1500 EECS

ABSTRACT: It is thought that the brain does not simply react to sensory feedback, but rather uses an internal model of the body to predict the consequences of motor commands before sensory feedback arrives. Time-delayed sensory feedback can then be used to correct for the unexpected---perturbations, motor noise, or a moving target. The cerebellum has been implicated in this predictive control process, as cerebellar damage leads to specific deficits in movement control (e.g. poor targeting, oscillation) that are reminiscent of a poorly tuned control system in engineering. It is unknown whether damage to the cerebellum interferes with the ability to use feedback control. Here we used behavioral and computational approaches to show that cerebellar patients have an intact feedback control system that is similar to that seen in healthy subjects, except that the healthy population seems to have less delay in the feedback loop, hinting at a Smith-Predictor-like mechanism for visual feedback delay compensation. We then show that we can leverage a cerebellar patient's in-tact feedback controller to improve movement by altering visual feedback in a virtual reality environment. The visual feedback-based intervention provides proof-of-concept that this mechanism could be leveraged to reduce the effects of ataxia in this patient population. This is the thesis work of Amanda Edwards who was co-advised on this project by Noah Cowan and Amy Bastian.

BIO: Noah Cowan directs the Locomotion in Mechanical and Biological Systems (LIMBS) Laboratory at Johns Hopkins University. LIMBS Lab conducts experiments and computational analyses on both biological and robotic systems, with a focus on applying concepts from dynamical systems and control theory to garner new insights into the principles that underlie neural computation. Noah earned his PhD in EECS at Michigan in 2001 and looks forward to returning to present his work at the control systems seminar.

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Questions? Contact: Judi Jones asap@umich.edu