The Center for Control, Dynamical Systems, and Computation
University of California at Santa Barbara
Spring 2008 Seminar Series
Presents

How Difficult Skills Become Automatic: A Computational Neuroscience Approach

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Friday, May 23, 2008 3:00-4:00pm Harold Frank Hall 1104

Abstract:

A biologically detailed computational model is described of how visual-motor skills become automatic. The model assumes there are two neural pathways from the relevant visual association area to the premotor area that mediates response selection. A longer and slower path projects to premotor cortex via the striatum, globus pallidus, and thalamus, whereas a faster, purely cortical path projects directly from the visual association area to the premotor area. The model assumes that the subcortical path, although slower, has greater neural plasticity because of a dopamine-mediated learning signal from the substantia nigra. In contrast, the faster cortical-cortical path learns more slowly via (dopamine independent) classical two-factor Hebbian learning. Because of its greater plasticity, early performance is dominated by the subcortical path, but the development of automaticity is characterized by a transfer of control to the faster cortical-cortical projection. The model includes differential equations that describe activation in each of the relevant brain areas as well as a set of difference equations that describe the relevant two- and three-factor learning. A variety of simulations are described showing that the model accounts for some classic single-cell recording and behavioral results.

About the Speaker:

Ashby received his PhD in Cognitive/Mathematical Psychology from Purdue University. He then completed a postdoctoral fellowship in the lab of William Estes at Harvard University. He joined the UCSB faculty in 1986. Professor Ashby is the author of more than 90 publications, including 7 articles in Psychological Review and 2 books (one edited). He is past president of the Society for Mathematical Psychology, a fellow of the Society for Experimental Psychology, and an APS fellow. He has also served as Chair of the NIH Cognition and Perception Study Section and as an Associate Editor for the Journal of Experimental Psychology: Learning, Memory & Cognition.