

## **Adams' Closed-Loop Theory**

Perhaps the first contemporary theory developed to describe how simple movements are learned was advanced by Adams (1971). In an attempt to overcome what he perceived to be the shortcomings of earlier, open-loop accounts of motor behavior, Adams set about developing a theory of motor learning that relied heavily on the availability of feedback to guide the learning of a motor skill. Contrary to the assumptions of open-loop theories, Adams argued that feedback was necessary to guide each performance attempt during the early stages of learning and that it also served as an important source for the detection and correction of errors in performance. Adams' closed-loop theory was predicated on the complementary operations of two distinct memory states. The first of these, called the memory trace, was responsible for selecting and initiating a given plan of action. The perceptual trace then served as a comparator mechanism, comparing the movement in progress with a correct memory of the movement. Adams considered the strengthening of these two distinct memory states central to the learning of a given motor skill. Adams' theory stimulated a number of research investigations designed to test his two-state memory system (Adams & Goetz, 1973; Christina & Anson, 1981; Christina & Merriman, 1977; Newell, 1974; Schmidt & White, 1972). Although a number of these studies provided support for the theory, its value as a comprehensive theory of learning was considered limited. This perceived shortcoming was based on the overuse of slow, linear-positioning movements to test the various predictions associated with the theory. These slower movements were not considered sufficiently representative of the full range of movements possible.



### [Closed loop control](#)

The results of a number of deafferentation studies (Lashley, 1917; Taub & Berman, 1968) also proved difficult to reconcile by using Adams' theory. As you will recall from our earlier discussions of the various motor control theories in Unit 1, animals and humans deprived of all sensory feedback are still able to accomplish a variety of movements. Given the central role played by feedback, Adams' closed-loop theory cannot account for this ability to perform movements in its absence.