

Ecological Theories of Perception and Action

The beginnings of an ecological approach to perception and action emerged with an influential set of papers written by Turvey and colleagues (Turvey, 1974; Turvey & Carello, 1988; Fowler & Turvey, 1978). In these studies, the authors outlined a new theory of motor learning that not only incorporated the major concepts described in Gibson's ecological theory of direct perception (Gibson, 1979), but also extended Bernstein's work (1967) in the area of movement coordination to the learning of motor skills. You may recall that Gibson and Bernstein provided the impetus for development of the dynamic systems framework of motor control that we described in Unit 1. These two theories share a common theme: interaction between the performer and the dynamics of the environment in which she or he is moving. The ecological approach has therefore extended the ideas embodied within the dynamic systems approach to a perceptual level of analysis.

In contrast to the more traditional motor learning theories developed by Adams and Schmidt, which describe the products of learning in terms of schemas or memory traces, the ecological theory of perception and action dismisses such memory-based explanations of learning. Central to the ecological approach to perception and action is the idea that the learner seeks to discover the lawful properties or invariant relationships between, among other things, the physical features of objects in the environment that make it possible to learn certain motor skills. Having discovered these properties, the learner becomes better able to generate a solution for any given movement problem that is encountered. Just as the dynamic systems approach focused on the interaction between performer and environment in the control of movement, the ecological approach emphasizes the changing relationship between the perceptions of the performer and the action environment in which the learning takes place. In a review article contrasting the various theories of motor learning, Newell (1991) identifies **two major weaknesses** associated with the more traditional theories of motor learning. *The first is their inability to explain how new patterns of coordination are learned.* At best, schema-based accounts can only describe how modifications to existing patterns of movement are accomplished. **The second weakness is the inability of traditional theories to account for the spontaneous compensations made in response to perturbations, or changes, that occur in the environment while a movement is in progress.** Ecological approaches to motor learning appear better able to address this ability without resorting to elaborate cognitive processing or the need for a preexisting reference of movement correctness (such as a memory trace or motor program).



[Ecological approach](#)

Traditional motor learning theorists have countered the claims made by ecological theorists by pointing out certain perceived weaknesses of their own. Schmidt (1988a), the originator of schema theory and of the generalized motor program concept, argues that the role of the GMP has been misinterpreted by advocates of the ecological approach and that it is considerably more

flexible and nonspecific in its function than ecological theorists imply. A second criticism of the ecological approach is that it places relatively little importance on the role of cognition during learning. In a review article addressing the controversy, Colley (1989) describes a number of movement scenarios in which some form of cognitive processing or mental representation is needed to guide the action. Certainly, it is difficult to imagine how we are capable of performing the appropriate actions in a variety of rule-based sports settings without resorting to a mental representation of some kind. For example, how does one know how to interact with an approaching soccer ball unless the conditional rules are already stored in memory? As we noted in Unit 5, simply seeing the approaching soccer ball is insufficient to define the nature of the interaction.

Ecological theories emphasize the changing relationship between a performer's perceptions and the action environment.

Even though the basic tenets of the ecological approach have only just begun to be systematically applied to the acquisition of movement skills, a growing base of support for this new theoretical approach is building among the scientific community. At the very least, the emergence of this alternative approach to studying skill acquisition has renewed interest among researchers in better understanding how novel motor skills are learned. As was the case in our earlier discussion of the various theories advanced to explain how movements are controlled, it is unlikely that a single, all-encompassing theory of motor learning will emerge.