John R. Anderson has developed perhaps the most comprehensive network model of memory that emphasizes propositional structure. Known initially as ACT (adaptive control of thought) (Anderson, 1976), the model evolved to ACT* as Anderson (1983) distinguished between procedural and declarative knowledge and added a system for modeling the long-term store of procedural knowledge. He has revised the model again (Anderson, 1996; Schooler & Anderson, 1997) to make it more consistent with research on the neural structure of the brain and to more strongly emphasize the adaptive nature of cognition. Now known as ACT-R, Anderson's model is so global that Leahey and Harris (1997) fear it may be too complex to definitively test or falsify.

Parallel Distributed Processing (PDP) Models of LTM. Parallel processing is distinguished from serial processing in that multiple cognitive operations occur simultaneously as opposed to sequentially. In a sentence verification task such as "A blue heron is an animal," for example, serial processing dictates that the search would start at *blue heron* and proceed along the pathways connected to the concept, one pathway at a time. In parallel processing, however, the search task is distributed, so that all possible pathways would be searched at the same time.

As they evolved, network models such as Anderson's came to include the assumption of parallel processing, but this assumption is at the very core of PDP, or connectionist, models of long-term memory. With connectionist models, researchers seek to describe cognition at a behavioral level in terms of what is known about actual neural patterns in the brain.

The PDP Research Group pioneered the development of these models (McClelland, Rumelhart, and the PDP Research Group, 1986; McClelland, 1988, 1994; Rumelhart, 1995), which propose that the building blocks of memory are connections. These connections are subsymbolic in nature, which means that they do not correspond to meaningful bits of information like concept nodes or propositions do. Instead, the units are simple processing devices, and connections describe how the units interact with each other. They form a vast network across which processing is assumed to be distributed. When learning occurs, environmental input (or input from within the network) activates the connections among units, strengthening some connections while weakening others. It is these patterns of activation that represent concepts and principles or knowledge as we think of it. This means that knowledge is stored in the connections among processing units.

Bereiter (1991) offered a "rough physical analogy" for understanding how a connectionist network might operate:

> Imagine that in the middle of a bare room you have a pile of a hundred or more frisbees, which are connected among themselves by means of elastic bands that vary in thickness and length. On each wall is a clamp to which you fasten a