



**RDPModels**

**How They Work**

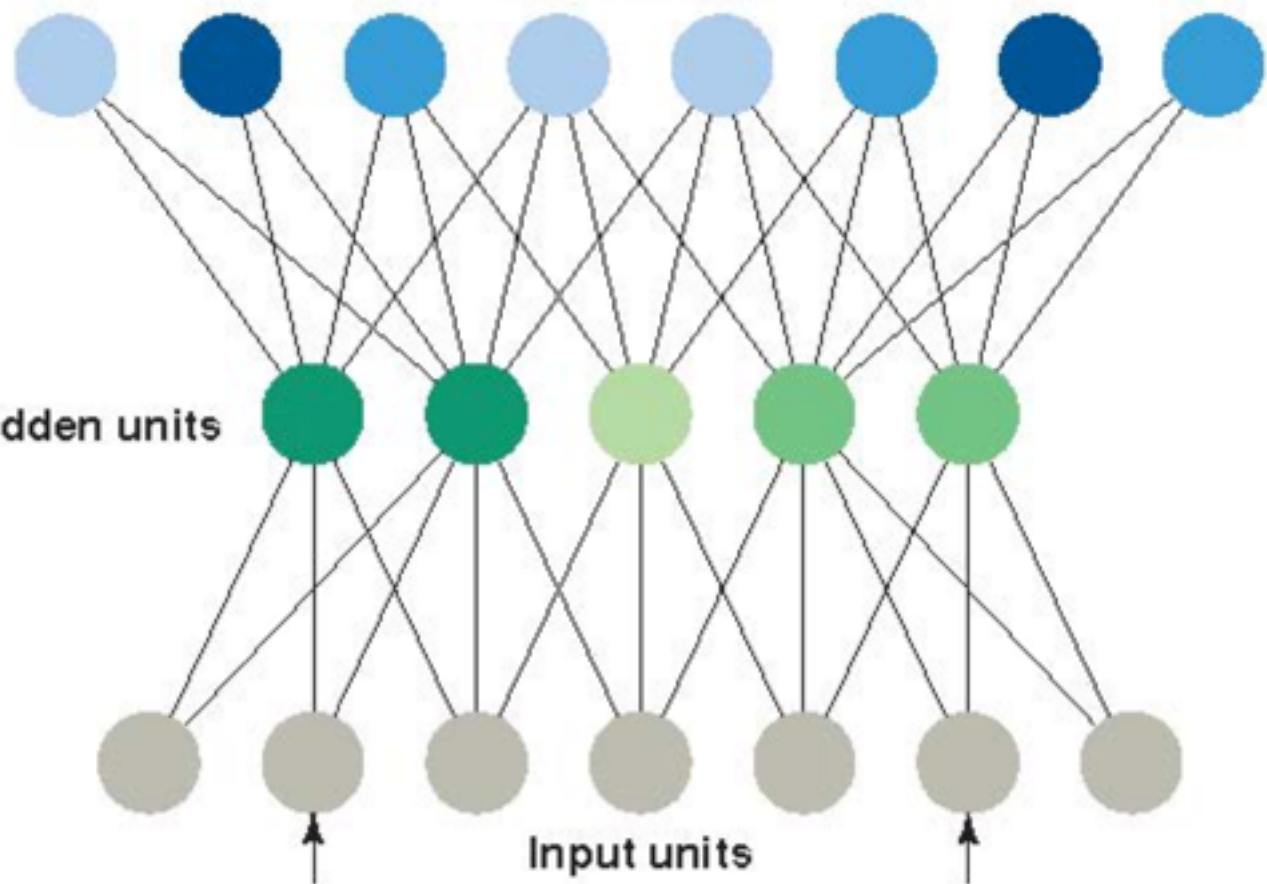
- PDP networks consist of 3 'layers' of units:

1. **Input units:** activated by stimulation from the environment  
(e.g. retinal activity when viewing pictures of faces during an experiment)
2. **Hidden units:** receive signals from input units  
(e.g. feature detectors in visual cortex that receive signals from the retina, neurons involved in perceptual judgments and decisions making, etc.)
3. **Output units:** receive signals from hidden units  
(e.g. the neurons involved in generating a verbal response by the experimental participant being shown pictures)

Output units

Hidden units

Input units



**Figure 9.17** A parallel distributed processing (PDP) network showing input units, hidden units, and output units. Incoming stimuli, indicated by the arrows, activate the input units, and signals travel through the network, activating the hidden and output units. Activity of units is indicated by shading, with darker shading indicating more activity. The patterns of activity that occur in the hidden and output units are determined both by the initial activity of the input units and by the connection weights that determine how strongly a unit will be activated by incoming activity. Connection weights are not shown in this figure. © Cengage Learning



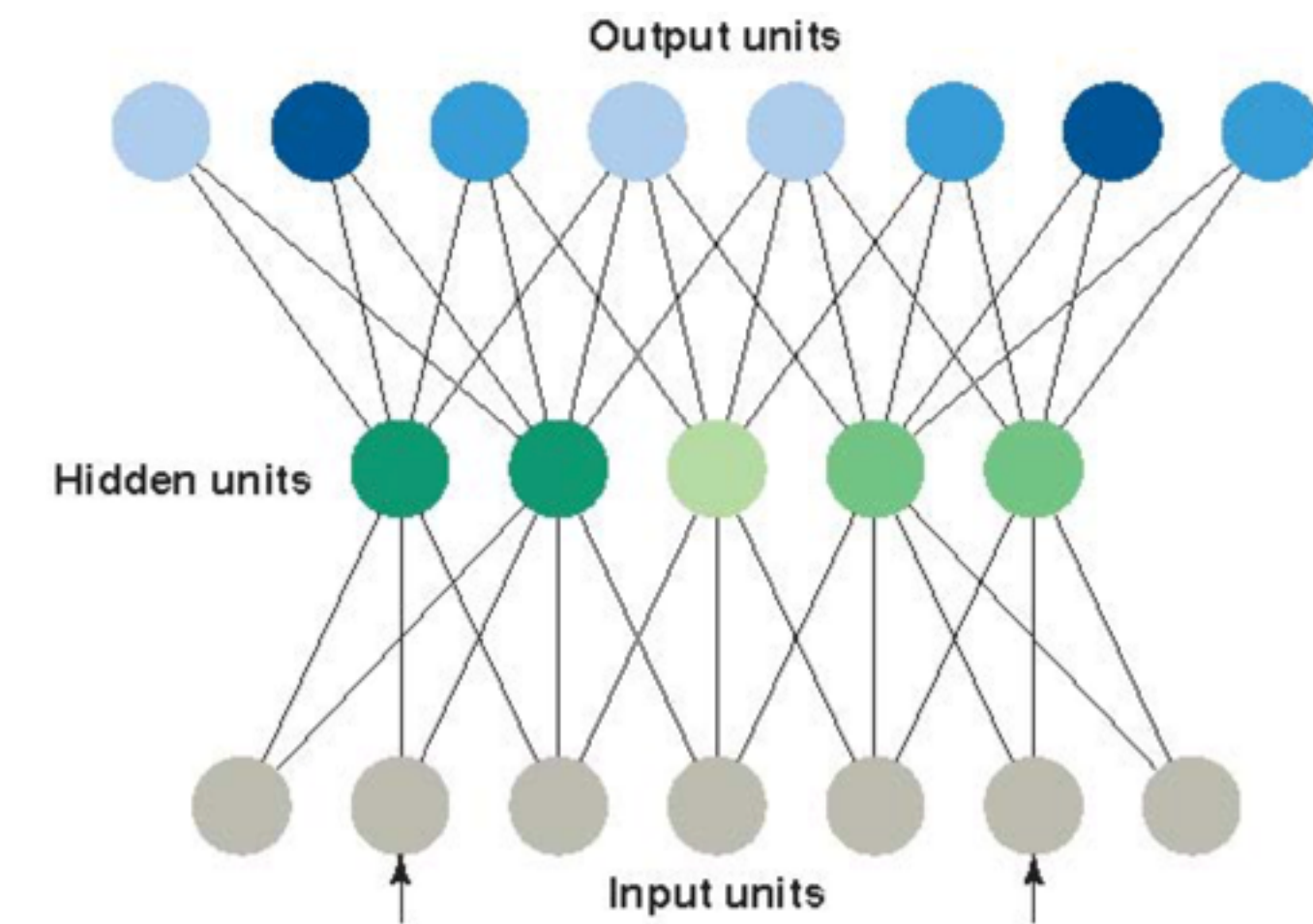




# PDP Models

## How They Work

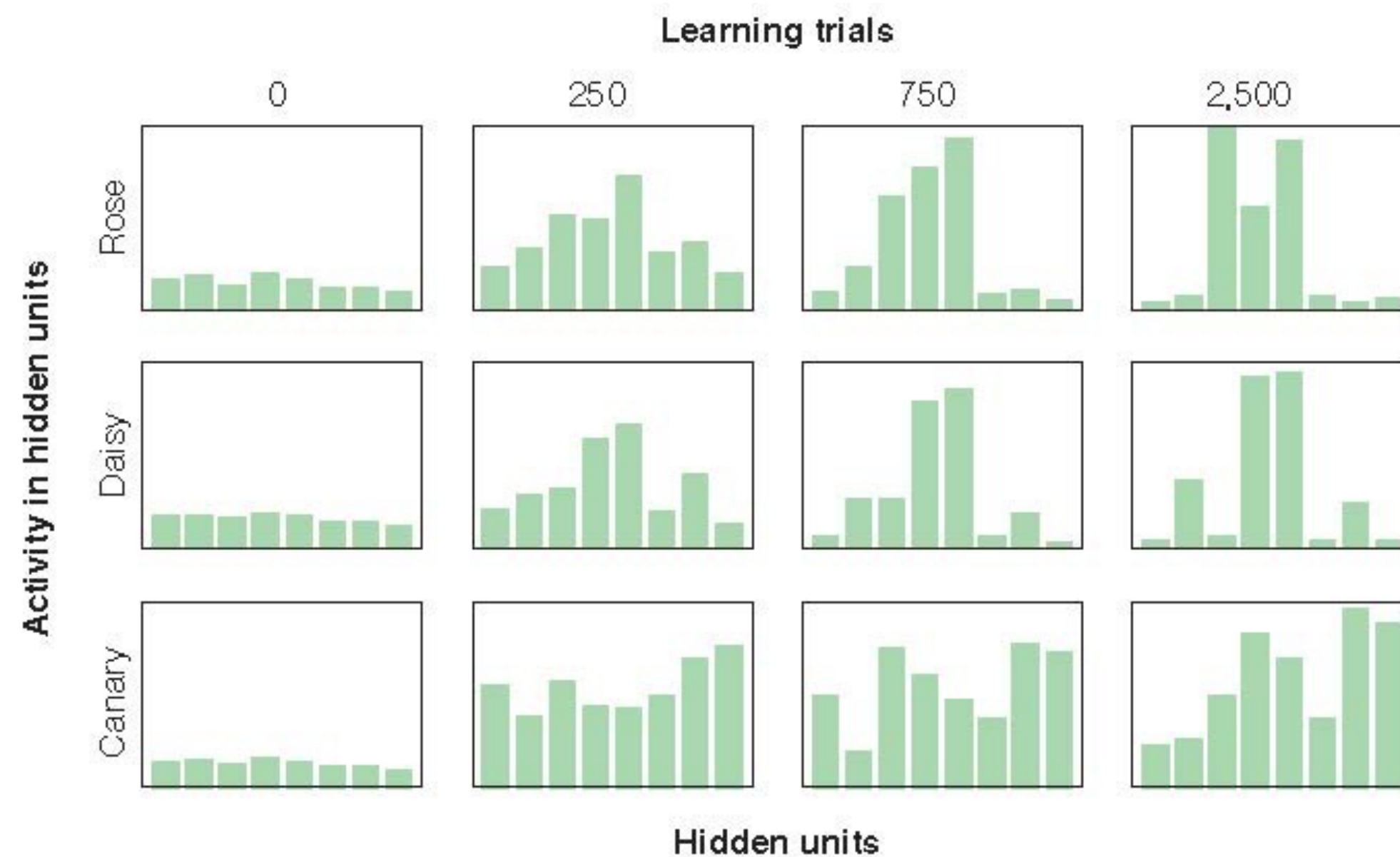
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**Figure 9.19** Learning in a connectionist network. Bars represent activity in the eight representation units. Notice how the pattern of activation changes as learning progresses. (Source: Adapted from J. L. McClelland & T. T. Rogers, *The parallel-distributed processing approach to semantic cognition*, *Nature Reviews Neuroscience*, 4, 310–320, 2003.)

- General flow during learning in a neural network:
  1. Network responds to stimulus and produces a response
  2. Information about correct response is provided (see below)
  3. Network modifies responding to match correct response (typically by adjusting weights, often in a trial and error fashion, i.e. more or less randomly)
- An **error signal** is generated that reflects the difference between actual activity of each output unit and the correct activity, which helps indicate how weights should be changed to allow the output signal to match the correct signal
- This signal is sent back through the circuit (via **back-propagation**)
- The entire process repeats until error signal = 0