Block diagrams in *B:CP* represent memory as a box above the comparator. Error output from higher orders is called an 'address signal'. This signal evokes from the 'memory' box a stored copy of the perceptual signal which is controlled through that comparator. One branch of that evoked output is the reference signal for the comparator; a second branch is added to perceptual input for 'retrieval' of the memory.

The 'memory' box and the 'address signal' labels are a convenient but misleading fiction based on an analogy to the storage and retrieval of bits of data in the memory of a digital computer.

Notice the many-to-one relation of signals at the input function, and the one-to-many relation at the output function. The input function combines the diverse rates of firing of several lower-level perceptual signals into one rate of firing, the perceptual signal. The reference signal is also a single rate of firing, as is the error signal. Two boxes intervene between the error output above and the reference inputs below. The output function does the branching to the same several lower-level systems which provide the perceptual inputs, and the 'memory' function transforms the rate of firing in the higher error signal to the rate that is appropriate for each lower system.

B:CP (212-213) says we use associative memory, and that any part evokes the rest. Consequently, the top-level reference input is not the 'address' for a memory. The 'memory' box should be relabeled the reference input function (RIF).

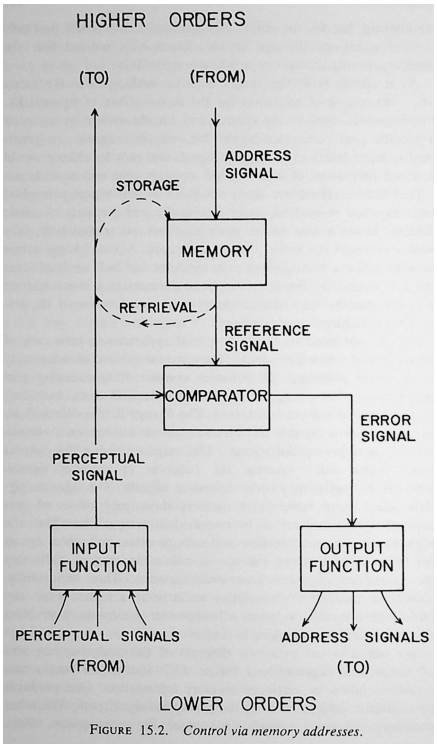
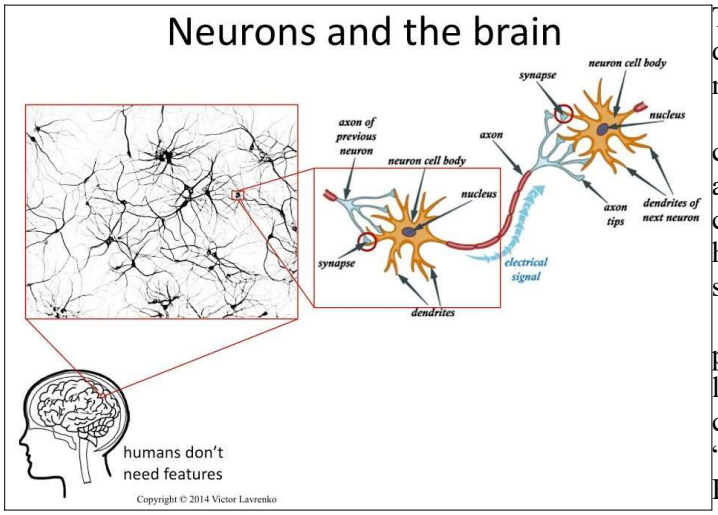


FIGURE 15.2. *Control via memory addresses.*



The consensus in neuroscience is that memory is distributed, stored at every synapse in the nervous system, not just at the reference inputs of comparators.

In simplest form, when a synapse fires frequently, concentrations of neurochemicals change in the region around the synapse, making it easier to fire again. This is called long-term potentiation (LTP). The converse happens (long-term depression or LPD) around disused synapses.

Axons and dendrites may branch and synapse at many points along their length. By parallel branches and by lateral influence the number of fibers in a neural bundle can be increased or decreased. As Hebb famously put it, "Cells that fire together wire together" (the basis of Hebbian and anti-Hebbian learning).

For recall of static memory it is enough to store and evoke an accustomed rate of firing. How does the higher system vary the references for its inputs if the reference values are stored in memory?