

Brain Stimulation Criteria and Memory Capacity

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Neuron Stimulators

- Phenomena in the outside world
 - Light
 - Sound
 - Pressure
 - Temperature
 - Taste
- Physical and chemical changes within the organism
 - Internal events
 - Signals from other neurons
 - Coffee ☺

Appearance of Digital Nature

- If two or more input pulses are needed to exceed the threshold and evoke an output pulse, then the neuron is an “and” organ
- If arrival of a single input pulse is sufficient to trigger an output pulse, then the neuron is an “or” organ

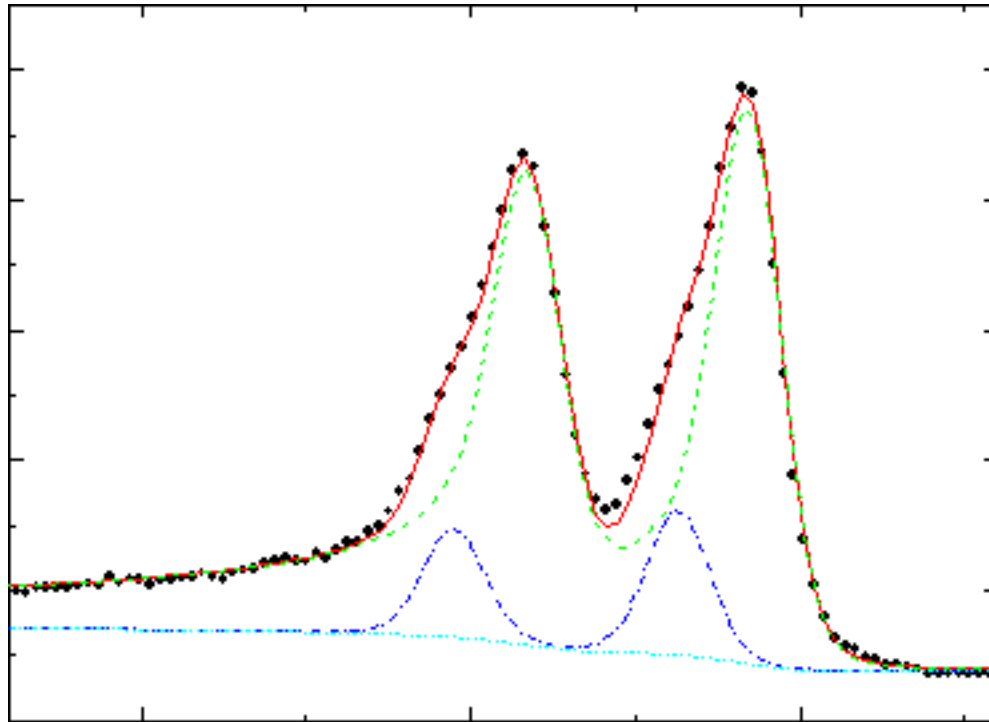
However, this view is “a simplification and idealization of reality”.

Stimulation Criteria

- The neuron may need to receive a certain minimum number of pulses, out of many, so that the neuron's *threshold* is exceeded
- Locations where the input pulses arrive at may alter the minimum number and/or affect the frequency/phase of the neuron firing.

The Summation Time

- Input pulses may arrive at (slightly) different times, not quite simultaneously



Stimulation Criteria for Receptors

- *Receptors* are neurons that respond to the external and internal stimuli
- **Threshold:** The minimum intensity of the stimulus matters
- The length of the stimulation time span may also matter
- Many neurons respond to a change (say, in illumination), as opposed to an absolute level of the stimulus: *differentiation*
- **Role of the complexities:** Analog or “mixed”; increase the count of basic active organs

Memory

- Memory is an organism's ability to store, retain, and subsequently retrieve information.
- Mechanisms of memory are not completely understood. Brain areas such as the *hippocampus*, the *amygdala*, or the *mammillary bodies* are thought to be involved in specific types of memory.
- Learning and memory are attributed to changes in neuronal synapses, thought to be mediated by *long-term potentiation* and *long-term depression*. Long-term potentiation (LTP) is the long-lasting enhancement in communication between two neurons that results from stimulating them simultaneously. Long-term depression is the opposite of LTP.

Memory Capacity

- Each of us has 10^{15} - 10^{16} synapses
- von Neumann's estimate: $2.8 \cdot 10^{20}$ bits (~31,086 petabytes)
- Other forms of memory:
 - Genetic memory
 - Nerve cells stimulating each other in cycles, like flip-flops
 - Books 😊