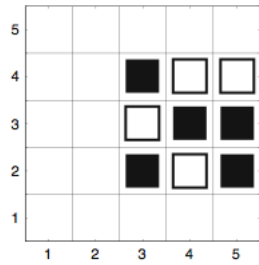


2

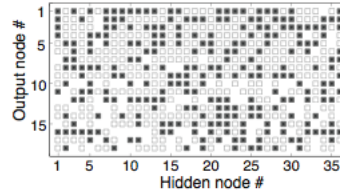
The What-and-Where task



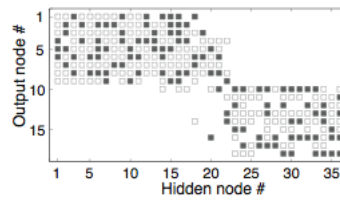
A. Model retina with sample image



B. Without bias towards short connections



C. With bias towards short connections



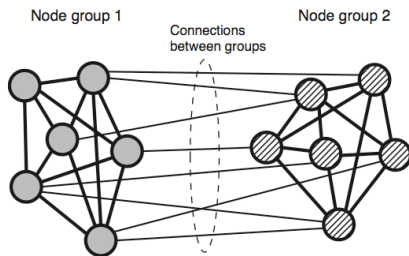
Jacobs and Jordan, 1992

3

Coupled attractor networks



A. Coupled attractor networks

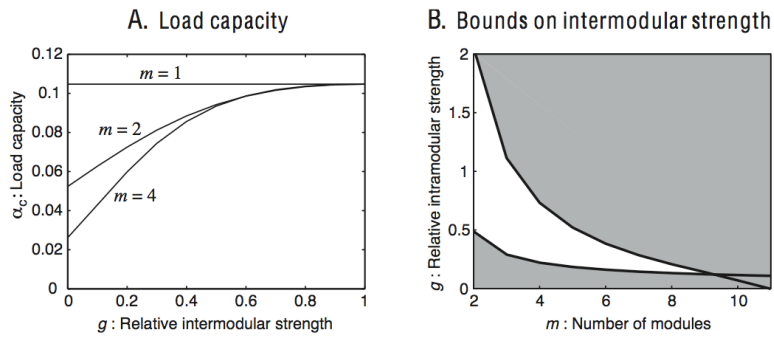


B. The left-right universe with letters

0000011100000	1111111110000
0000011100000	1111111111100
0000111110000	1110000001110
0000110110000	1110000011100
0001100011000	1110001110000
0011100011100	1111111000000
0011111111100	1111111000000
0111111111110	1110001110000
0111000001110	1110000011100
0111000001110	1110000001110
0111000001110	1111111111100
0111000001110	1111111110000

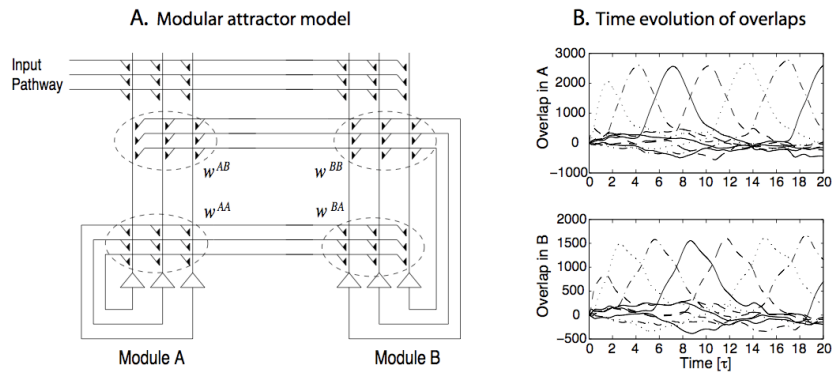
4

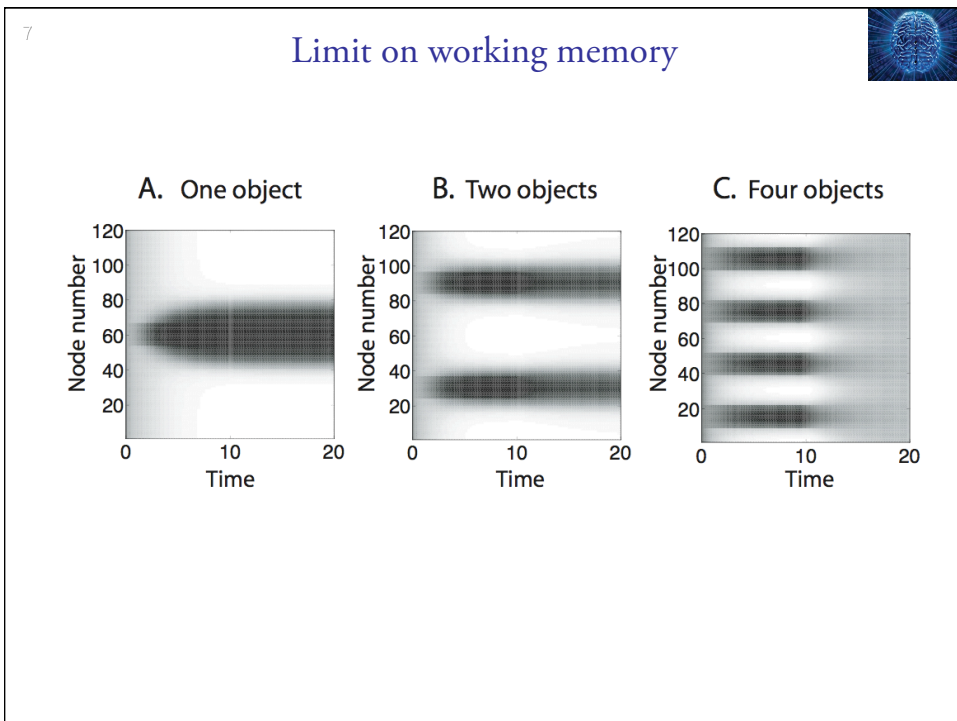
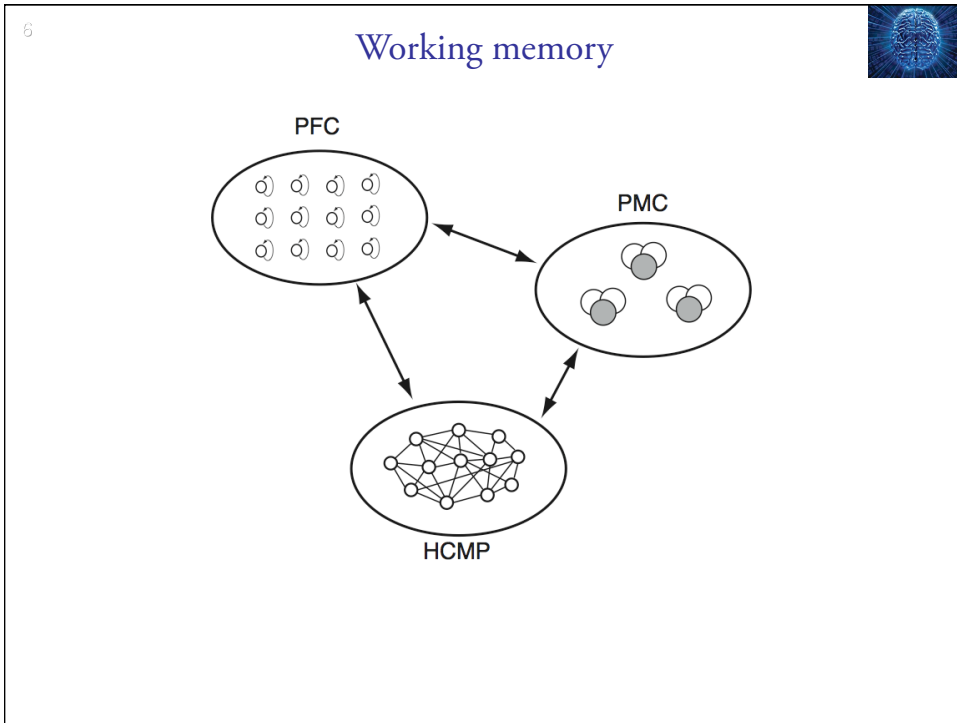
Limit on modularity

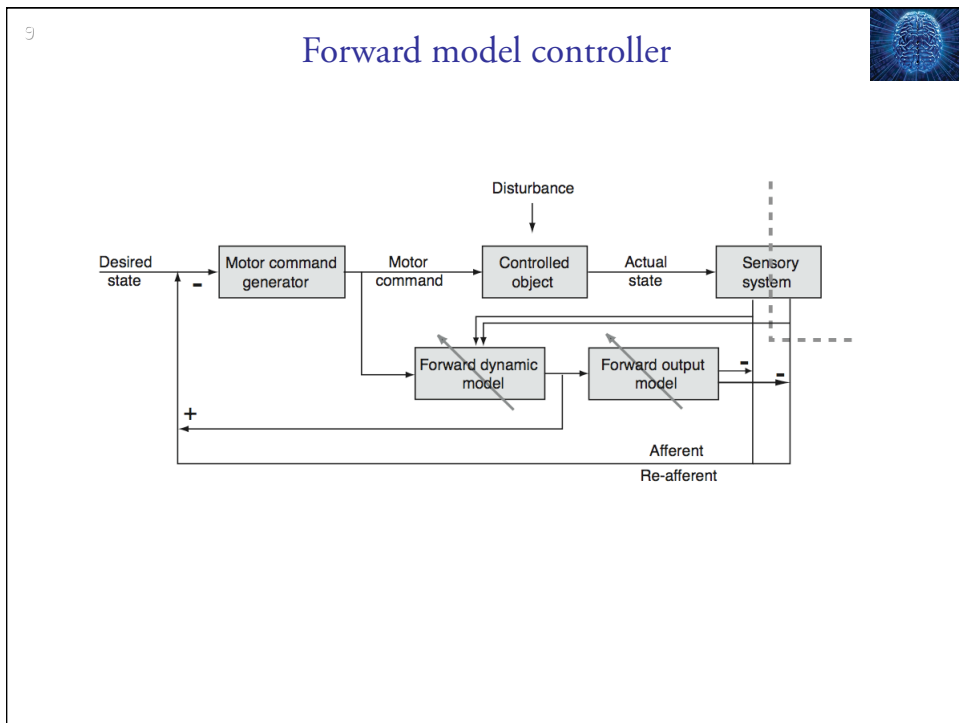
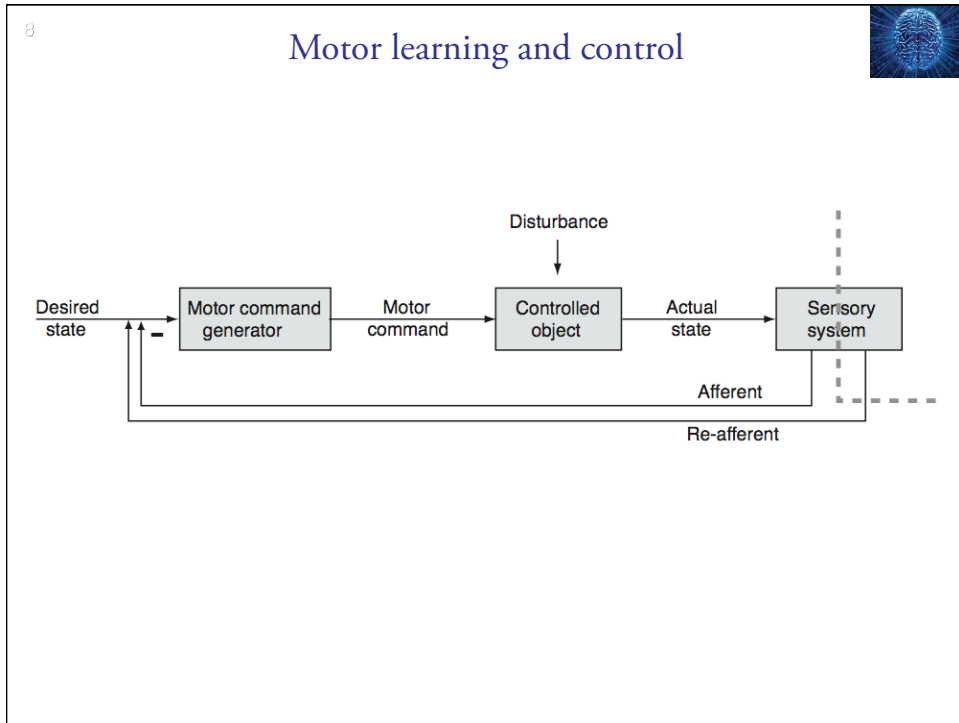


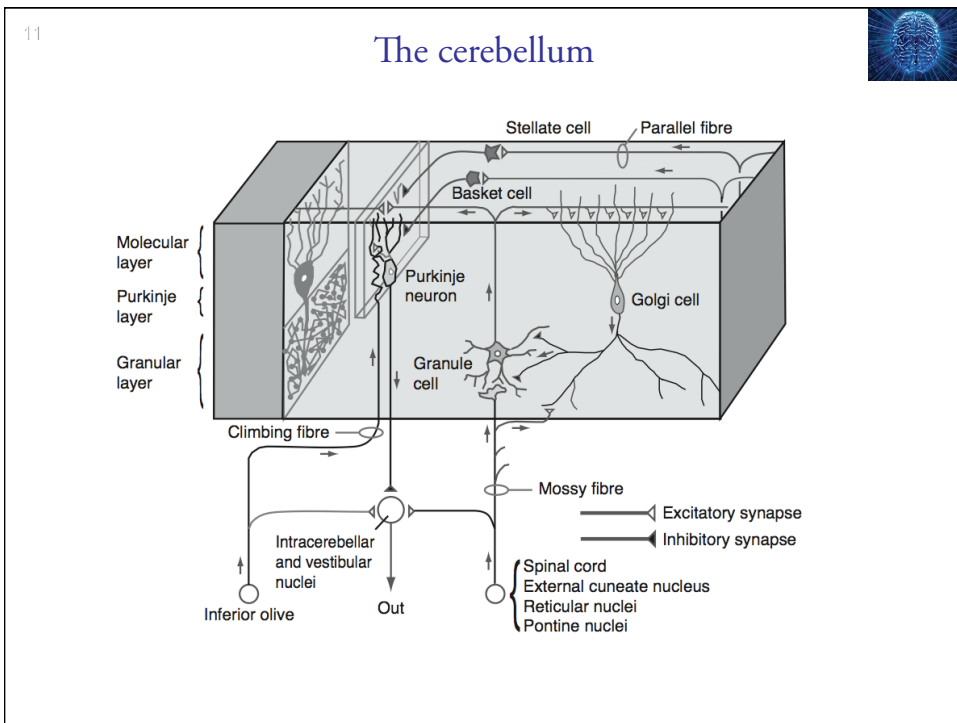
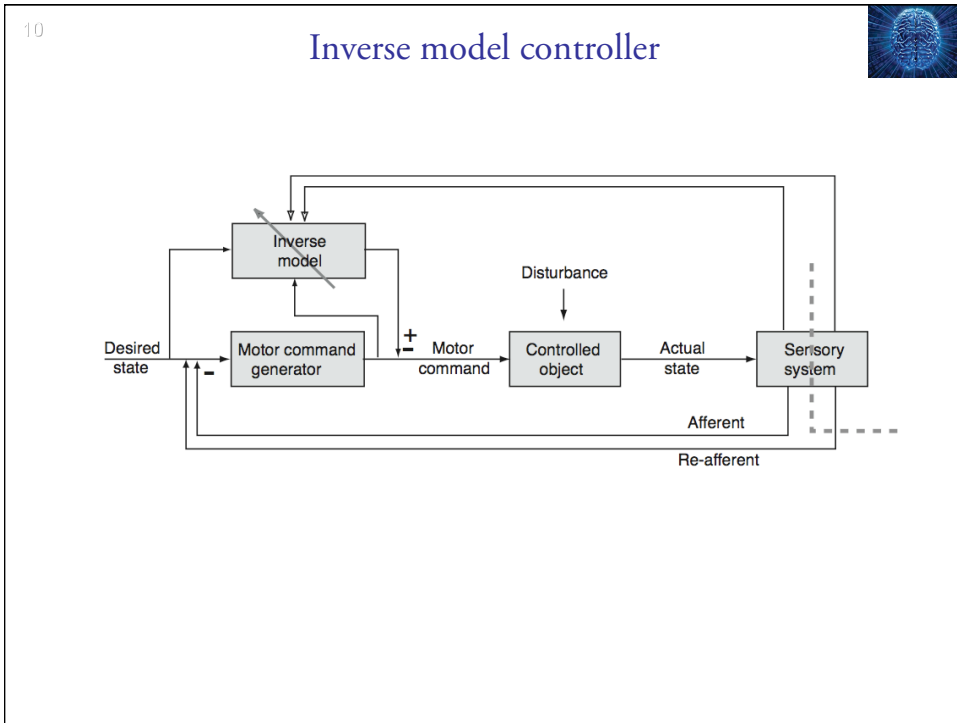
5

Sequence learning









12

Reinforcement learning

The diagram illustrates a reinforcement learning task in three sequential panels. On the left, a bell icon indicates a sound stimulus. The first panel shows a mouse in a box with two levers and two circular targets. The second panel shows the mouse pulling the left lever. The third panel shows the mouse pulling the right lever, which is associated with a reward (indicated by a small circle). A small brain icon is in the top right corner.

13

The basal ganglia

A. Outline of basic BG anatomy

The anatomical diagram shows the following structures and their connections:

- Cerebral cortex**: Projects to the **Striatum** (Caudate nucleus and Putamen).
- Striatum**: The **Putamen** projects to the **Subthalamic nucleus**, which in turn projects to the **Thalamus**. The **Caudate nucleus** projects to the **Thalamus**.
- Thalamus**: Projects back to the **Cerebral cortex**.
- Subthalamic nucleus**: Also receives input from the **Substantia nigra (pars reticulata)**.
- Substantia nigra**: Divided into **pars compacta** and **pars reticulata**. The **pars compacta** projects to the **Superior colliculus**.
- Superior colliculus**: Projects to the **Thalamus**.
- Globus pallidus**: Located within the **Striatum**, it projects to the **Subthalamic nucleus**.

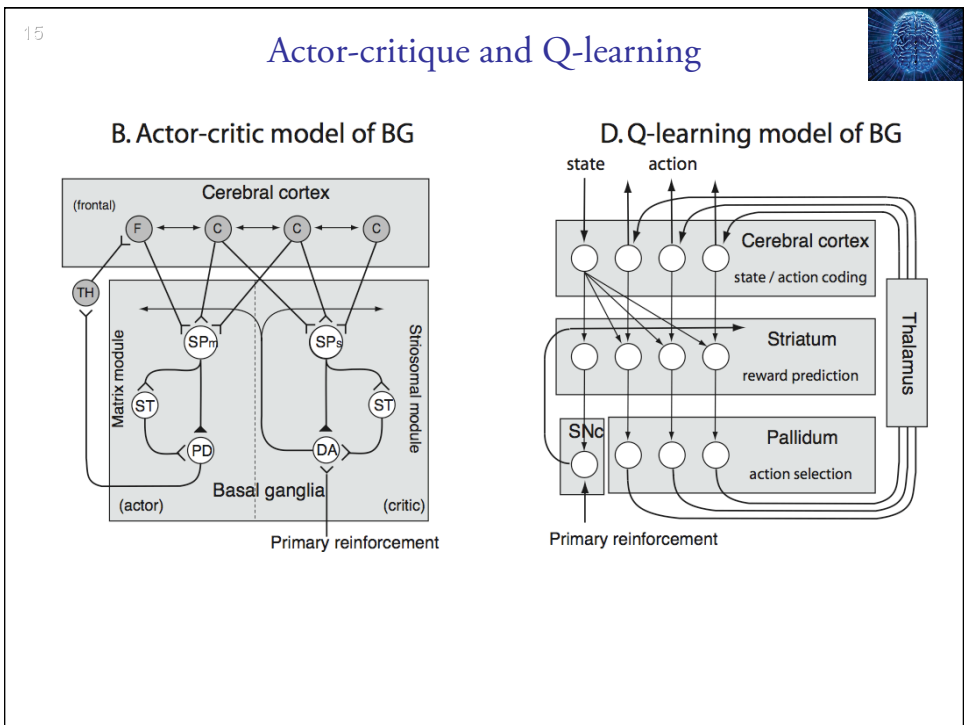
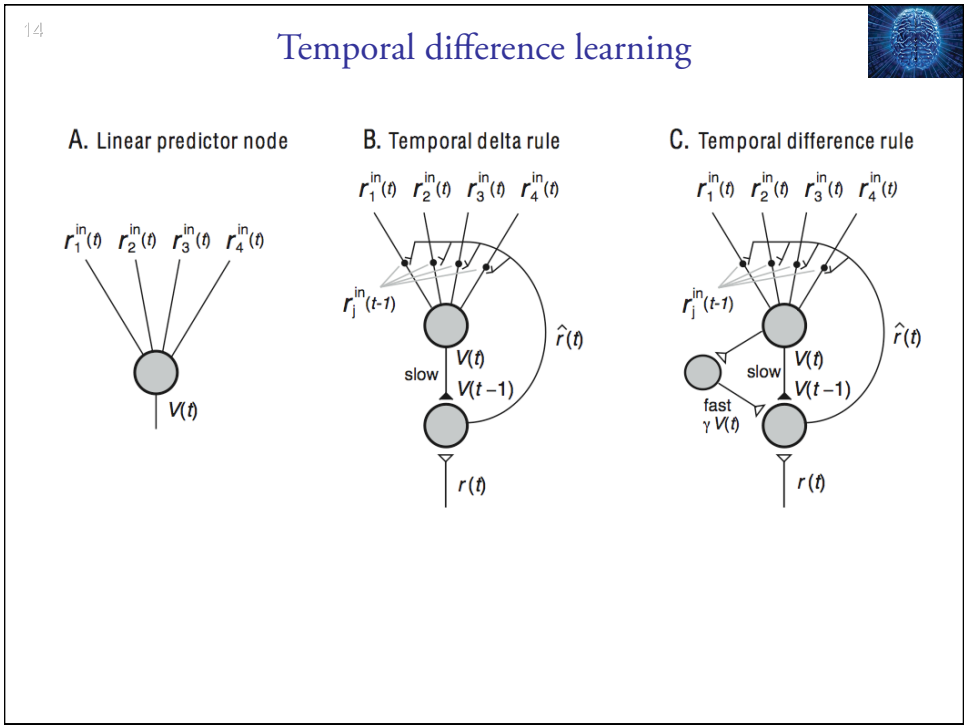
C. Recordings of SNc neurons and simulations

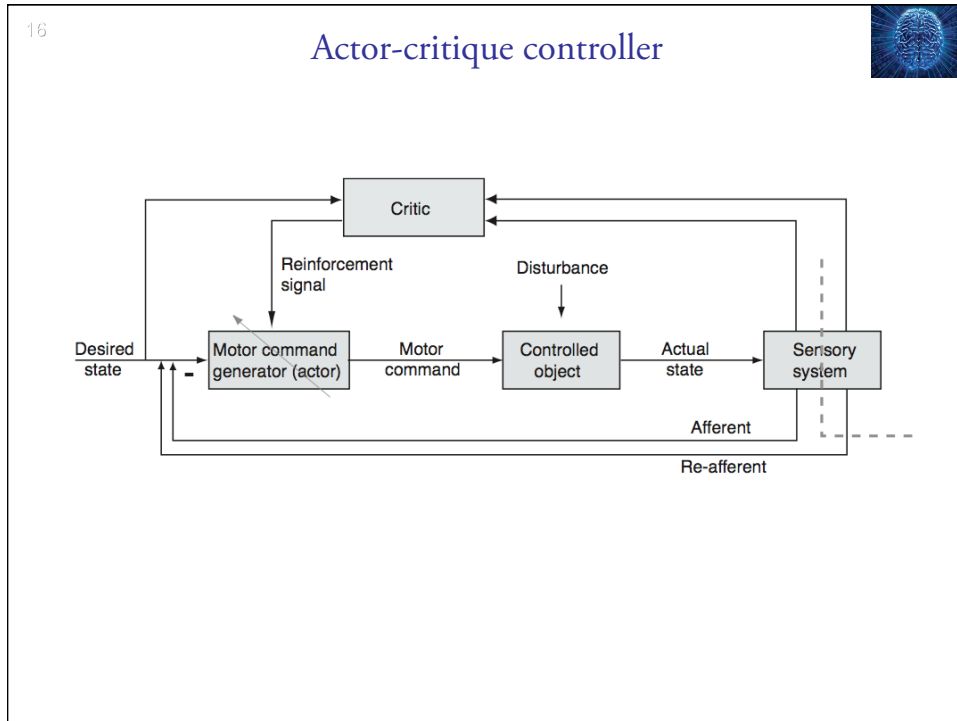
The recordings show neural activity (spikes) in response to different stimuli:

- Stimulus A**: Shows a burst of activity followed by a sustained firing rate.
- No reward**: Shows a burst of activity followed by a rapid decrease in firing rate.
- Stimulus B**: Shows a burst of activity followed by a sustained firing rate.
- Reward**: Shows a burst of activity followed by a sustained firing rate.

The graph below shows the **rate** of firing over **Episode** (0 to 100):

- Pattern 4** (red line): Shows a high firing rate that quickly drops to a low, stable firing rate.
- Pattern 3** (green line): Shows a high firing rate that quickly drops to a low, stable firing rate.
- Pattern 2** (blue line): Shows a high firing rate that quickly drops to a low, stable firing rate.





17

Further readings

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