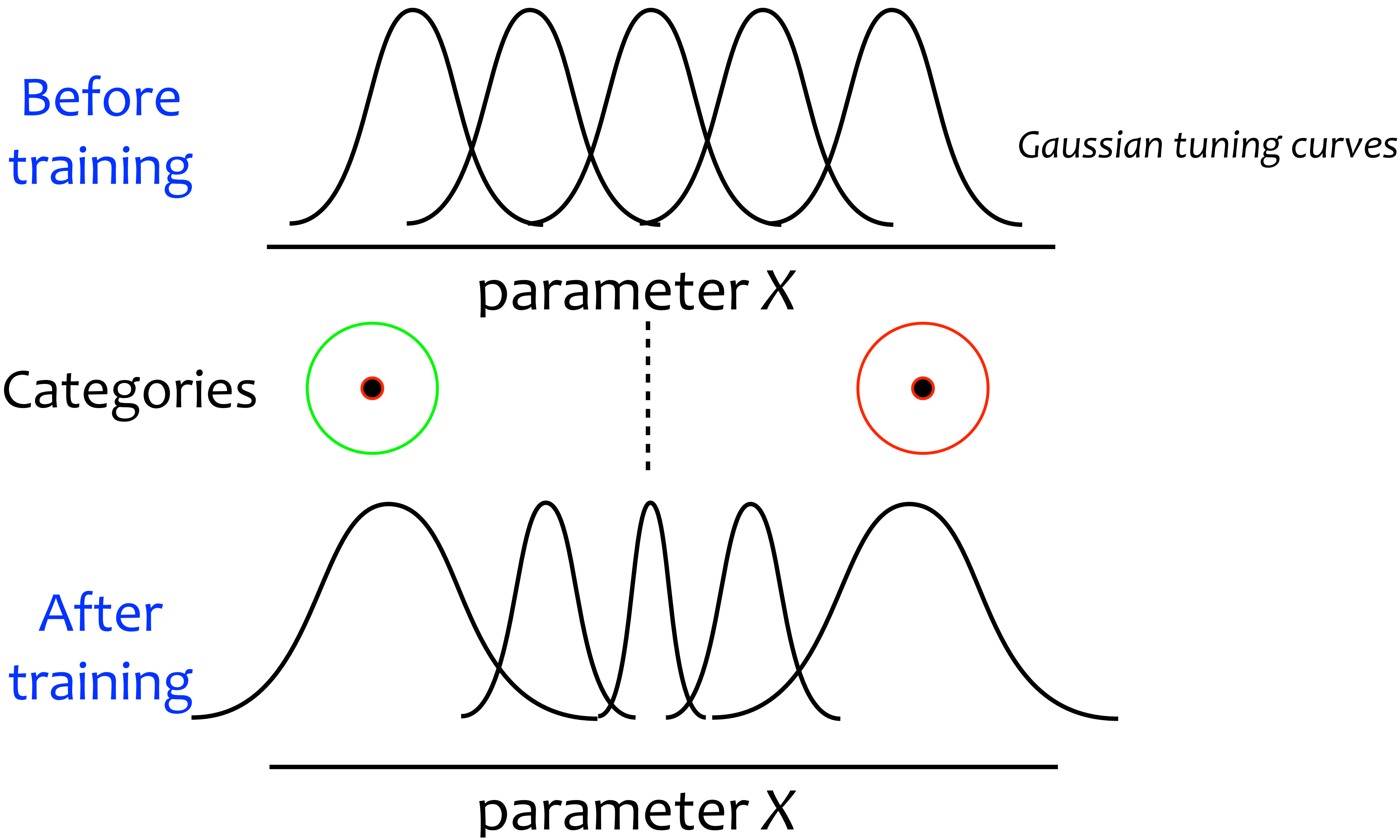
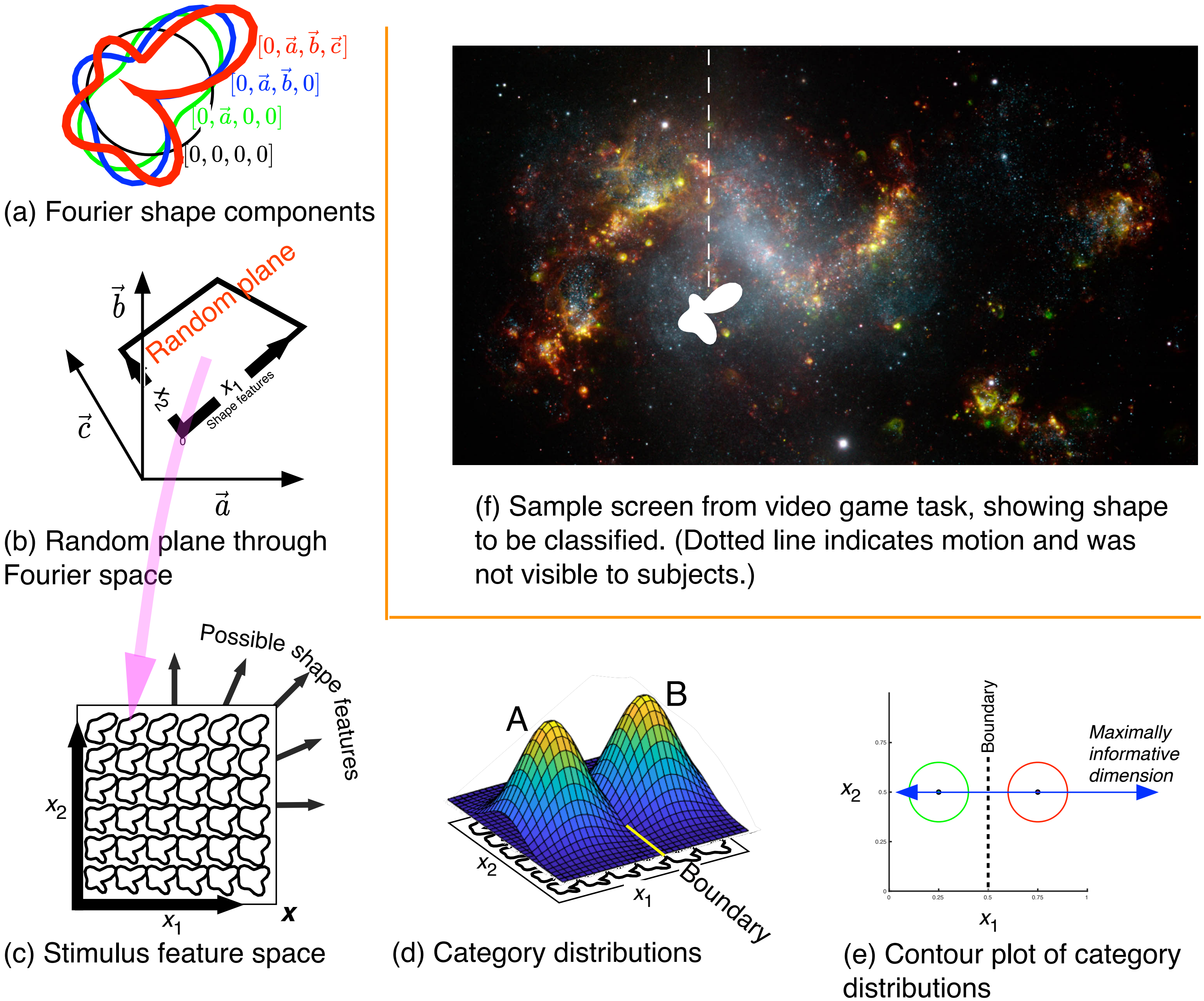
CP and neural coding



CP and "acquired distinctiveness"

- As subjects learn categories, their ability to discriminate fine differences near the category boundary improves
  - Called acquired distinctiveness
- But most studies have used hard boundaries, which don't really exist in natural categories!
- With a hard boundary, only features that cross the boundary are informative at all—but that isn't realistic

A modern CP experiment (Feldman, 2020)



(a) Fourier shape components

(b) Random plane through Fourier space

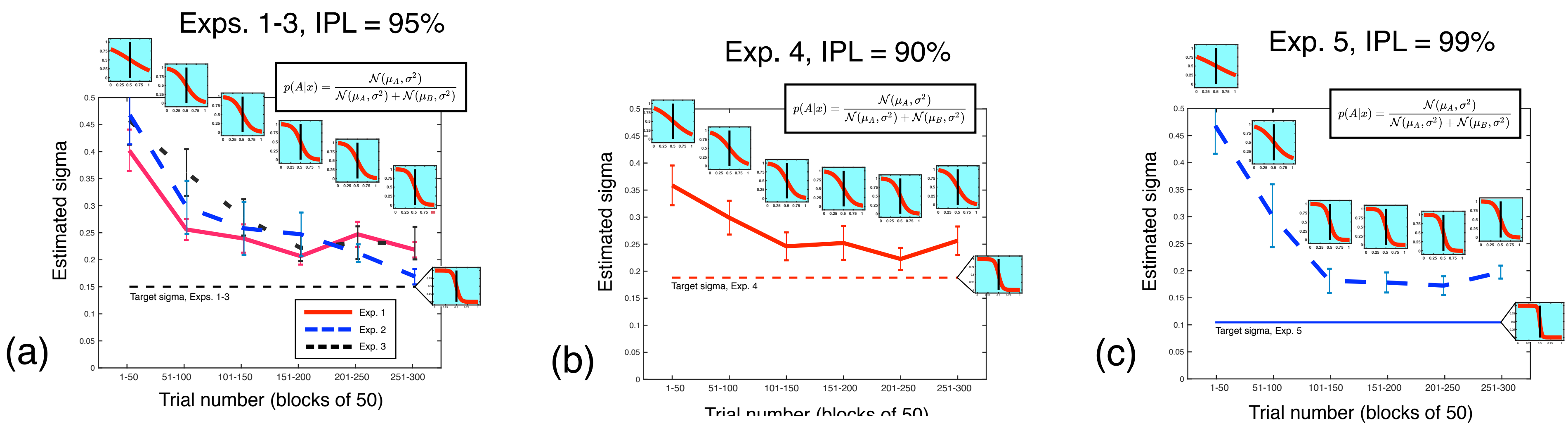
(c) Stimulus feature space

(d) Category distributions

(e) Contour plot of category distributions

(f) Sample screen from video game task, showing shape to be classified. (Dotted line indicates motion and was not visible to subjects.)

Categorization results

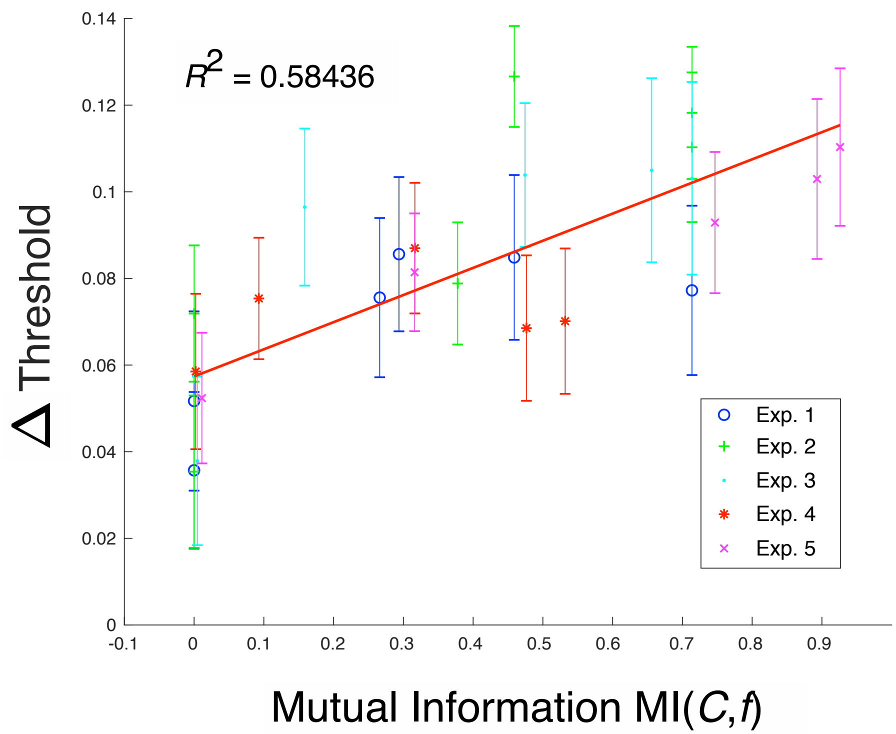


As training progresses, the classification curve gets more and more step-like

- though note that it only because as step-like as the actual category

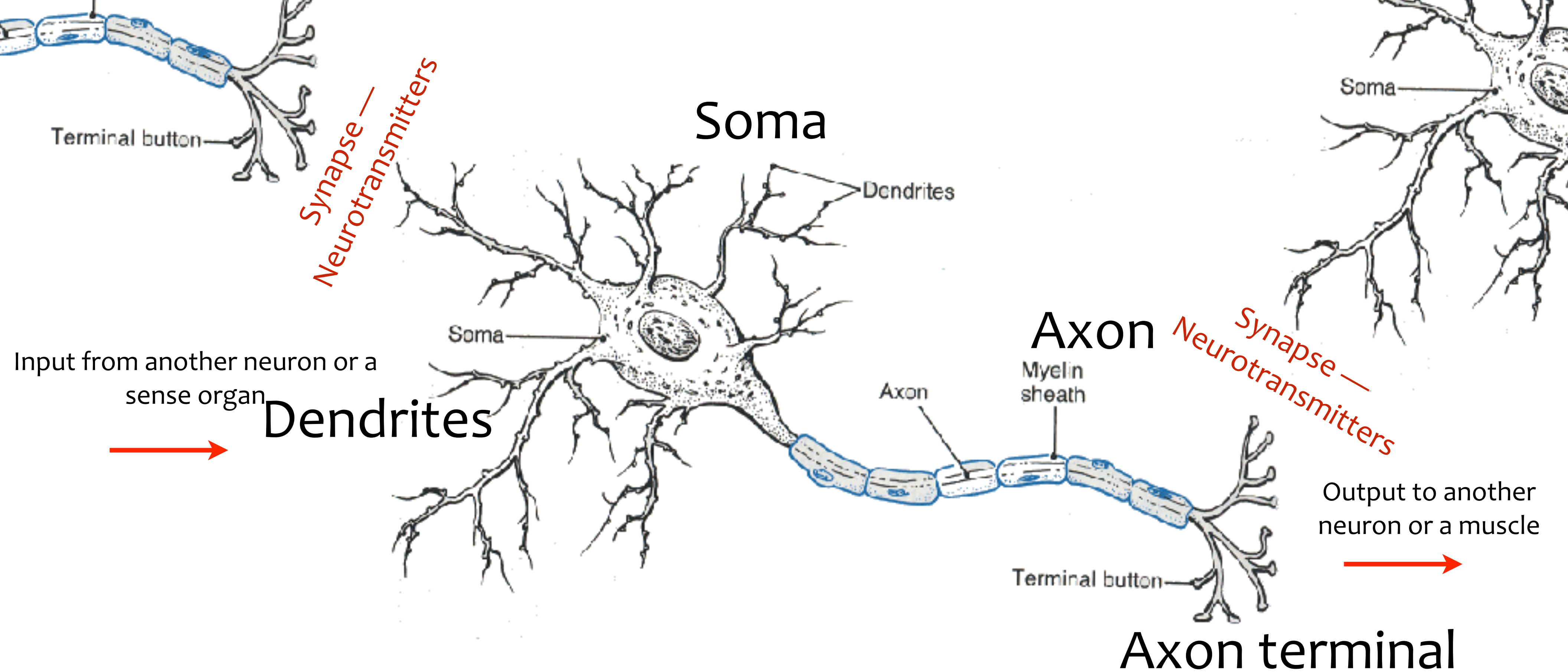
Discrimination results

Improvement in discrimination after training vs before training



Discrimination improves in proportion to how informative each feature is about the categories

The neuron

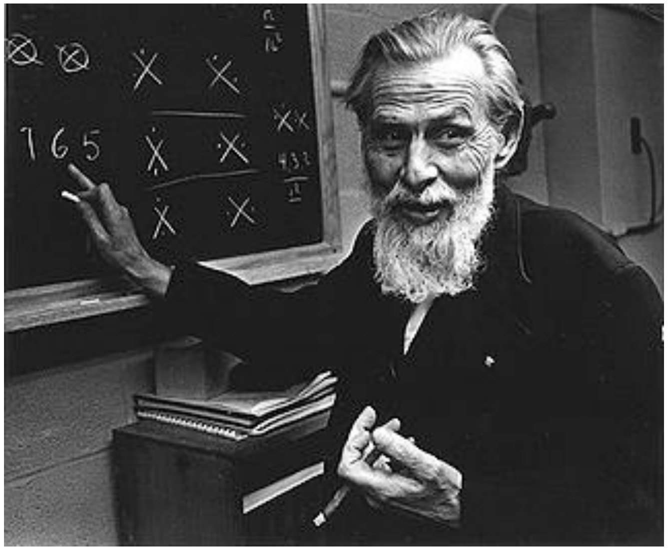


Neuron integrates excitation and inhibition to get total net activation;

If activation is above threshold, it "spikes" (sends an action potential down the axon)

After firing, the neuron resets (~2 or 3msec). If it is still being stimulated over threshold, it fires again. Hence the firing rate indicates the level of activation.

McCulloch & Pitts: Neurons are little computing devices



Excitatory/
Inhibitory
0/1 inputs

Summation/
thresholding

0 or 1 output