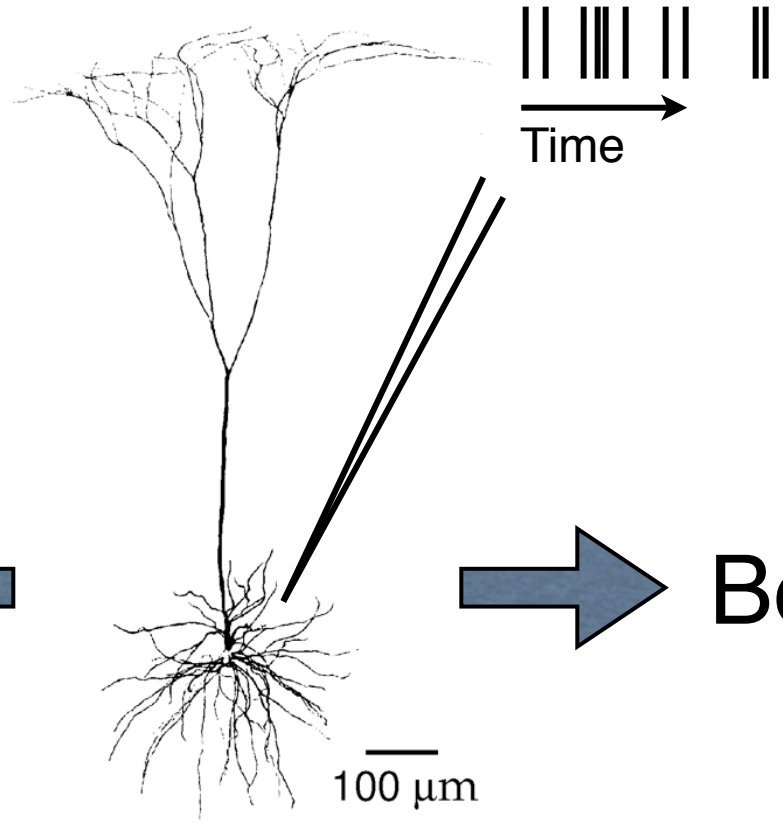
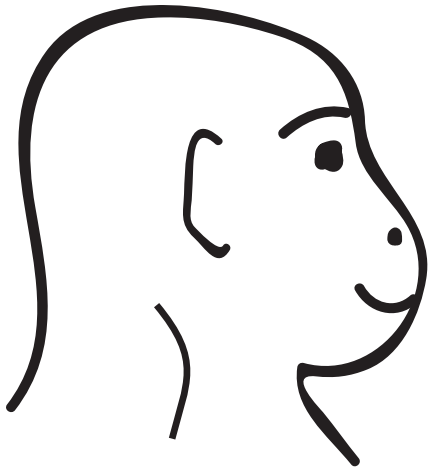
Decoding

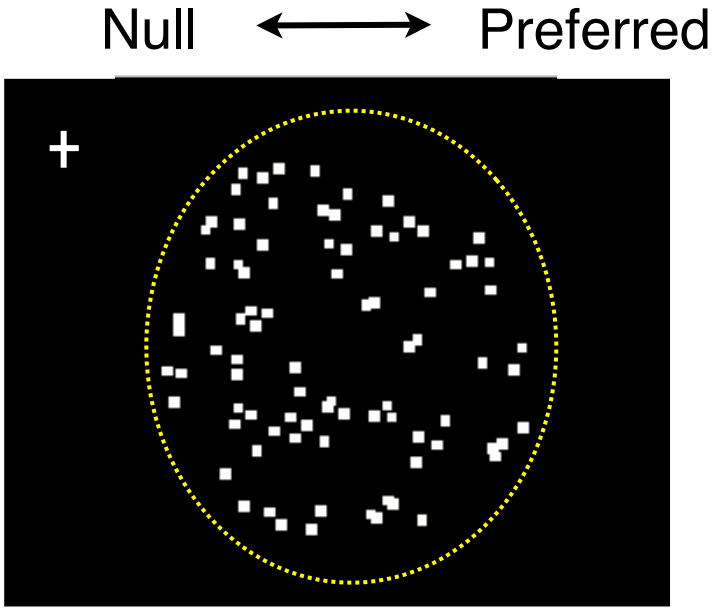
External stimuli



Behavior

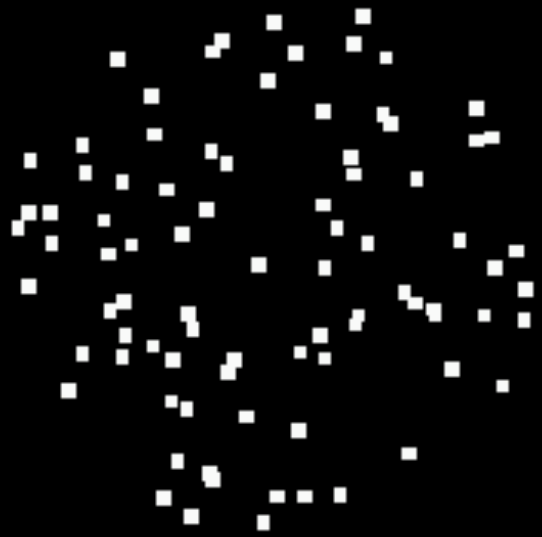
Motion discrimination





0%

No Net Motion

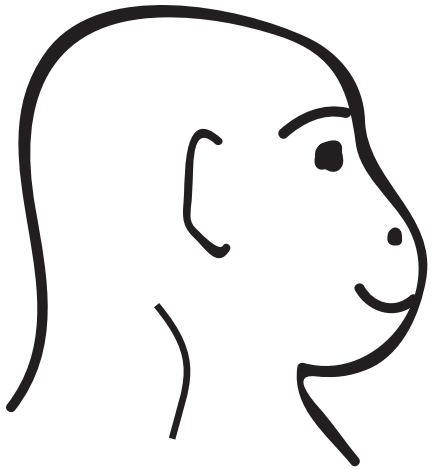


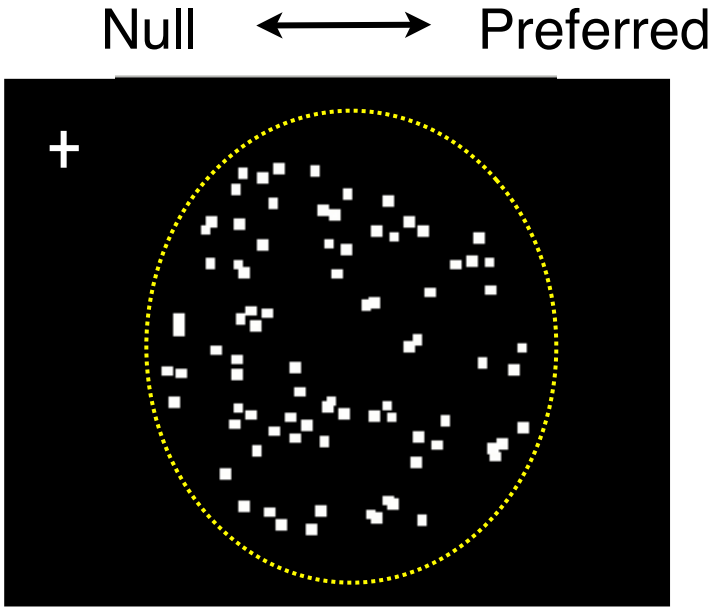
50%

100%

Strongest Motion

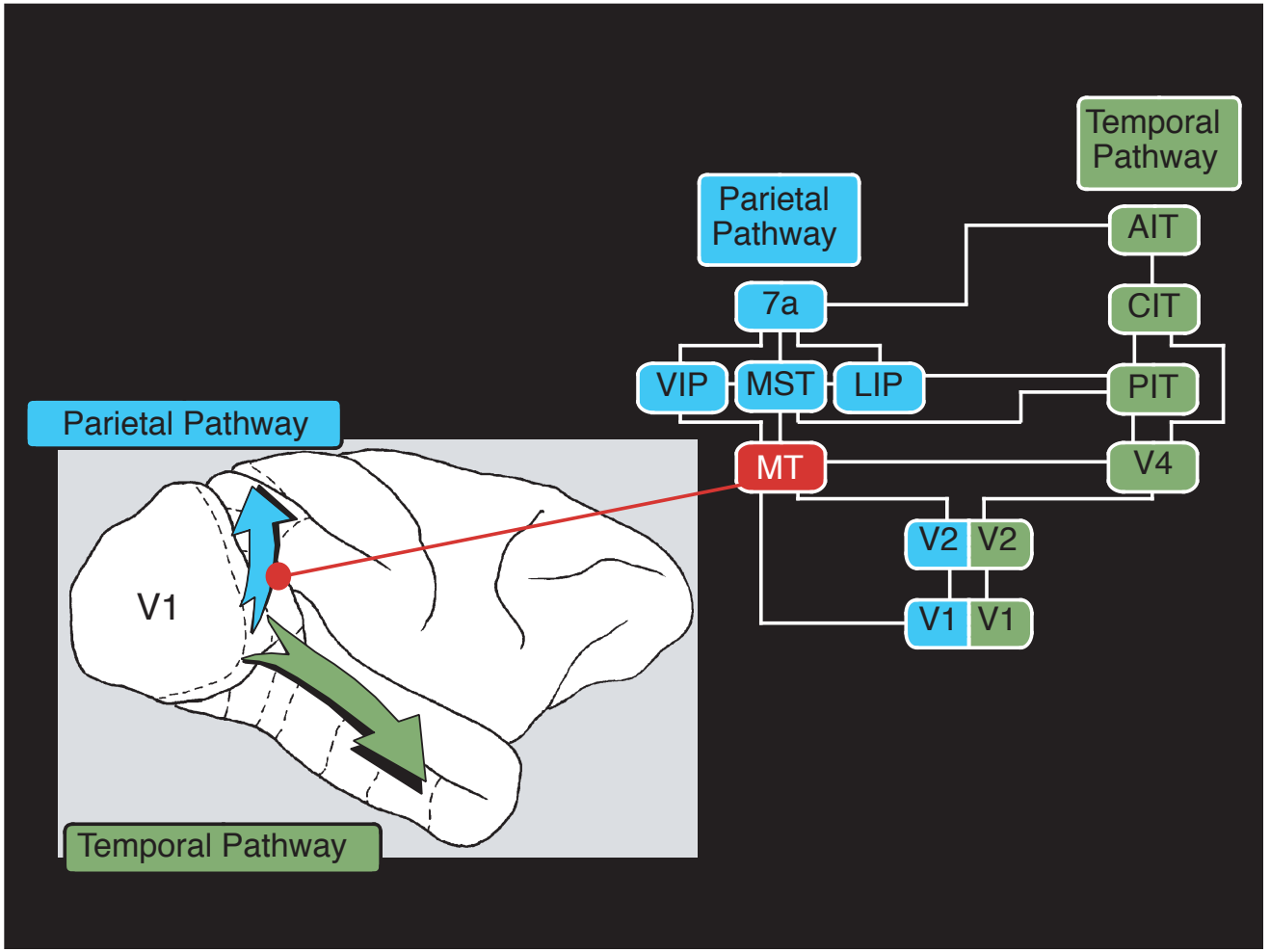
Motion discrimination



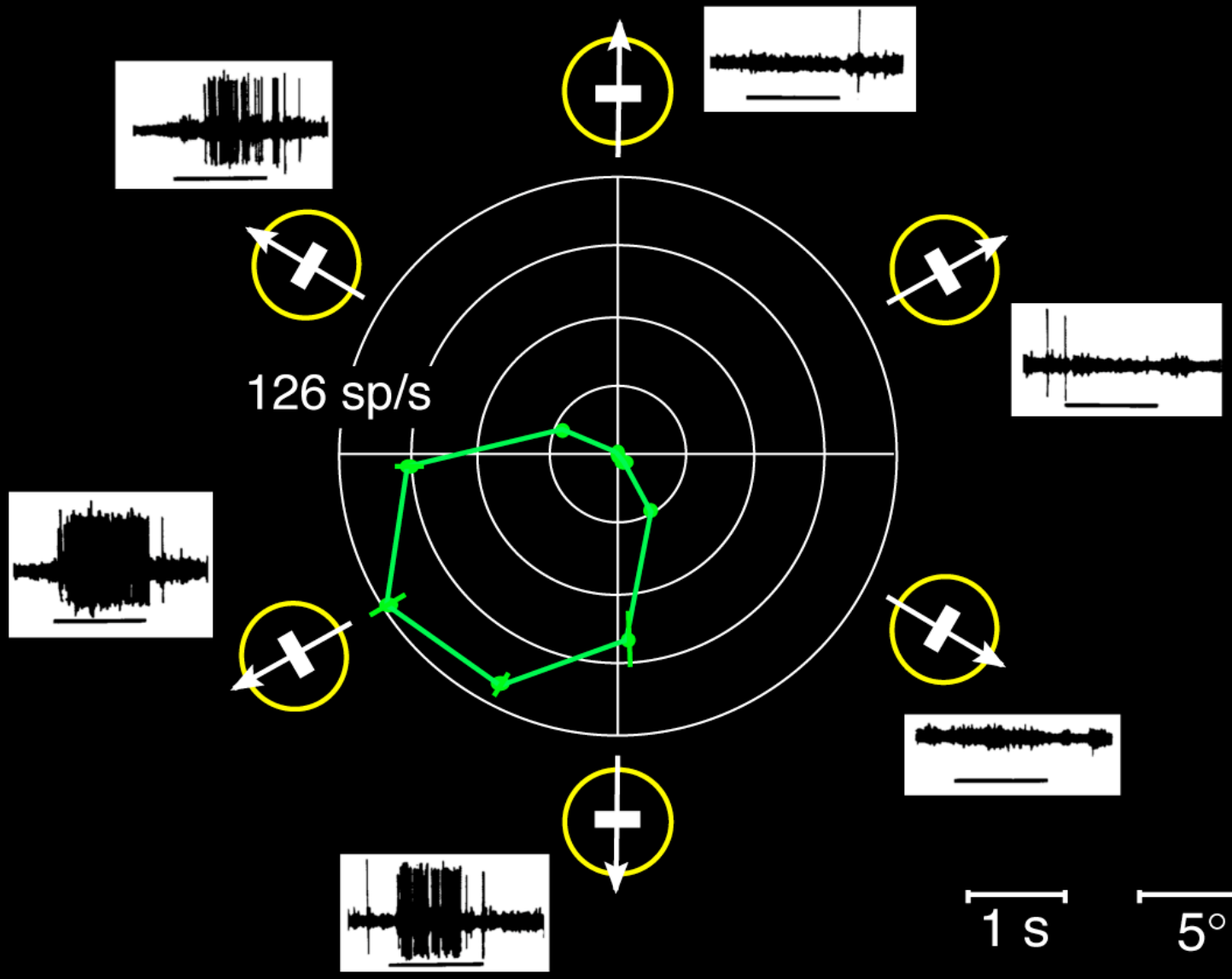


Recording in area MT of visual cortex

Direction



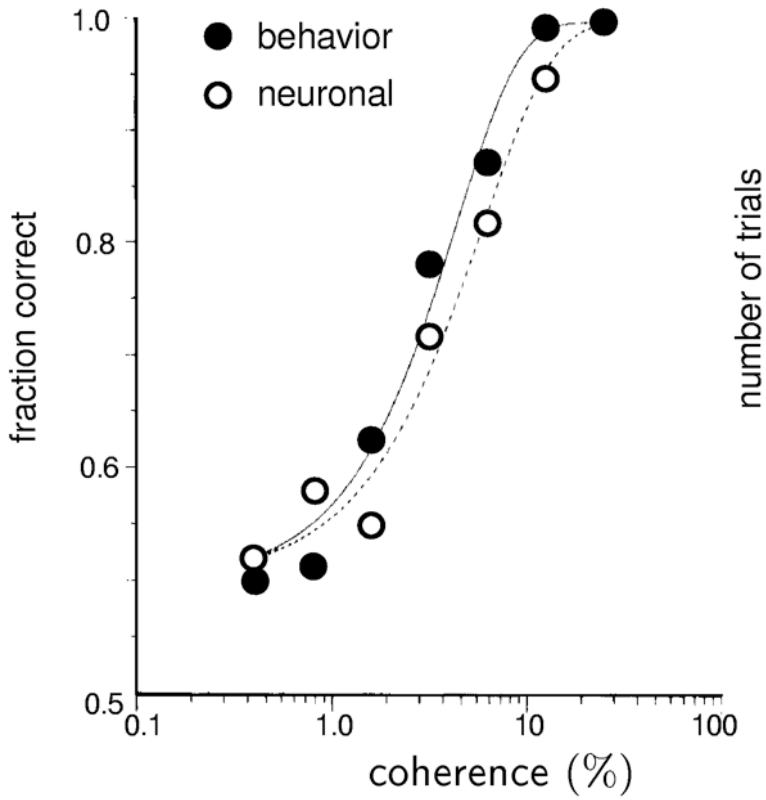
Directional selectivity in MT

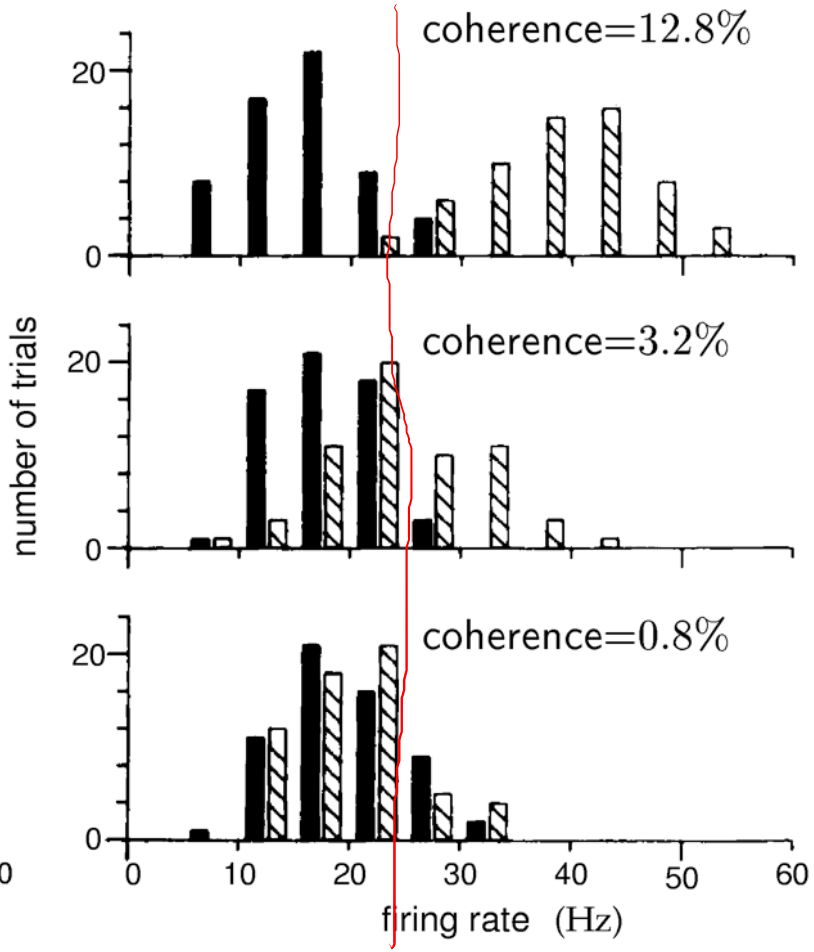


Motion discrimination

How decode neural signal?

Single detection theory



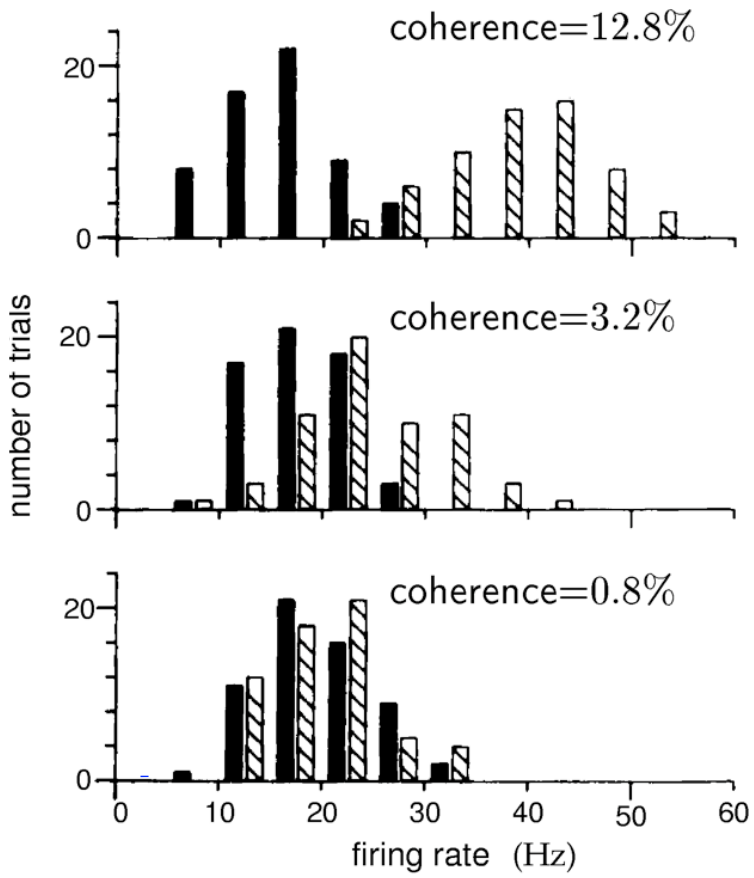


Miss

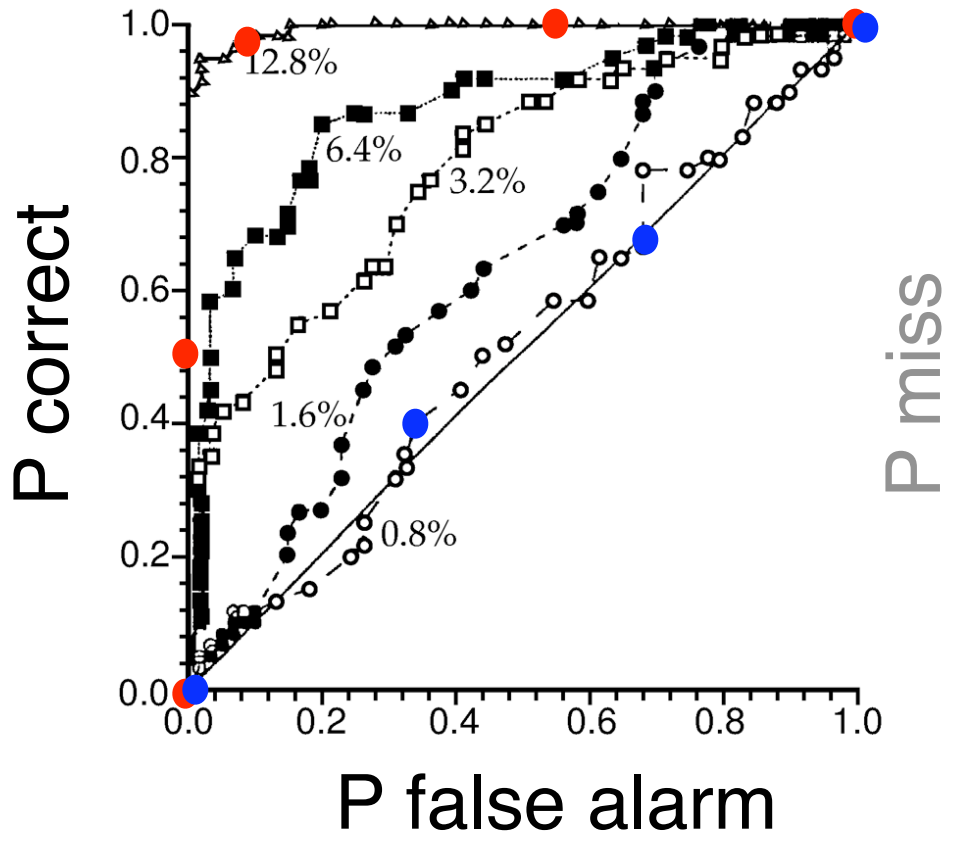
False Alarm

ROC analysis

Criterion (or threshold) dependent



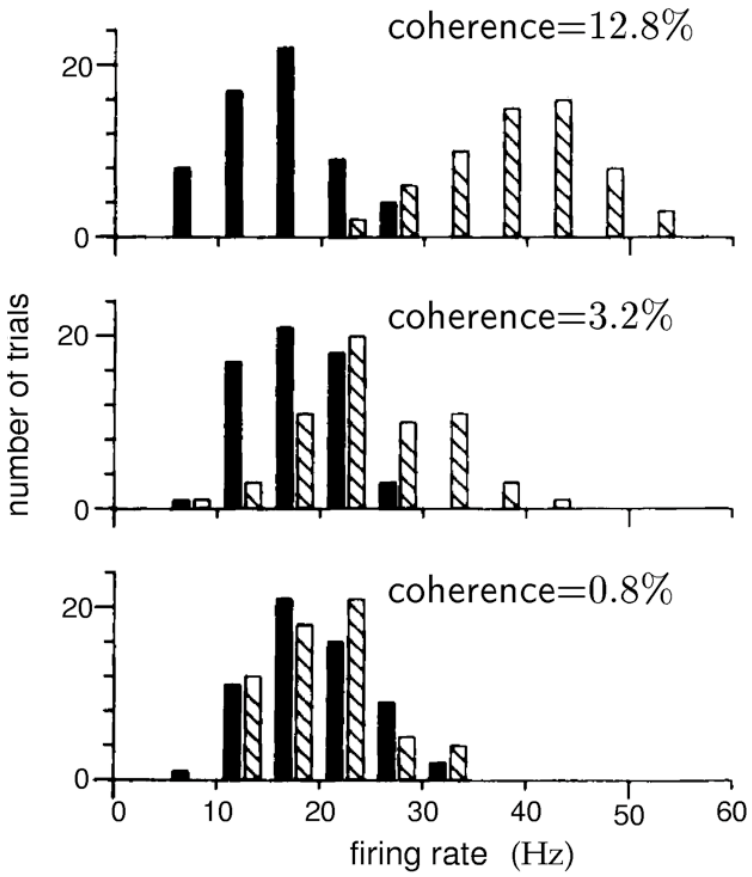
P correct reject

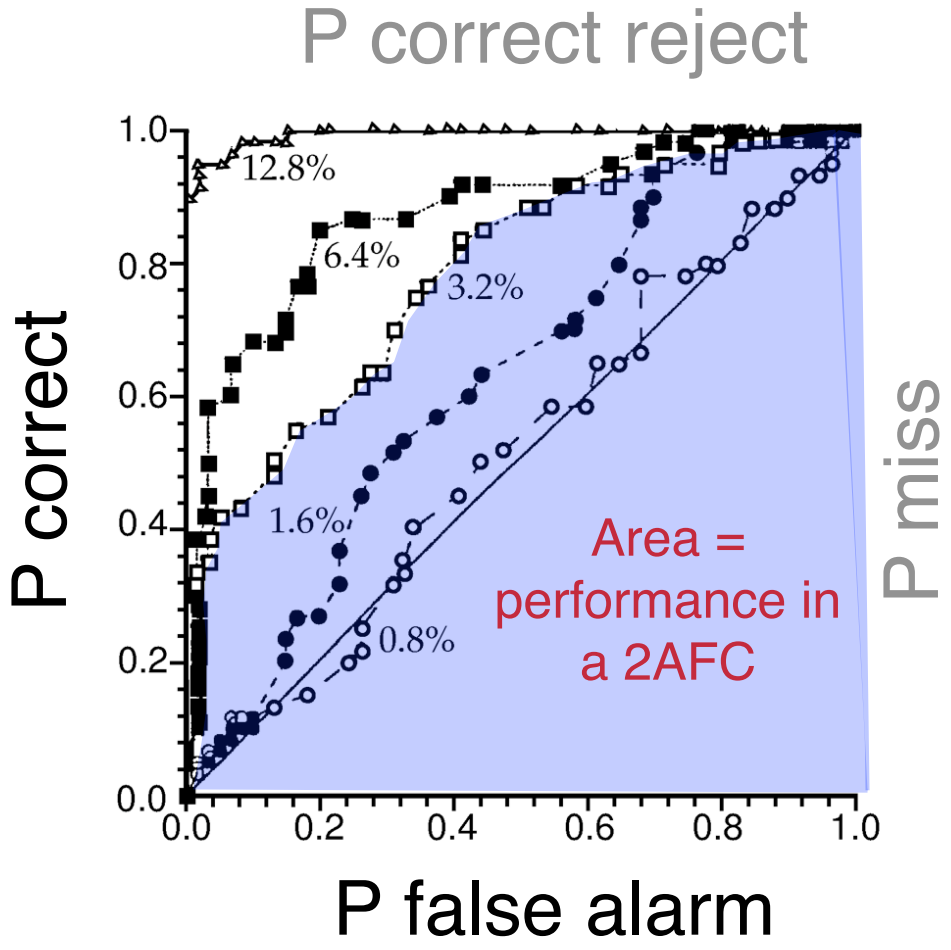


Area under curve, Probability of getting it right

ROC analysis

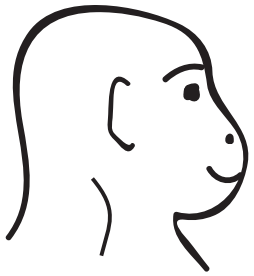
Criterion free (area under the ROC curve)

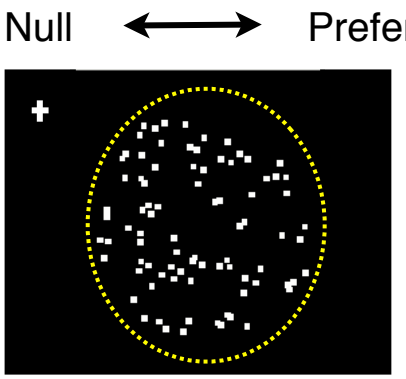




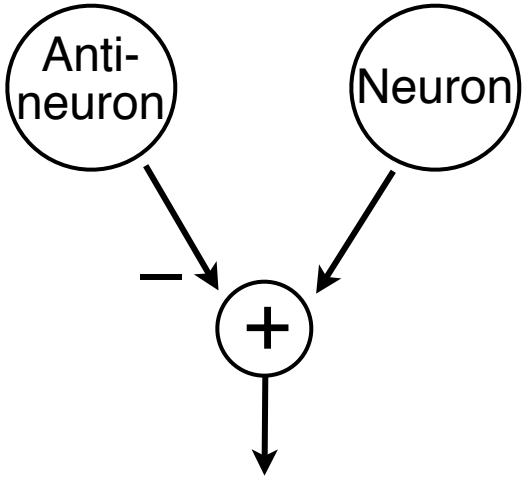
Threshold - free

Motion discrimination



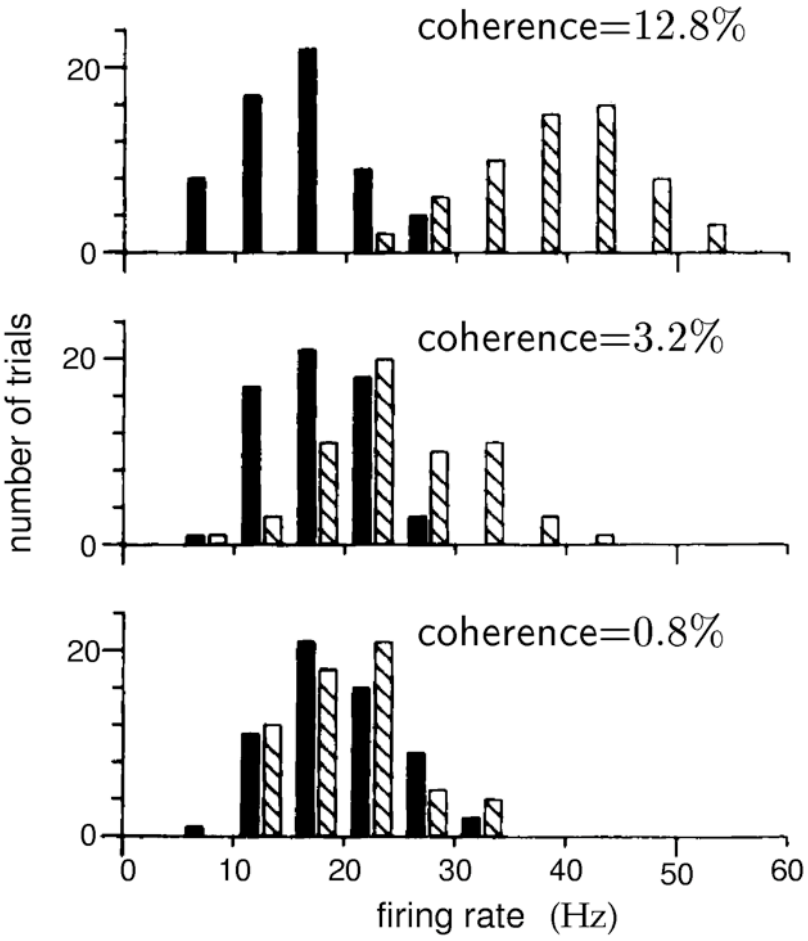


Text

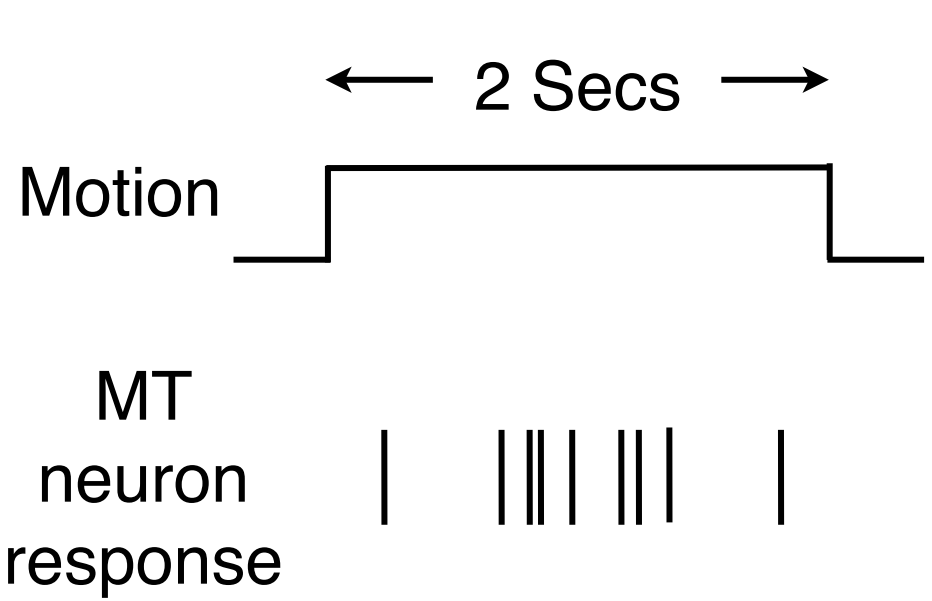


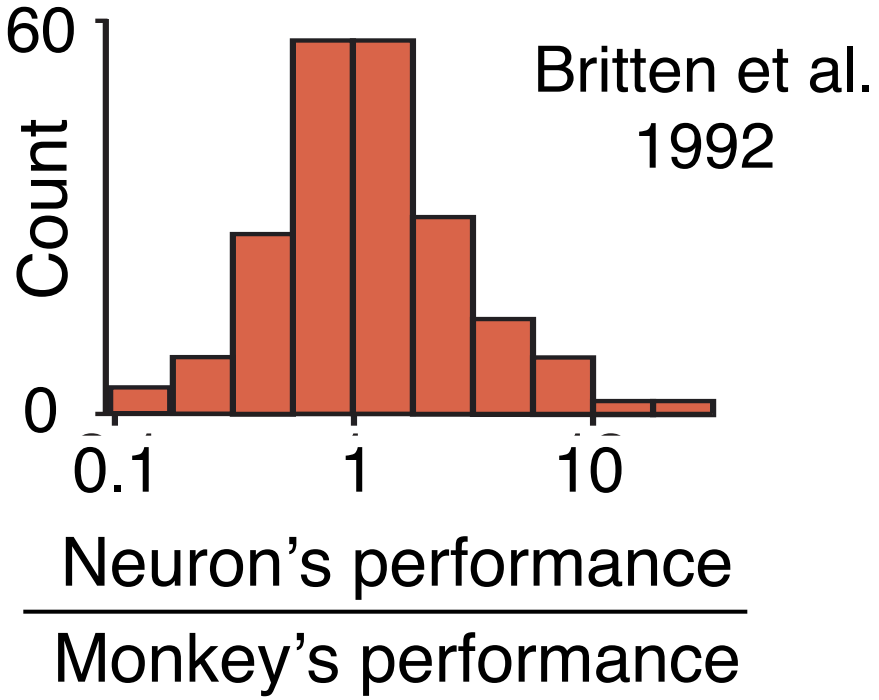
Comparative
No threshold

> 0 is Preferred
< 0 is Null



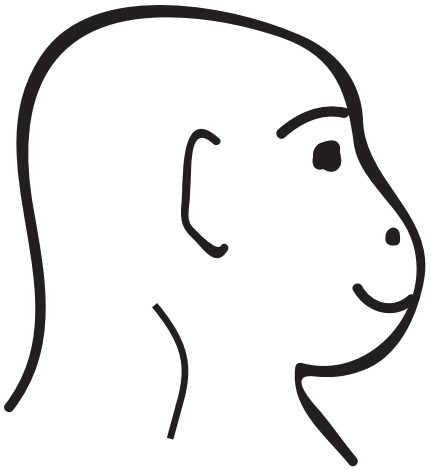
Behavioral versus neuronal performance

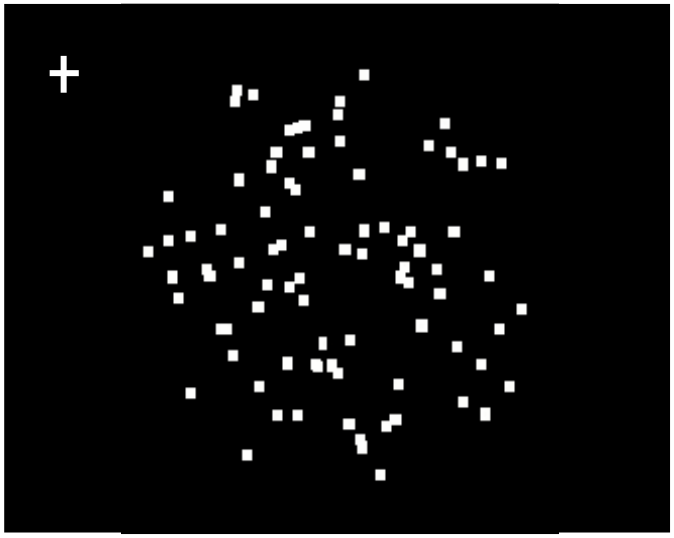




Motion detection

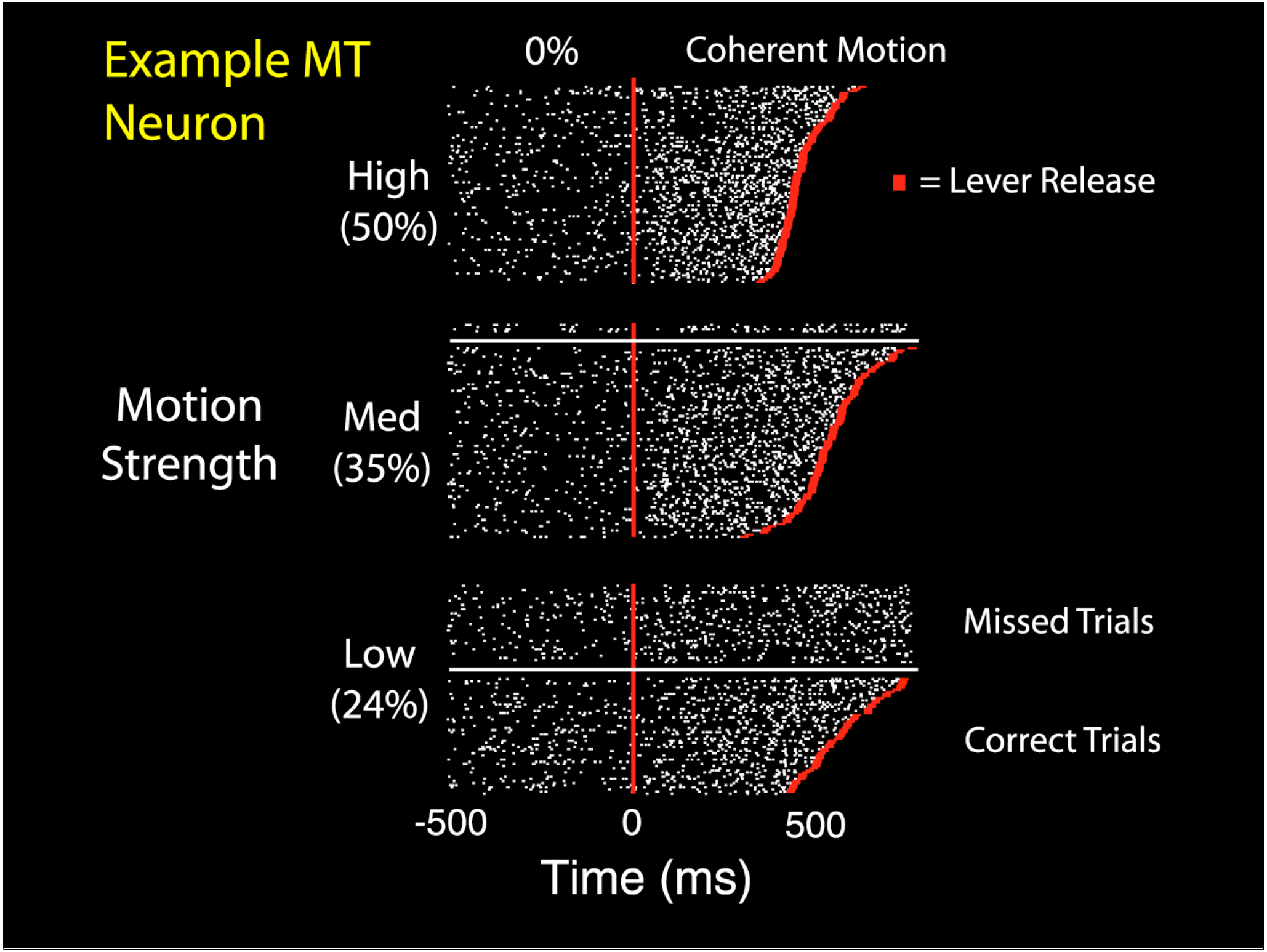
Reaction Time

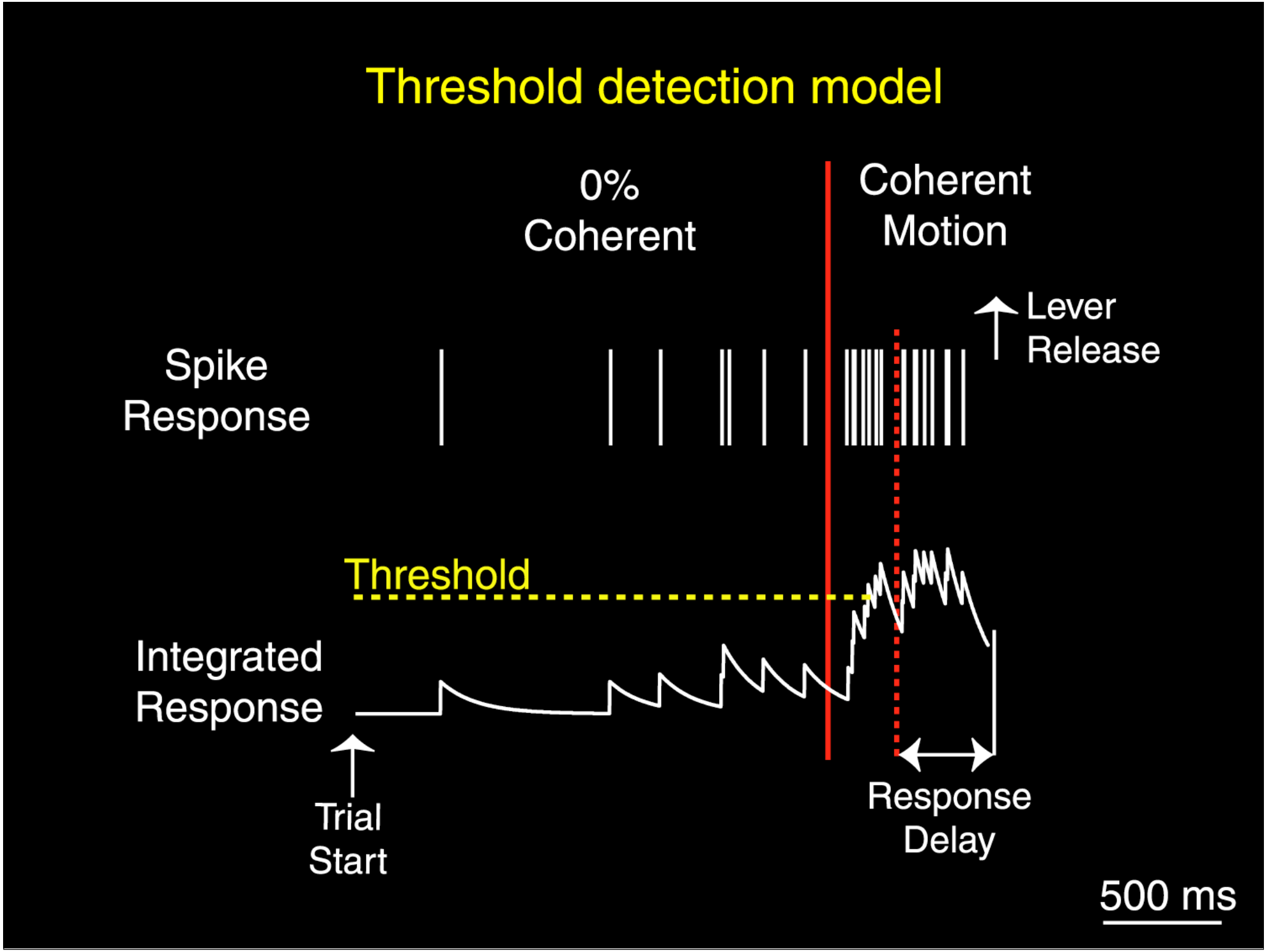




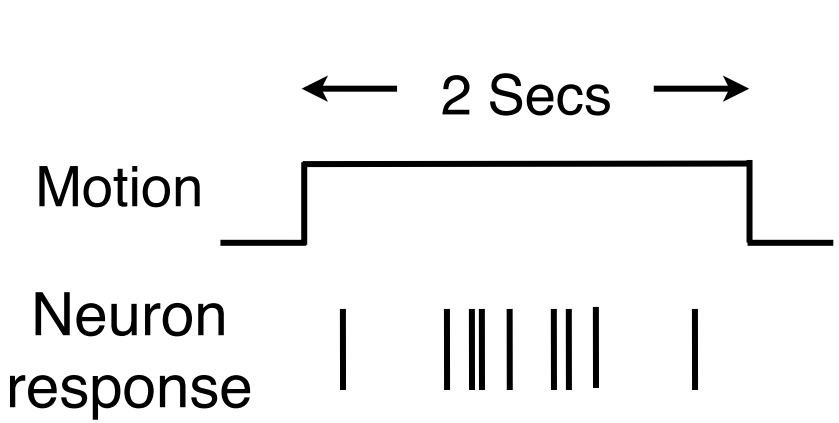
Reaction time task

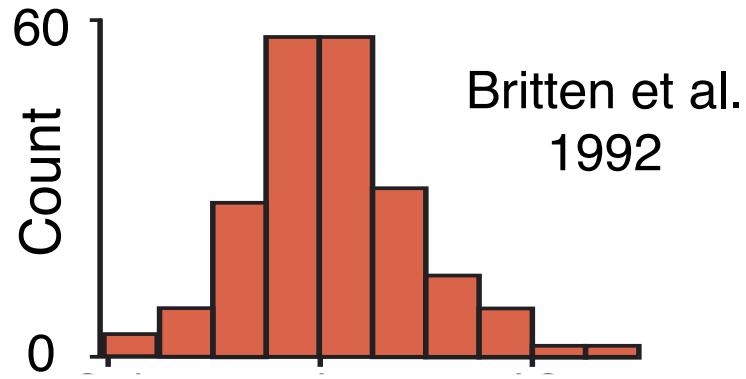
Motion

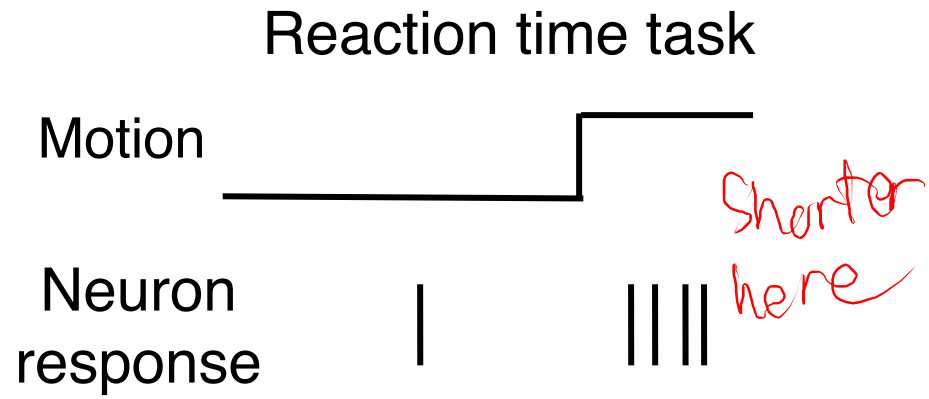

Example MT Neuron
0%
Coherent Motion
High (50%)
= Lever Release
Motion Strength
Med (35%)
Low (24%)
Missed Trials
Correct Trials
-500
0
500
Time (ms)

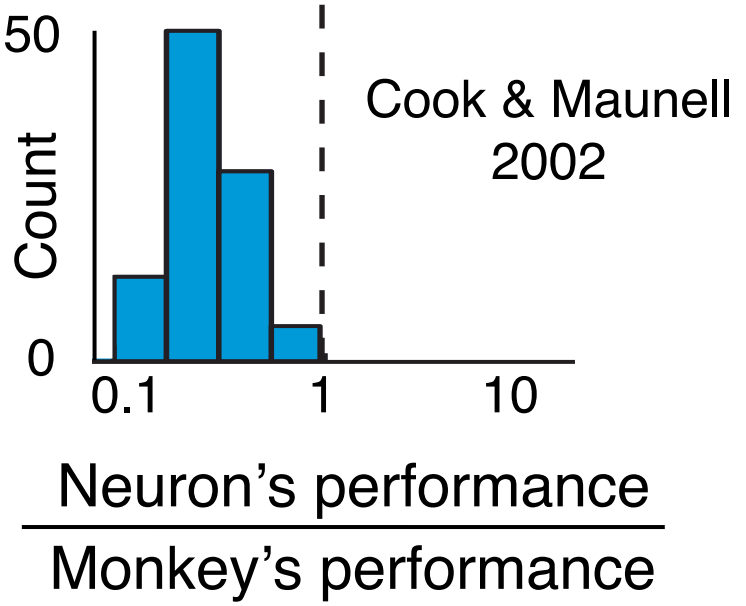

Threshold detection model
0%
Coherent
Coherent
Motion
Lever
Release
Spike
Response
Threshold
Integrated
Response
Trial
Start
Response
Delay
500 ms

MT performance depends on stimulus duration

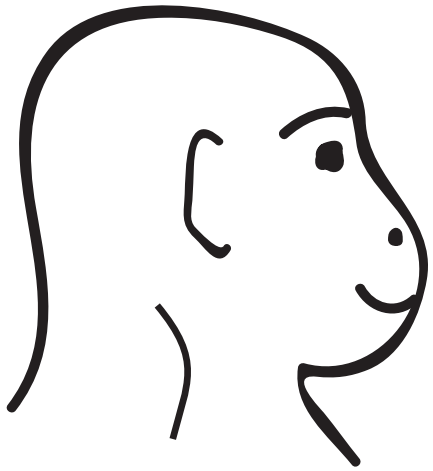


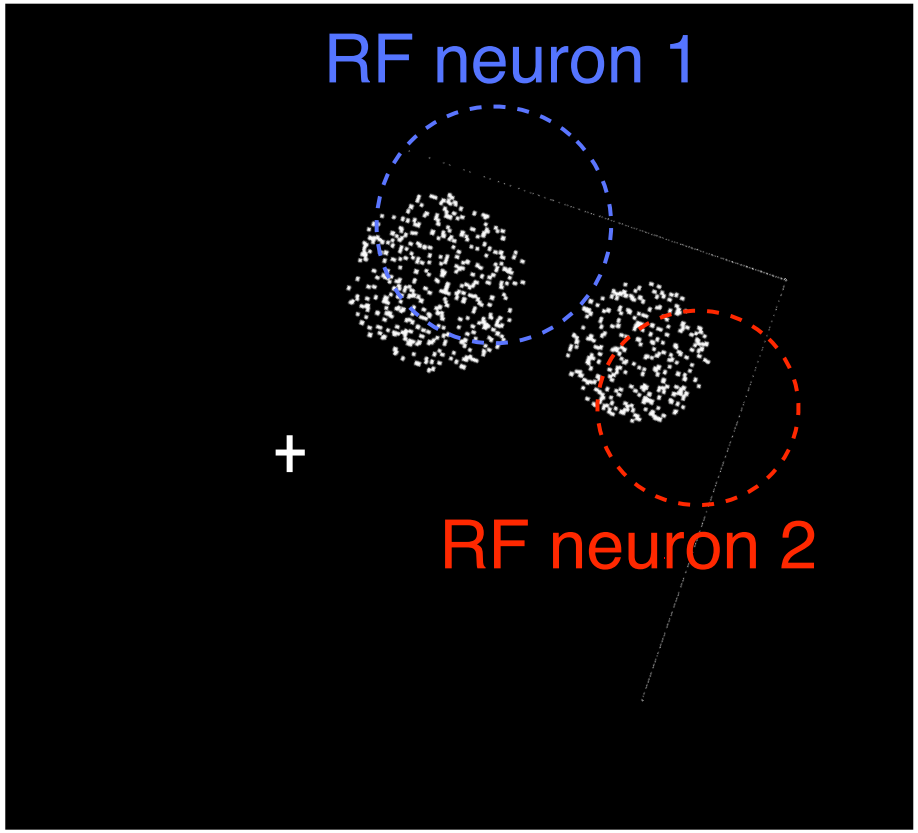


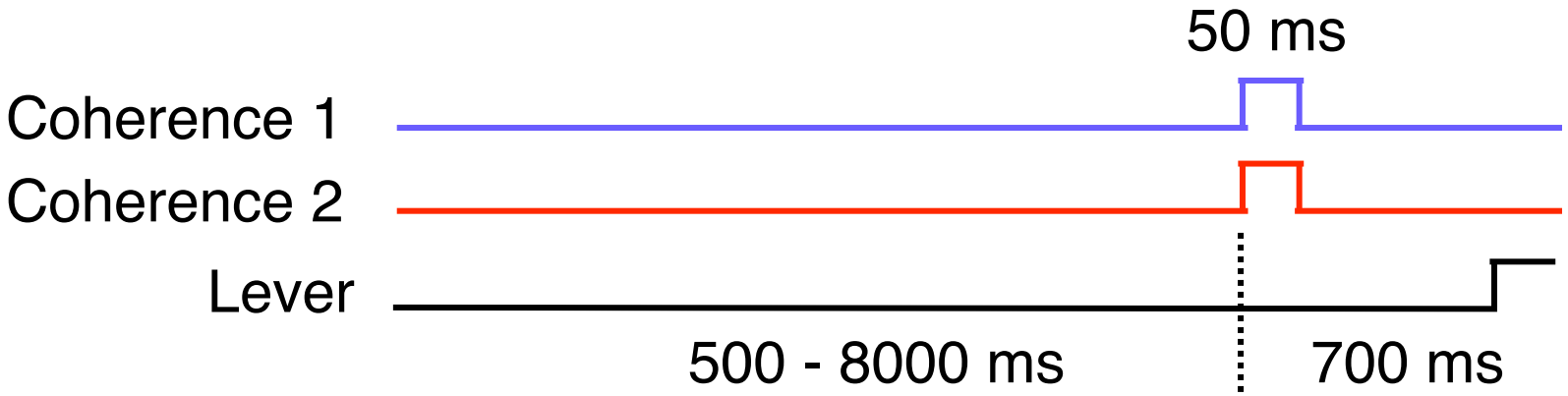




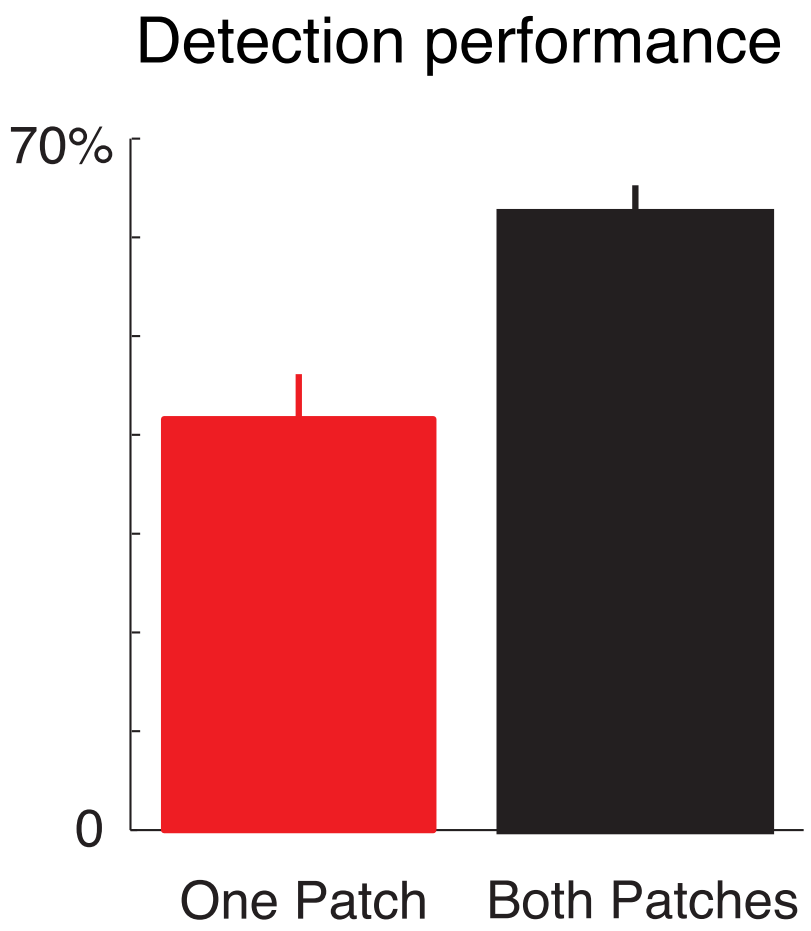
Motion detection task with two stimuli



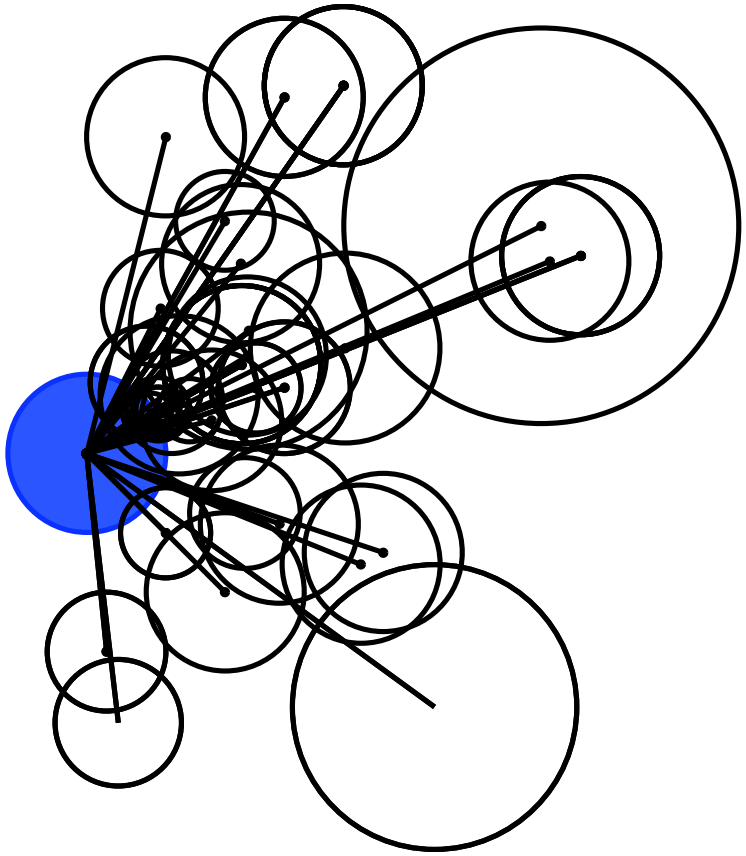




Behavioral performance was better with motion in both patches



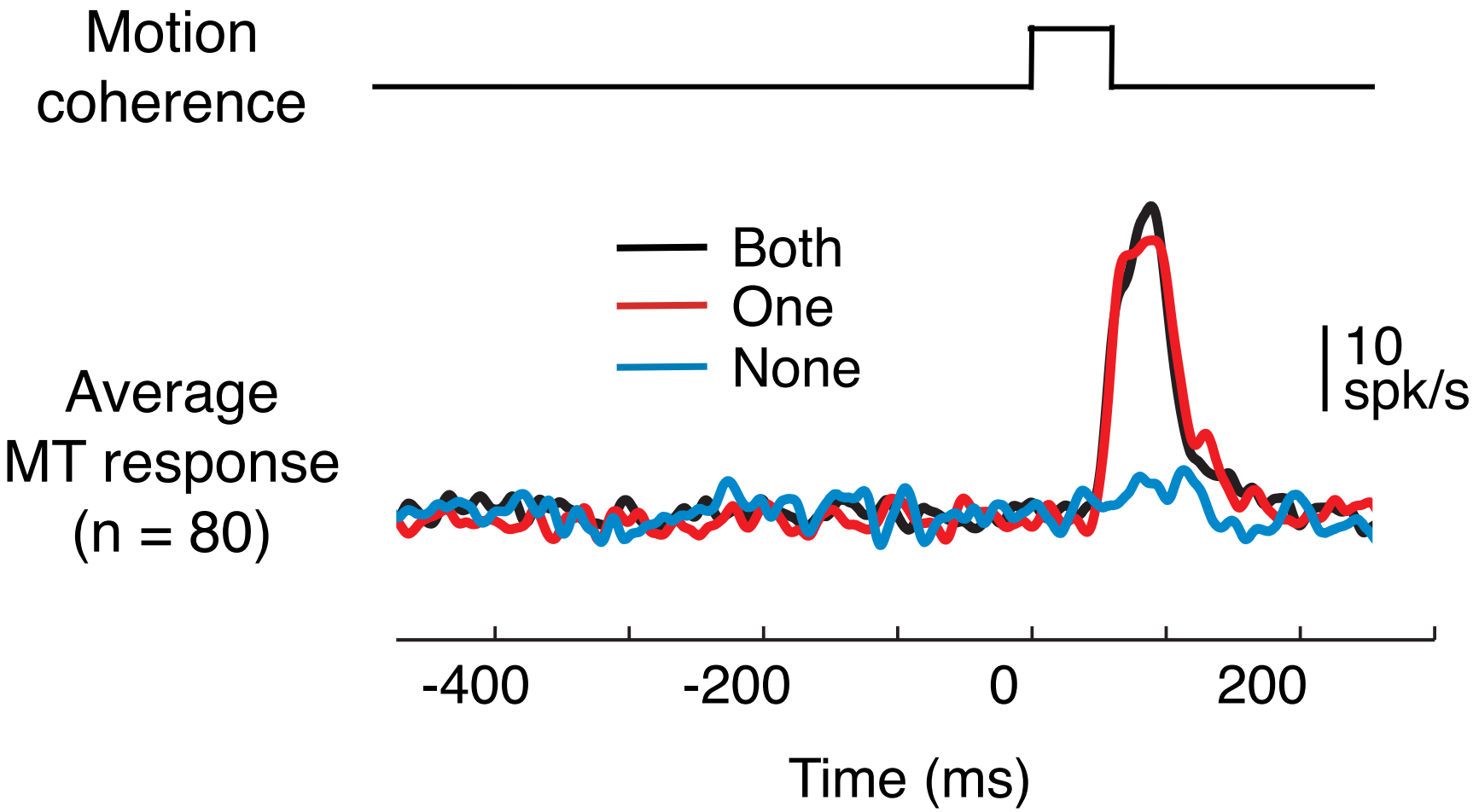
Relative RF locations



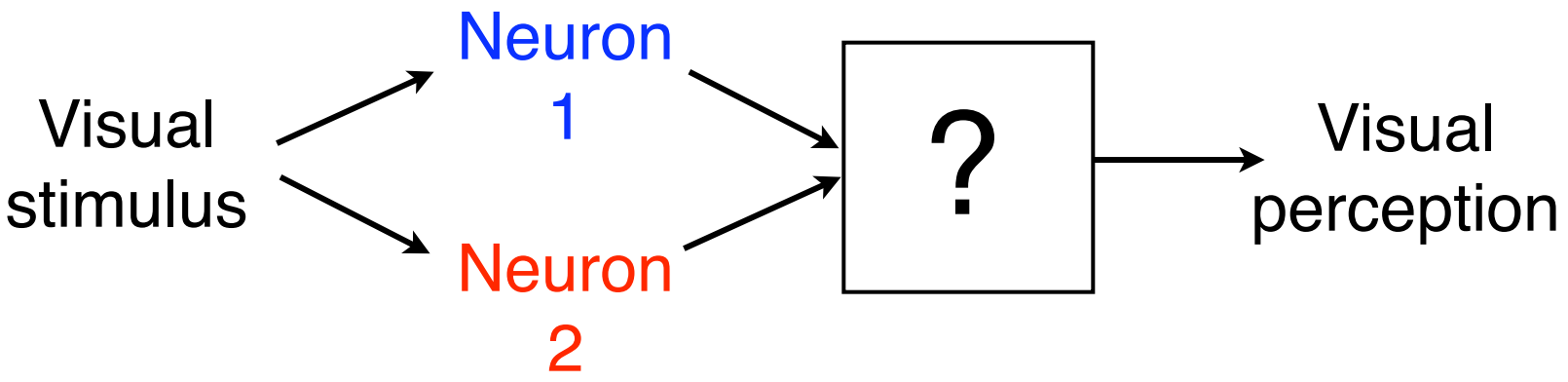
RF Neuron 1

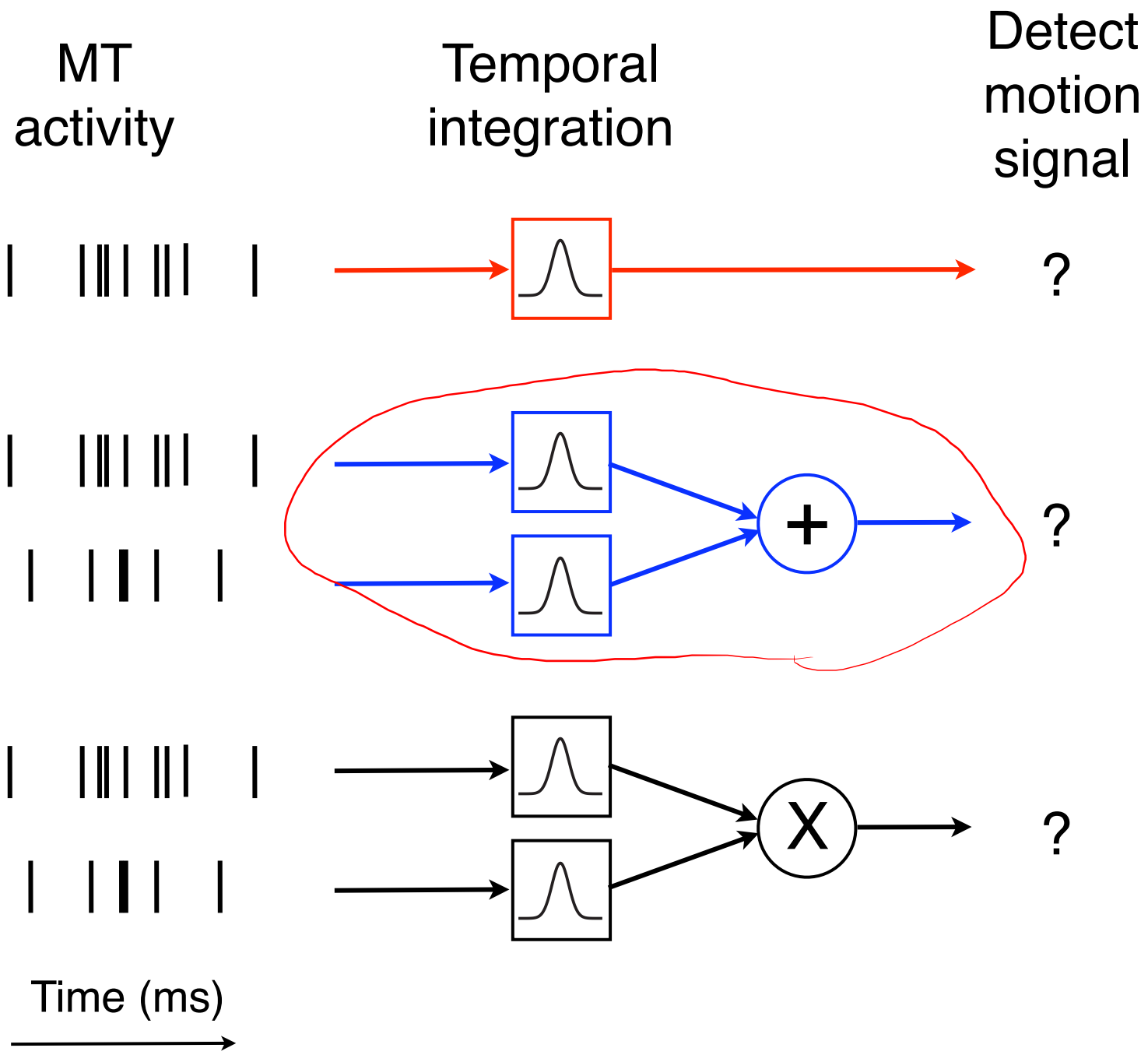
RF locations of Neuron 2

MT responses

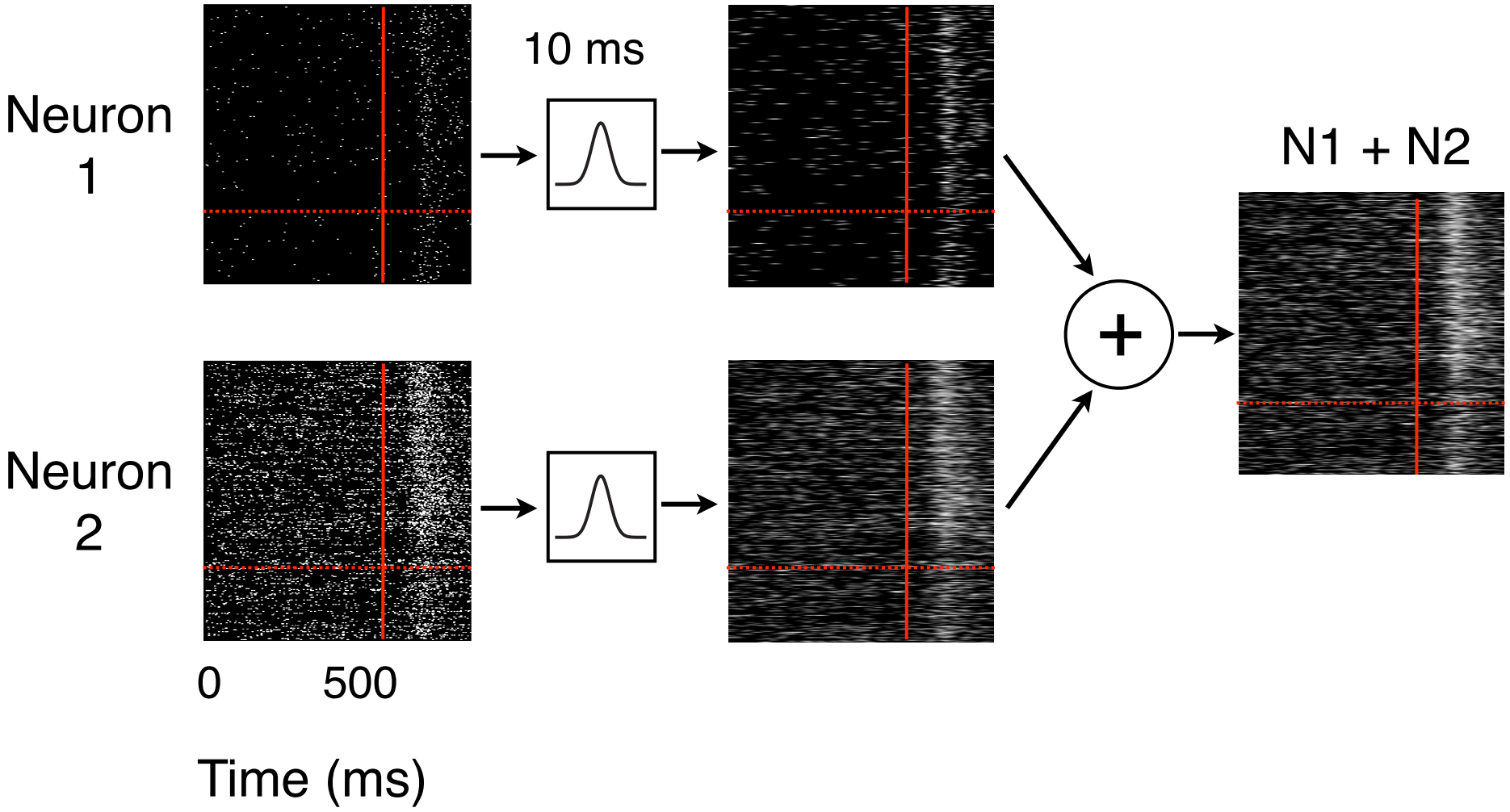


How does the brain combine the output of different visual cortical neurons?

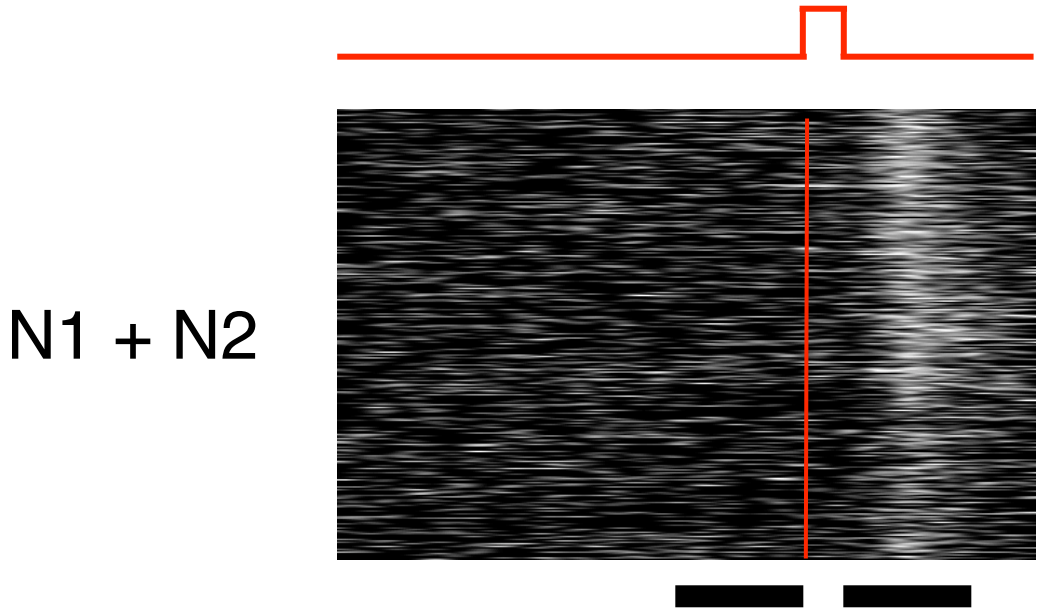



MT activity
Temporal integration
Detect motion signal
?
+
?
X
?
Time (ms)

Example recording

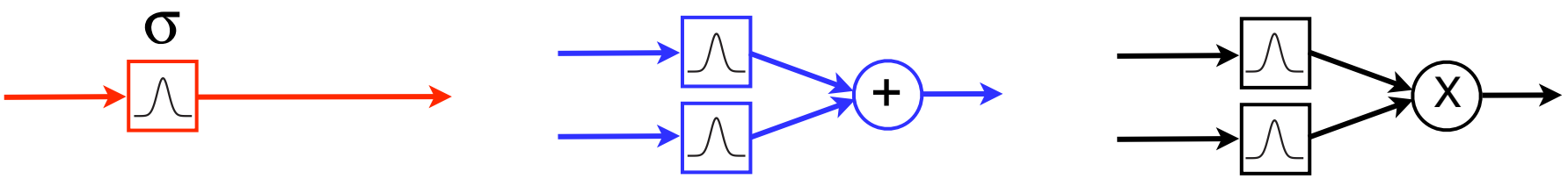


Example neurometric

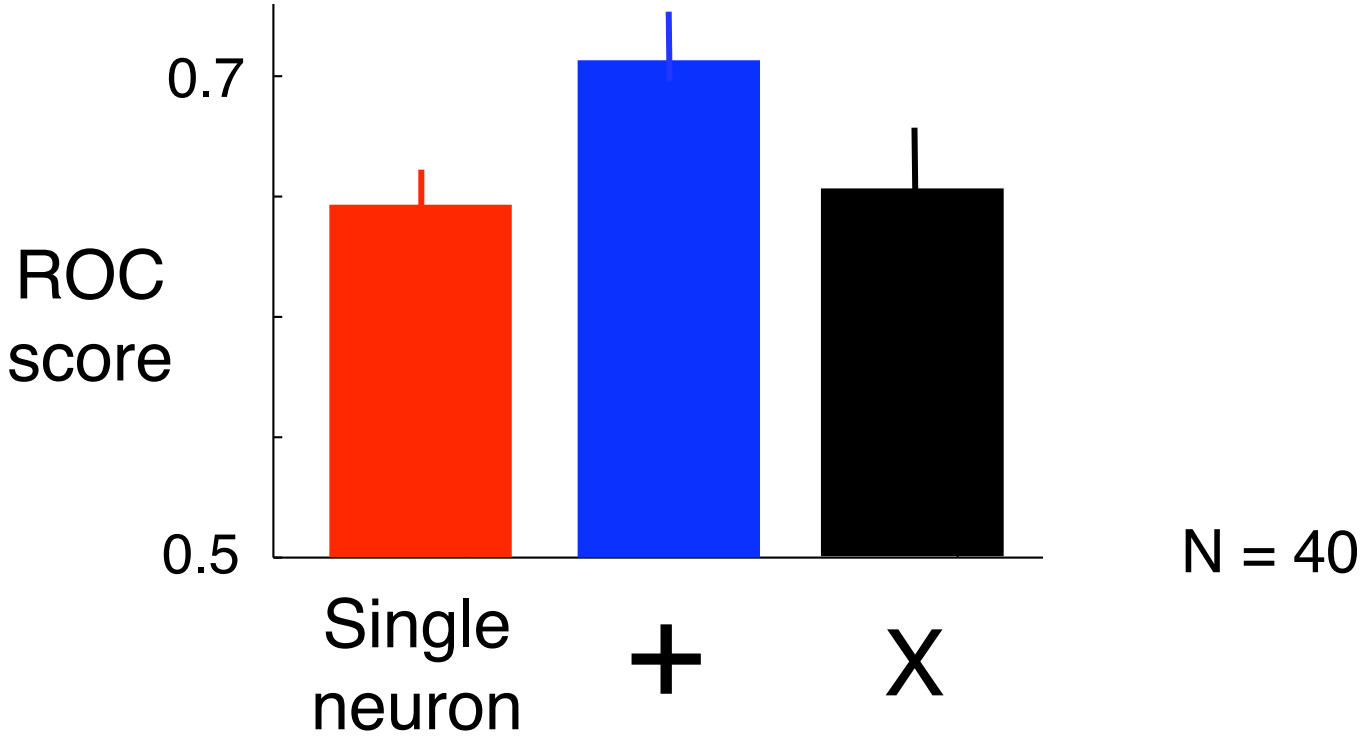


ROC score = 0.78

Signal detection is best with a summation model

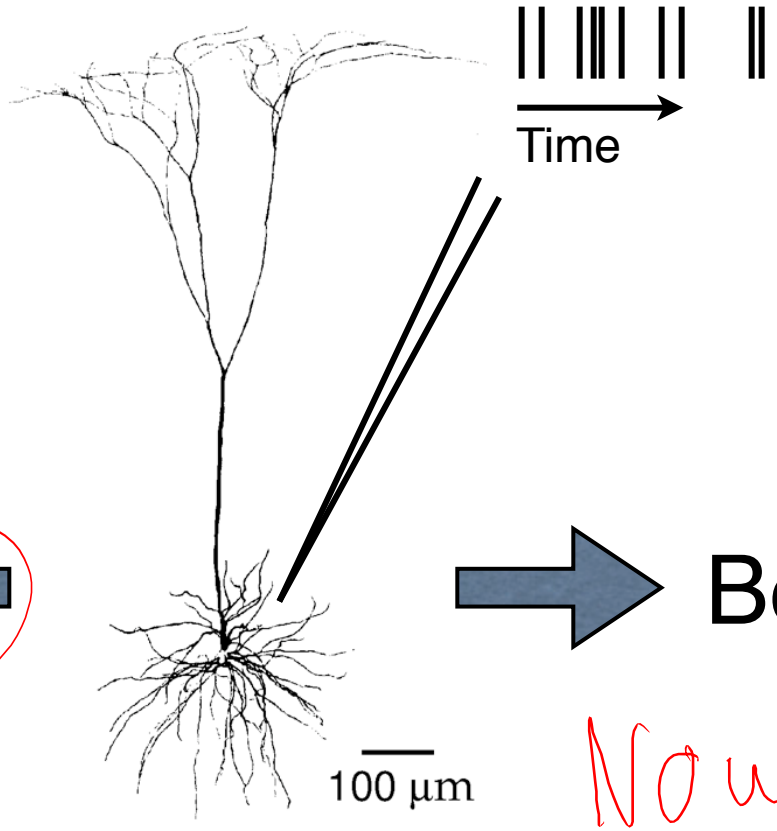


Neurometric performance (σ= 10 ms)



Decoding

External stimuli

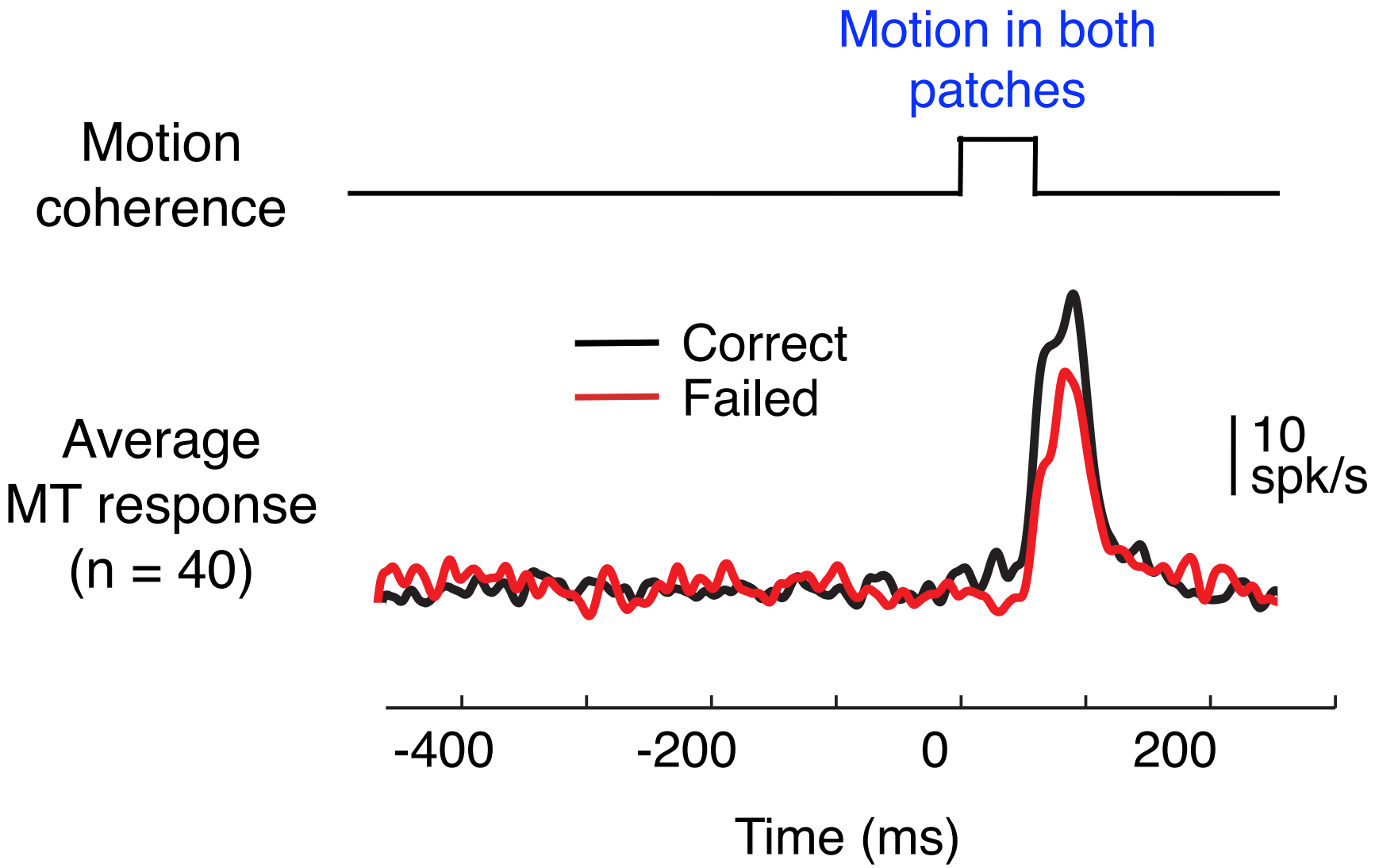


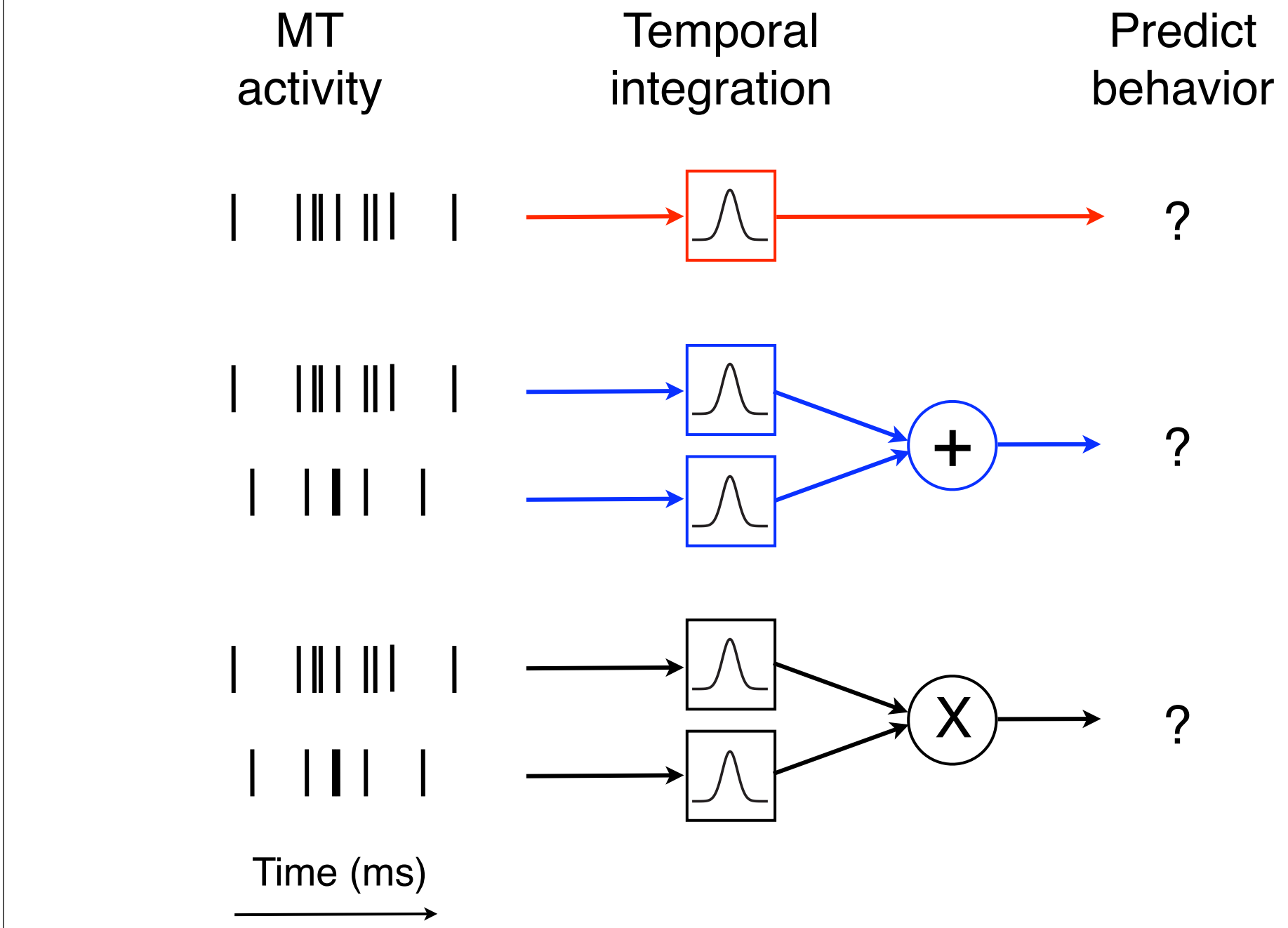
Behavior

So far

Now

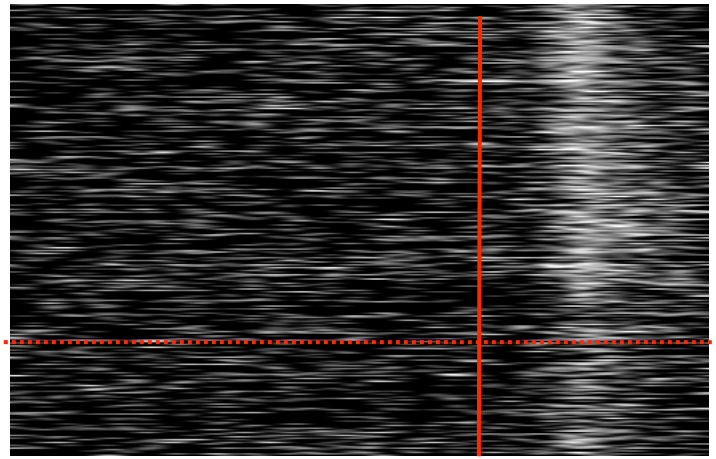
MT responses were greater on correct trials




MT
activity
Temporal
integration
Predict
behavior
?
+
?
X
?
Time (ms)

MT activity covaries with correct & failed

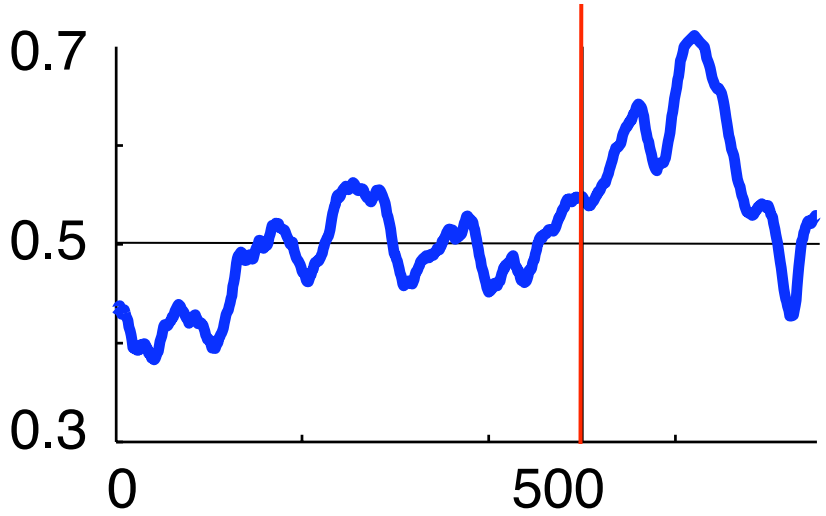
N1 + N2



Correct

Failed

Detect probability (DP)



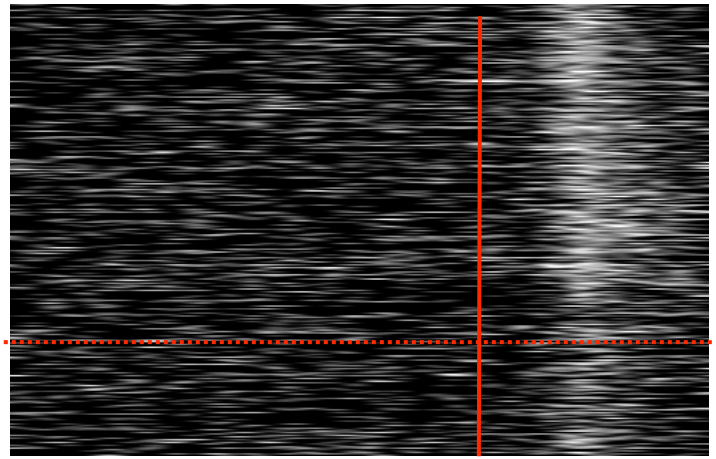
Choice

Behaviour

% correct
Reaction times

MT activity covaries with RT

N1 + N2

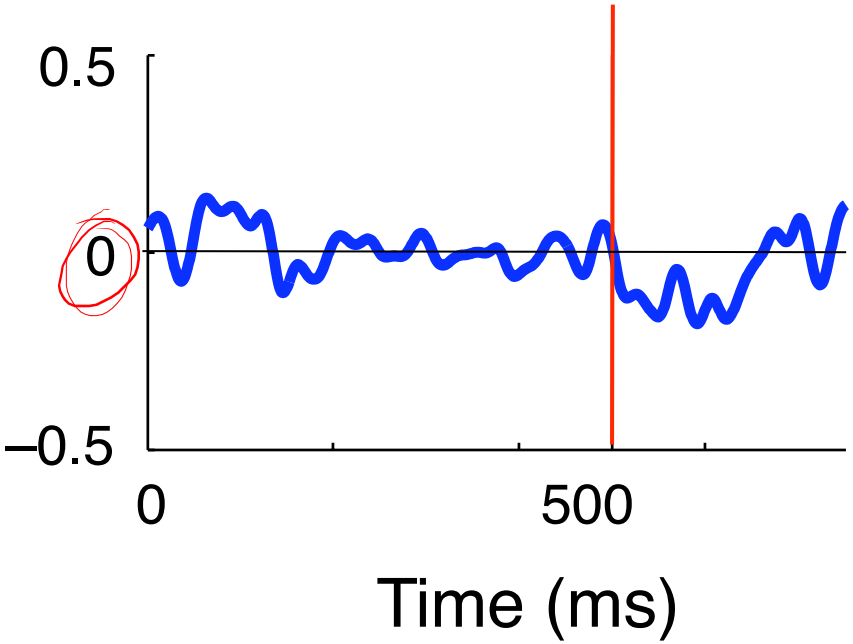


Fast RTs

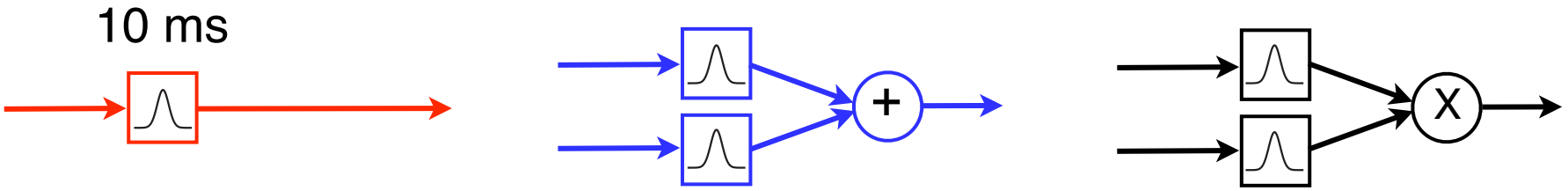
Slow RTs

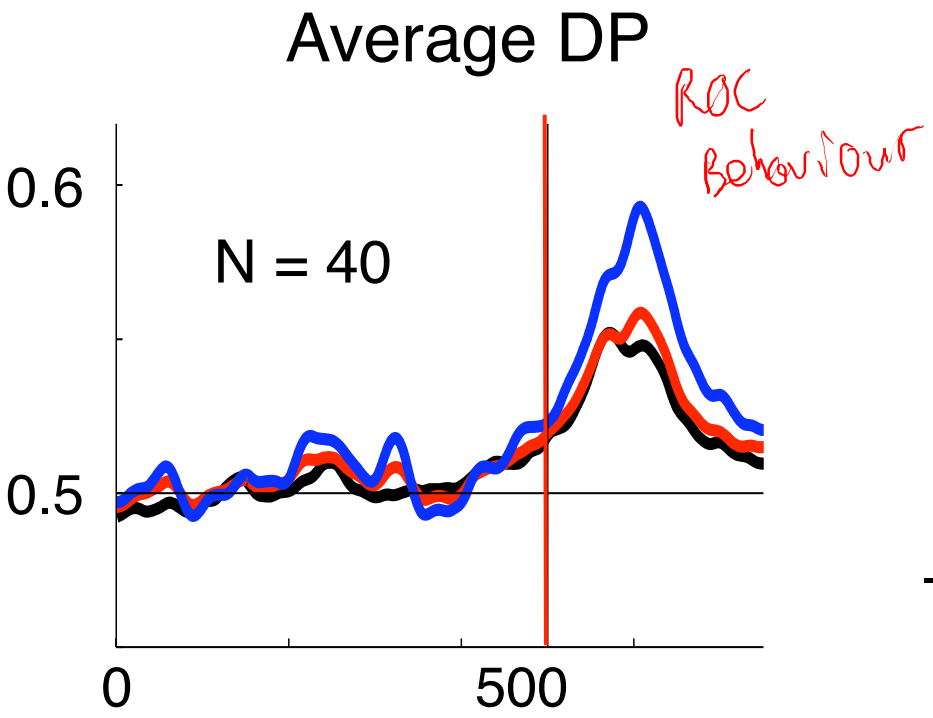
RT correlation

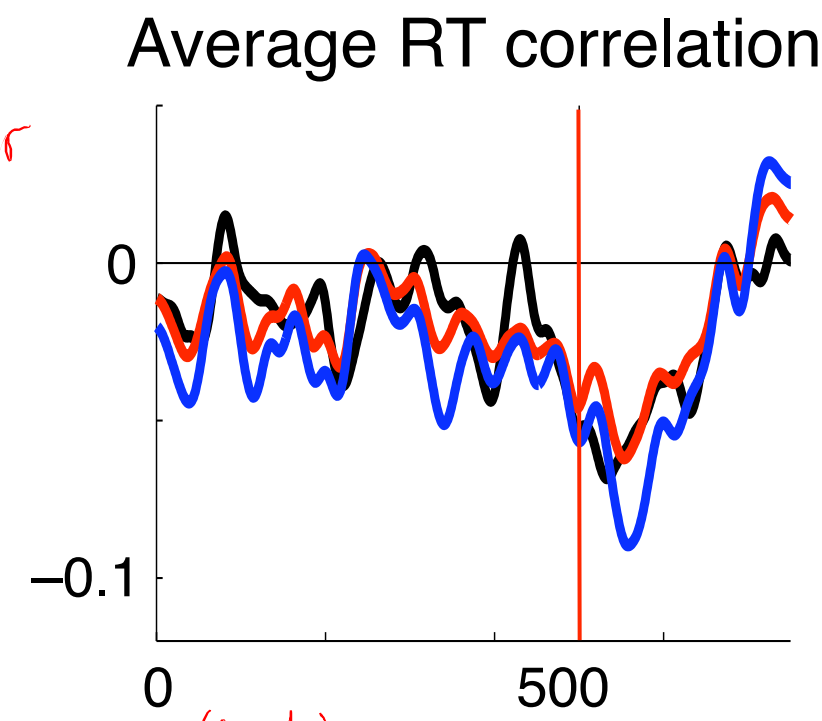
Pearson



Covariation with behavior is strongest with the summation model



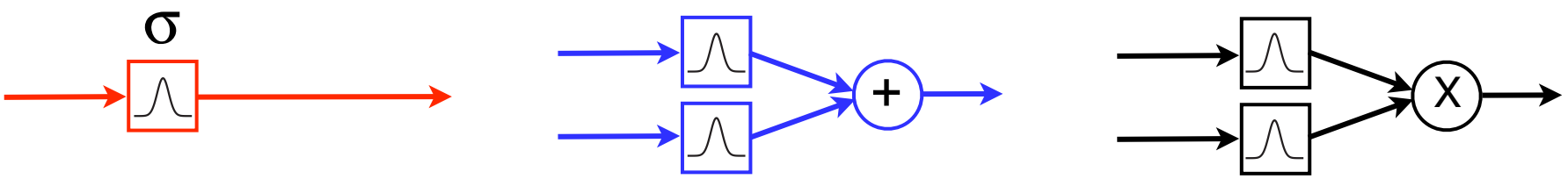


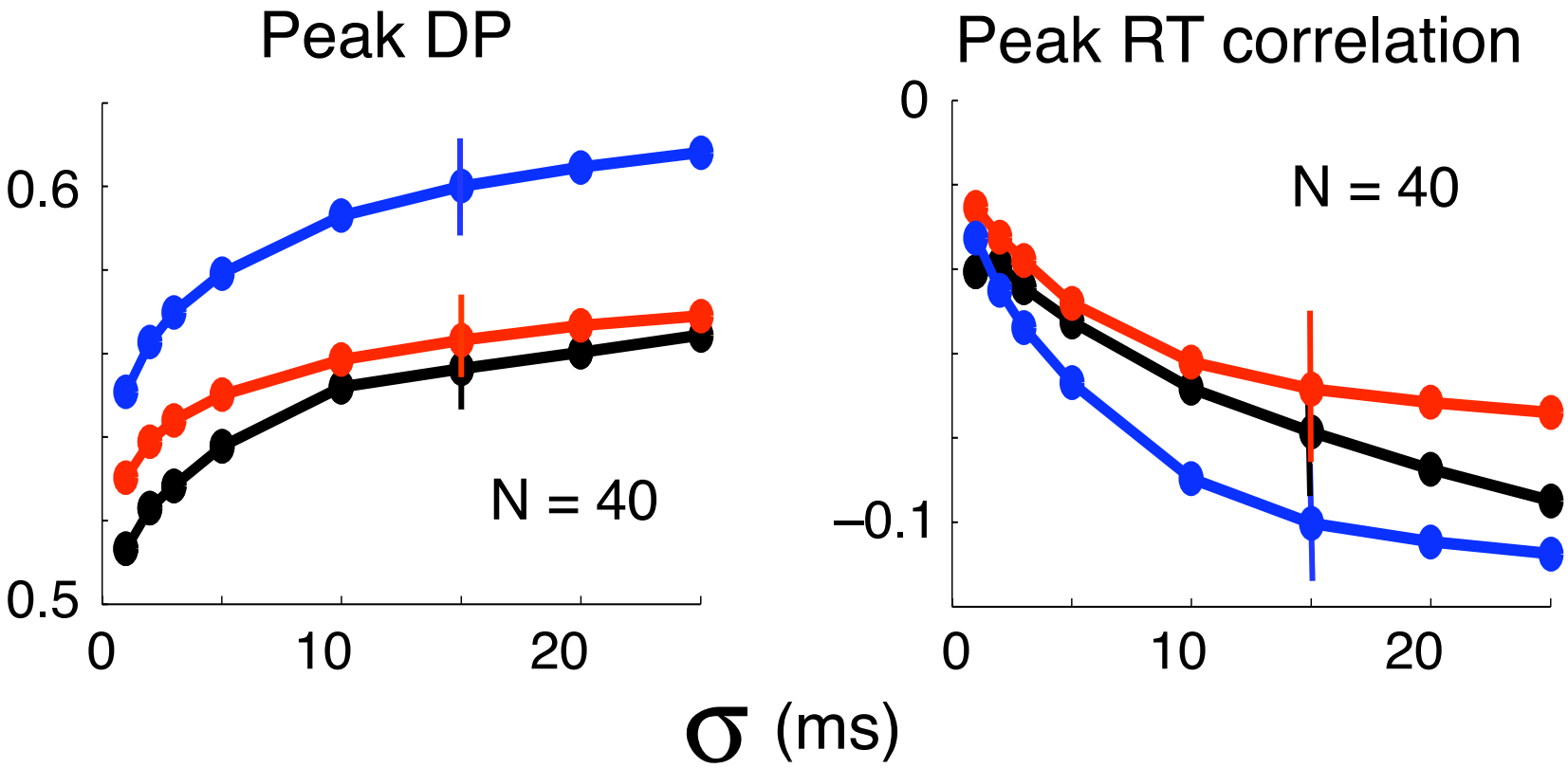


Time (ms)

Attention
Reaction time

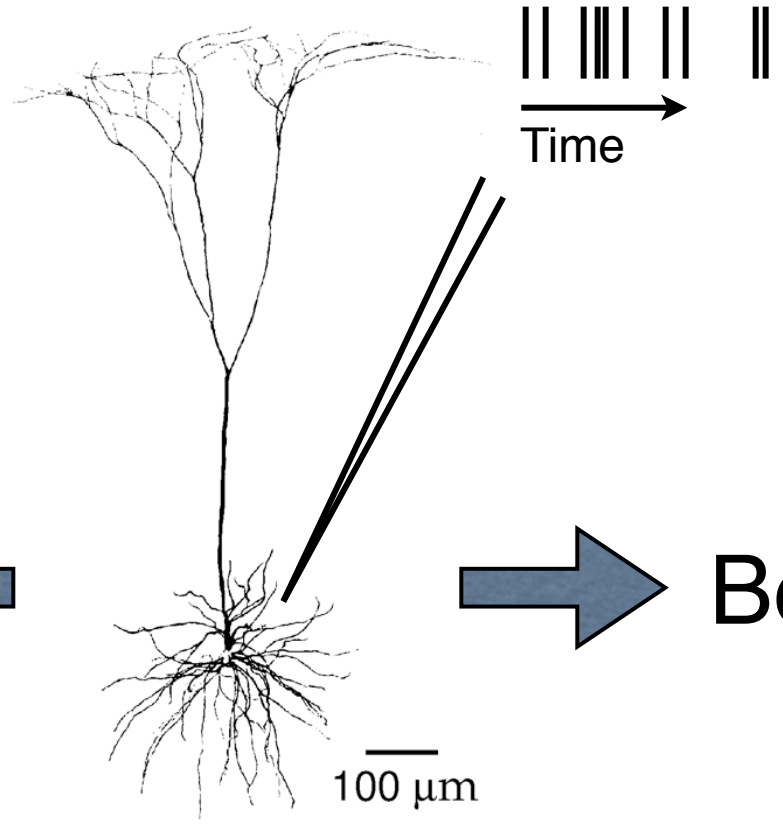
Covariation with behavior is strongest with longer windows of integration





Decoding

External stimuli



Behavior