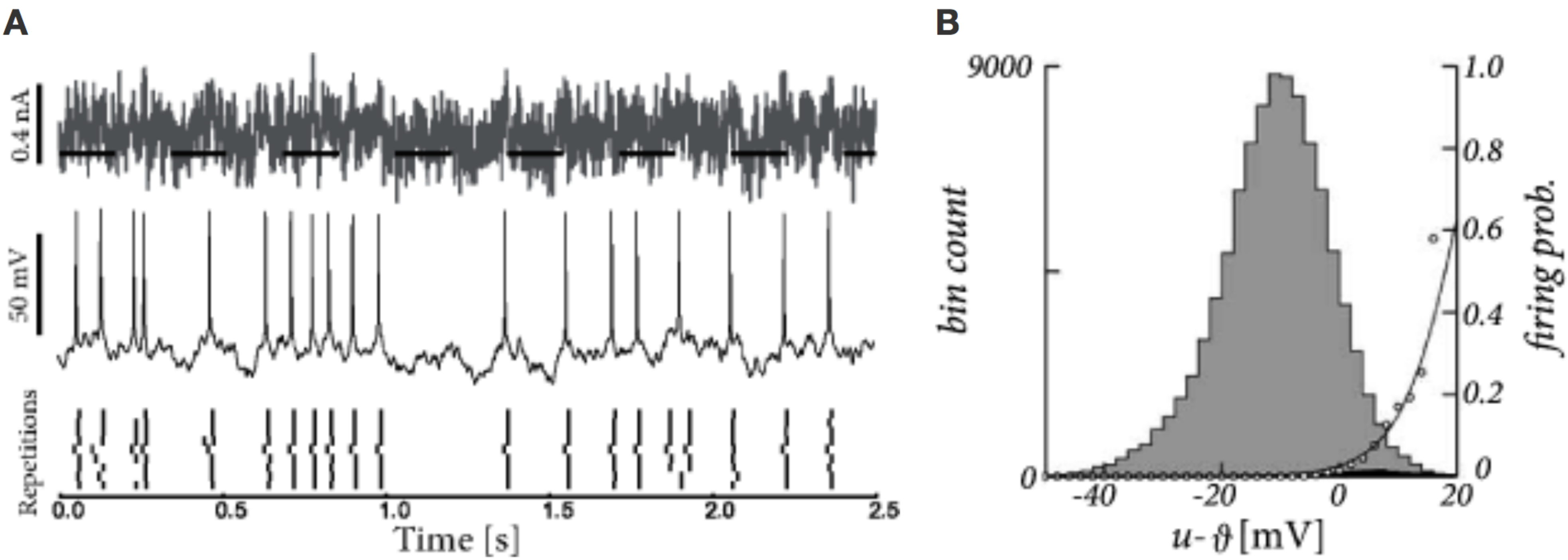


Fig. 9.3: The instantaneous firing intensity extracted from experiments can be fitted by an exponential escape rate. **A**. A real neuron is driven by a time-dependent input current (top)

Fig. 9.3: The instantaneous firing intensity extracted from experiments can be fitted by an exponential escape rate. **A.** A real neuron is driven by a time-dependent input current (top) generating a fluctuating voltage with occasional spikes (middle), which are repeated with high precision, but not perfectly, across several trials (bottom). **B.** The black histogram (very small) shows the number of times (bin count, vertical axis) that the model voltage calculated from Eq. (9.1) falls in the bin $u - \vartheta$ (horizontal axis) *and* the real neuron fires. Gray histogram indicates distribution of voltage when the real neuron does not fire. The ratio (black/black plus gray) in each bin gives the firing probability $P_F\,(u - \vartheta)$ (open circles, probability scale on the right) which can be fitted by Eq. (9.8) using an exponential escape rate (solid line), $f\,(u - \vartheta) = \frac{1}{\tau_0}\,\exp[\beta\,(u - \vartheta)]$ with a steepness of $\beta = (4\ \mathrm{mV})^{-1}$ and a mean latency at threshold of $\tau_0 = 19$ ms. From Jolivet et al. 2006.

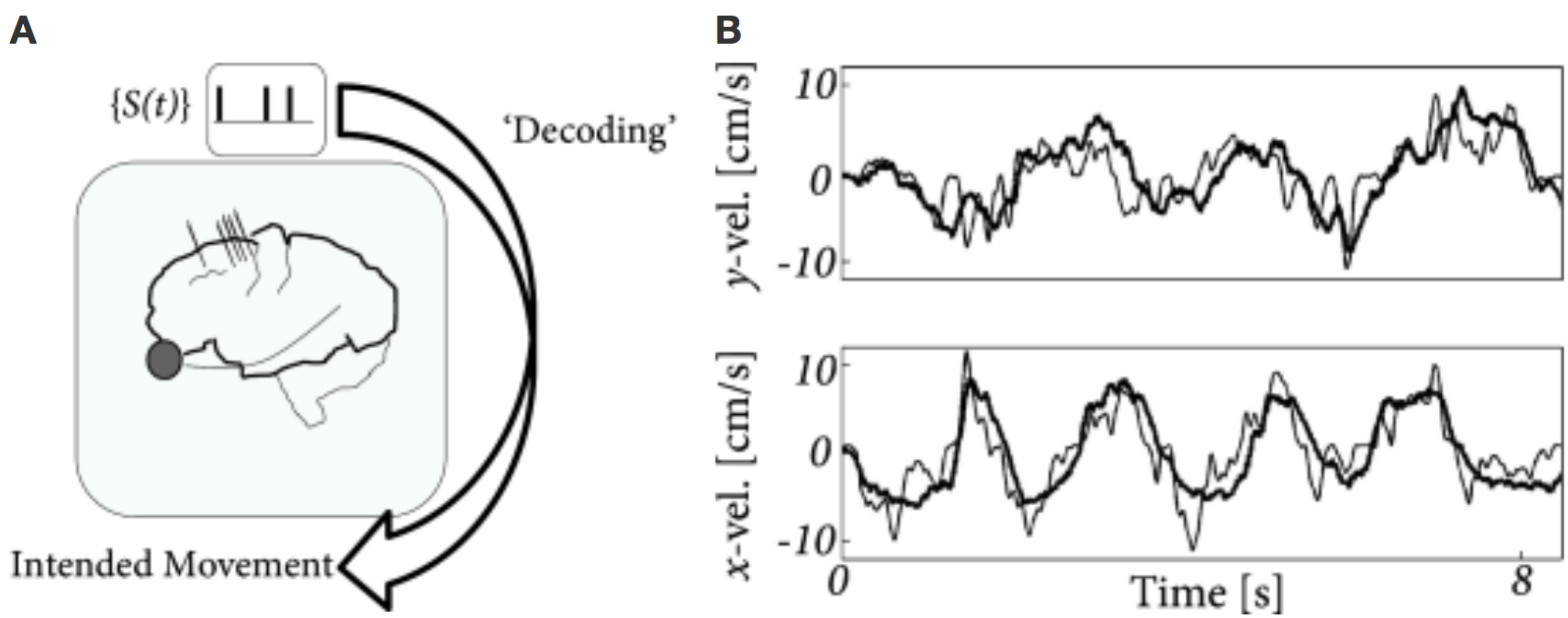
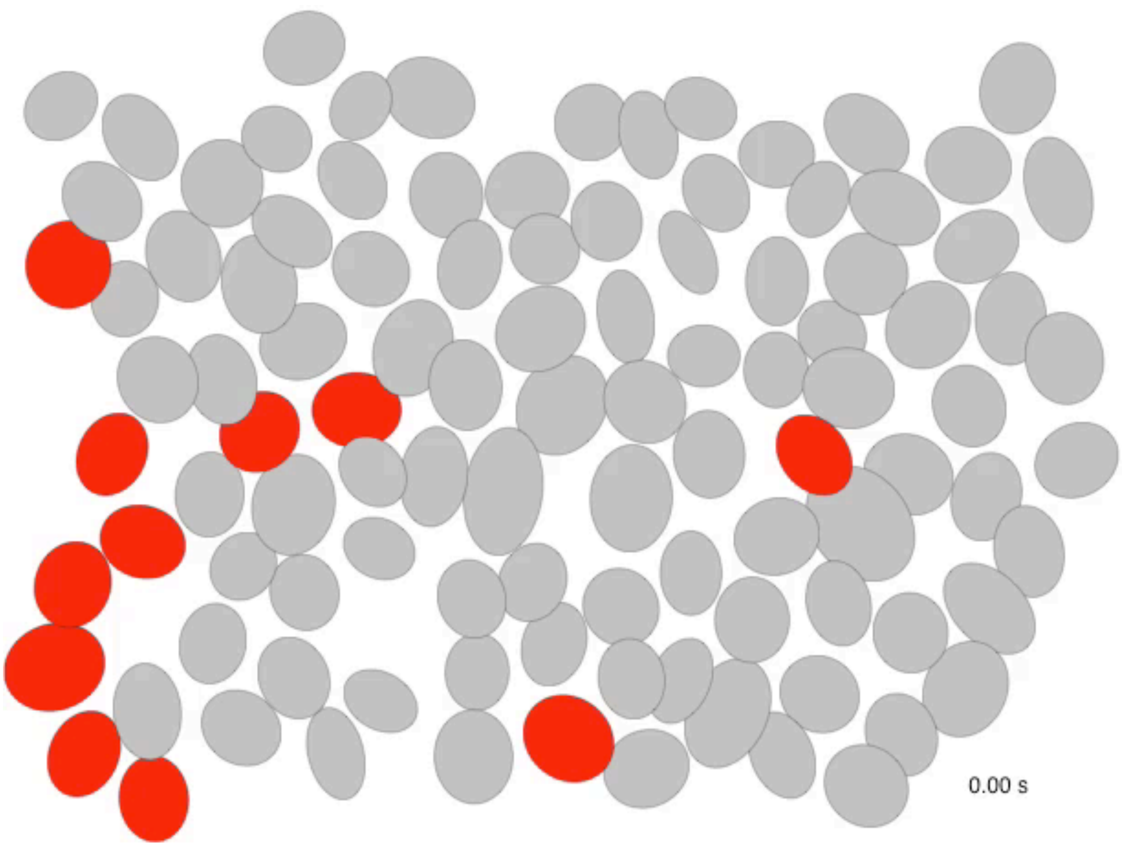


Fig. 11.12: Decoding hand velocity from spiking activity in area MI of cortex. **A** Schematics. **B.** The real hand velocity (thin black line) is compared to the decoded velocity (thick black line) for the $x-$ (top) and the $y-$components (bottom). Modified from Truccolo et al. (521).

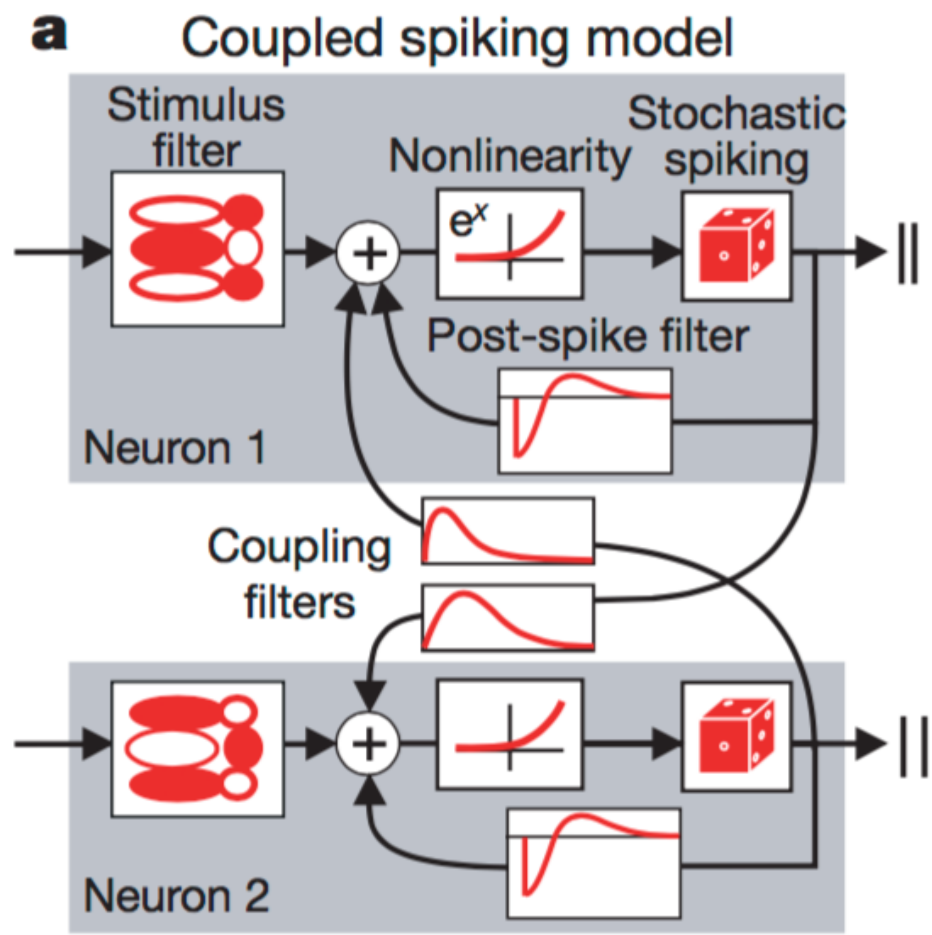
2008, nature

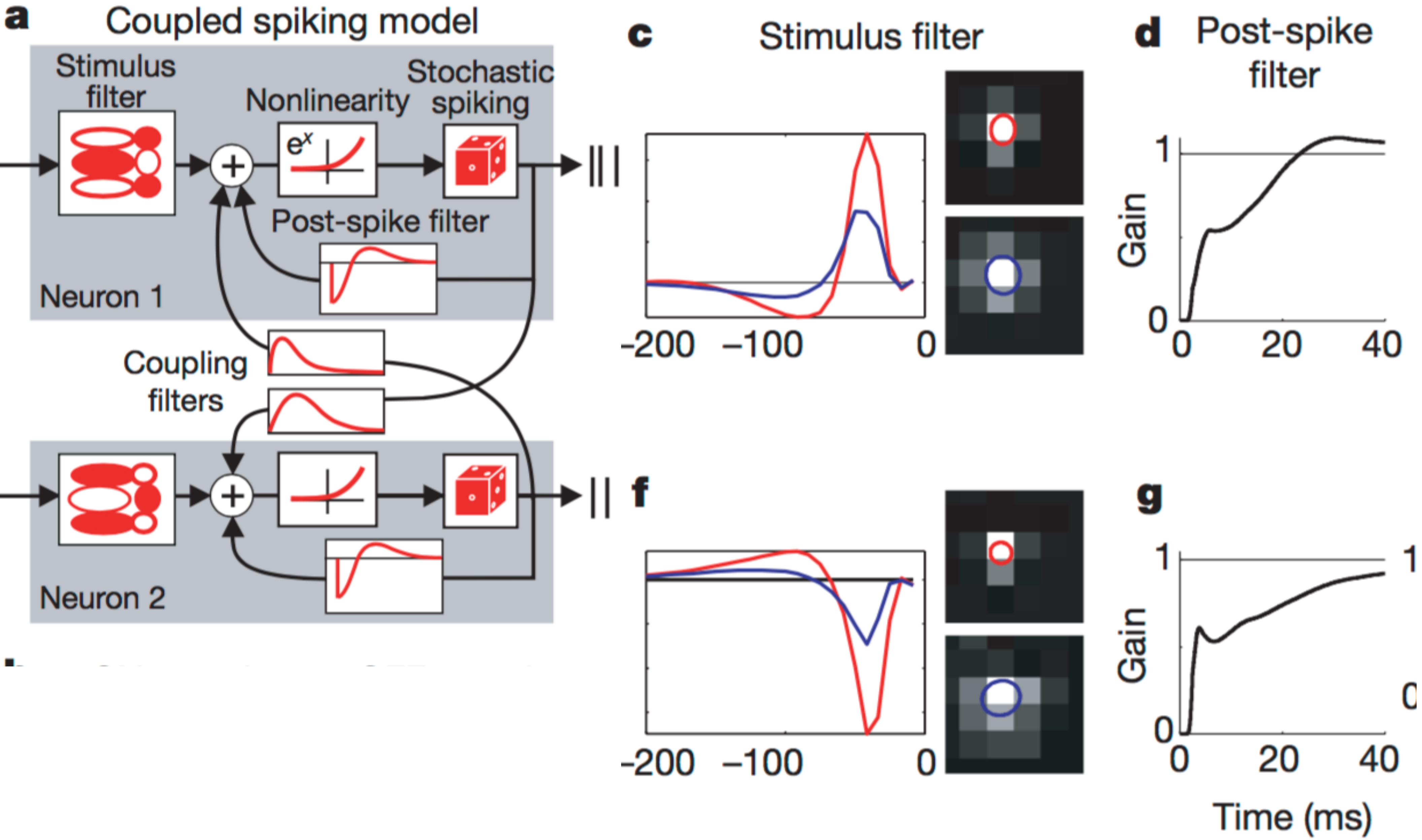
Spatio-temporal correlations and visual signalling in a complete neuronal population

Jonathan W. Pillow[1], Jonathon Shlens[2], Liam Paninski[3], Alexander Sher[4], Alan M. Litke[4], E. J. Chichilnisky[2] & Eero P. Simoncelli[5]

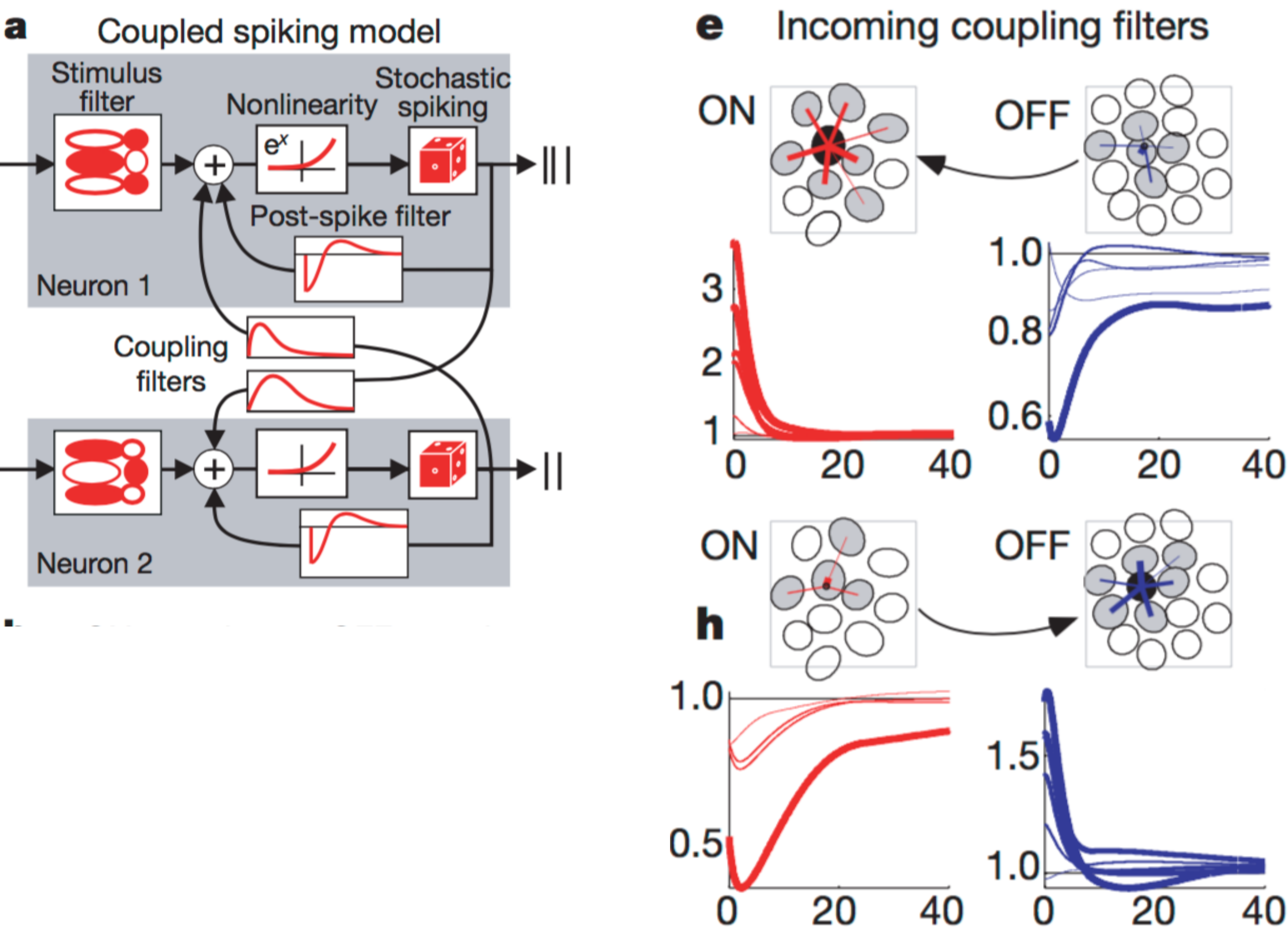


Shlens et al ’09

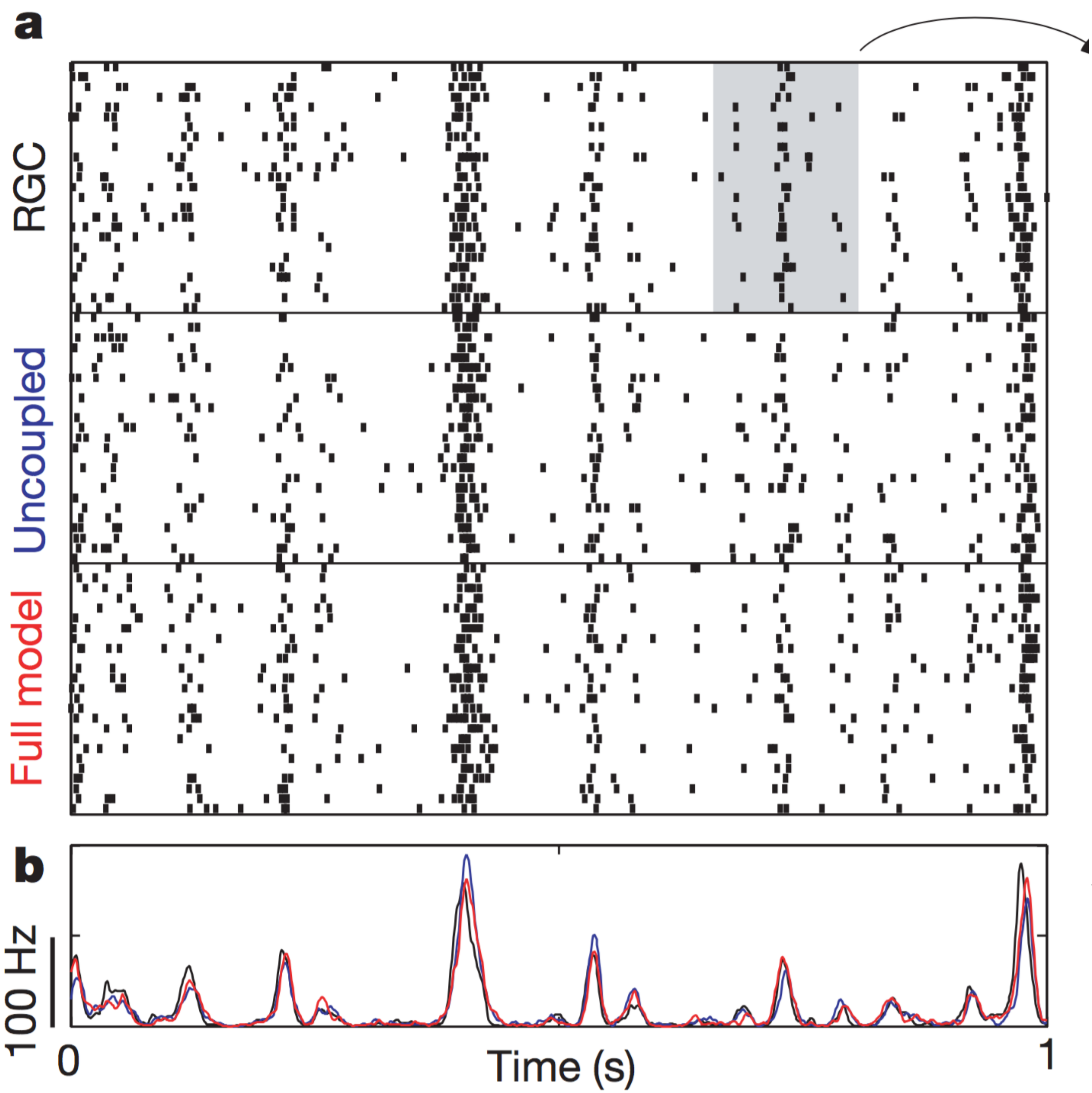




Pillow et al, 2008

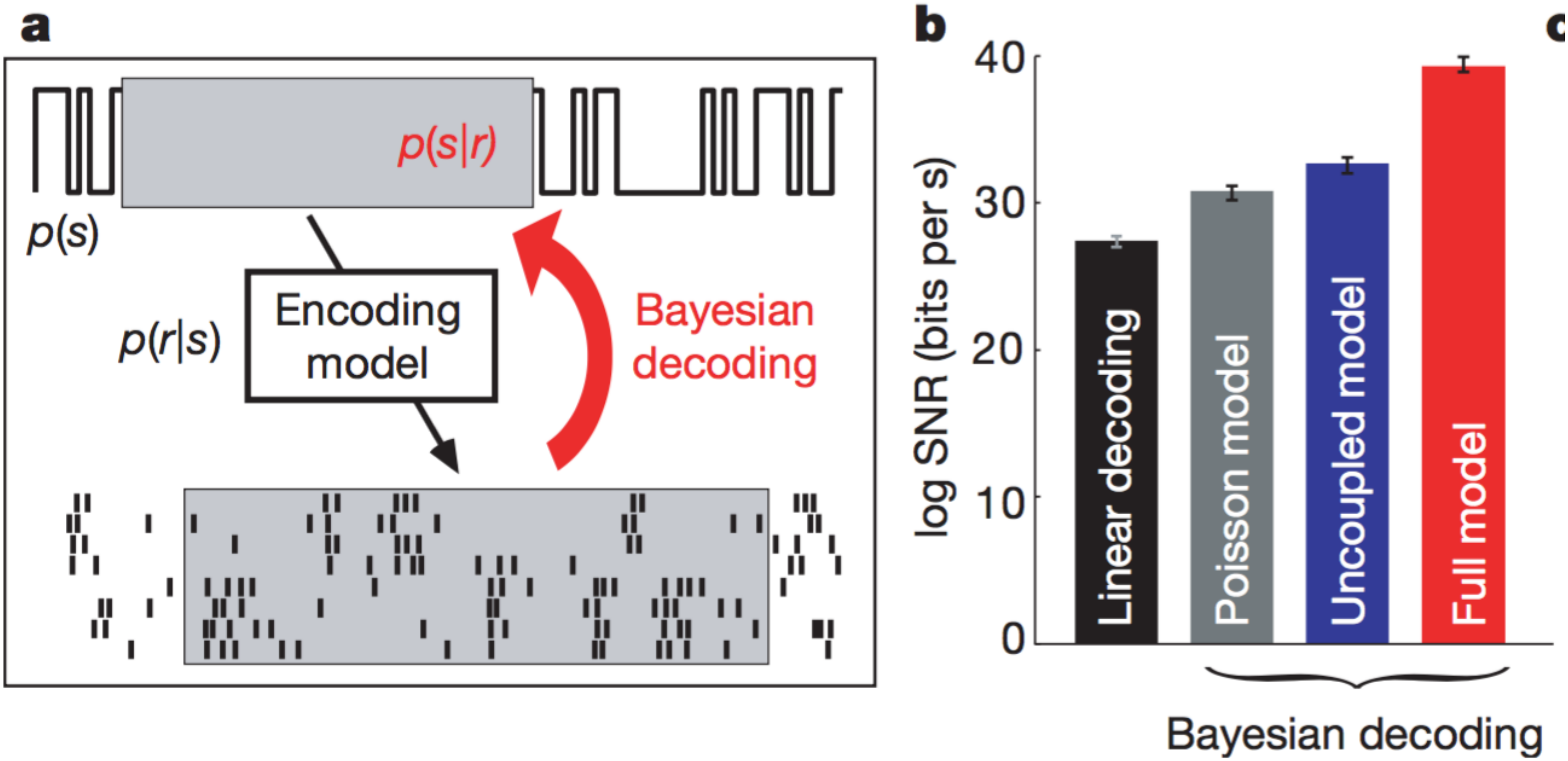

a
Coupled spiking model
Stimulus filter
Nonlinearity
Stochastic spiking
Post-spike filter
Neuron 1
Coupling filters
Neuron 2
e
Incoming coupling filters
ON
OFF
h
0
20
40
1.0
0.8
0.6
0.5
1.5
3
2
1

What’s role of coupling / correlations?



No strong role in predicting single-cell spike probabilities

What's role of coupling / correlations? Decoding



$p(s)$ is multiplied by the model-defined likelihood $p(r|s)$ to obtain the posterior $p(s|r)$.

preserves 20% more information than the uncoupled model, which indicates that there is additional sensory information available from the population response when correlations are taken into account. Error bars show 95%