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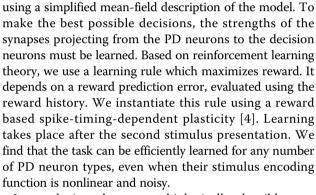
# A model of perceptual discrimination under sequential sensory evidence

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Perceptual discrimination may be interpreted as a decision between alternatives based on available sensory evidence. In many experiments, the different alternatives are encoded by quite distinct neuronal groups. In this case, proposed neural models consider that the decision results from the competition between decision-specific neuronal groups, each of these integrating distinct sensory evidence [1]. Alternatively, evidence may be presented in a sequential manner, and the different stimuli may be encoded by the same neuronal group, as exemplified by experiments where monkeys are engaged in a vibrotactile discrimination task [2]. To achieve discrimination in this case, the nervous system needs to keep a trace of the previously presented stimuli. How the correct discrimination can be learned and implemented is poorly understood.

To address these questions, we use a modeling approach. We concentrate on the particular case of the vibrotactile discrimination task on which experimental insight has been accumulated over the last years [2]. The partial differential (PD) neurons in monkey area VPC, encoding both sequentially presented vibrotactile stimuli (with frequencies  $f_1$  and  $f_2$ ) by keeping the memory of the first one during a delay period, have been reproduced in a spiking neuron network model with short-term facilitating synapses [3]. We want to explore how these PD neurons may be used to discriminate between both stimuli configurations:  $f_1 > f_2$  or  $f_1 < f_2$ . Based on the experimental evidence, we model a heterogeneous PD neuronal population, encoding both frequencies in multiple ways. Downstream to the first network, we add a competitionbased decision making spiking neuron network [1]. To obtain the desired neural dynamics of the coupled



two-networks model, we choose the model parameters

In conclusion, the present biologically plausible twonetworks model is able to solve a perceptual discrimination task under sequential sensory evidence.

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#### References

- Wang X-J: Probabilistic decision making by slow reverberation in cortical circuits. Neuron 2002, 36:955-968.
- Hernández A, Nácher V, Luna R, Zainos A, Lemus L, Alvarez M, Vázquez Y, Camarillo L, Romo R: Decoding a perceptual decision process across cortex. Neuron 2010, 66:300-314.
- Deco G, Rolls ET, Romo R: Synaptic dynamics and decision making. Proc Natl Acad Sci USA 2010, 107:7545-7549.



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 Frémeaux N, Sprekeler H, Gerstner W: Functional requirements for rewardmodulated spike-timing-dependent plasticity. J Neurosci 2010, 30(40):13326-13337.

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