SPIKE-FIELD COUPLING DOES NOT IMPLY SPIKE-SPIKE SYNCHRONY.

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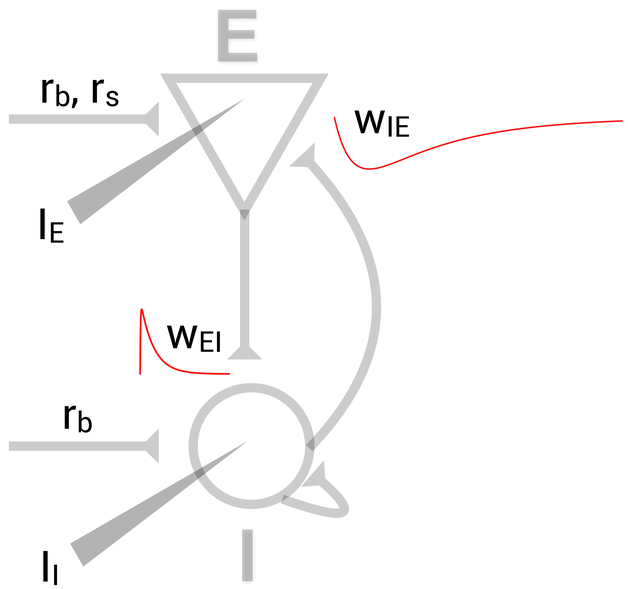
INTRODUCTION

- Gamma oscillations are important for cortical communications.
- If gamma oscillations specifically aid in 'communication through coherence' they must synchronize spike timing.
- Excitatory-Inhibitory interactions are known to both synchronize and silence firing.
- The origin and inter-play between these two 'modes' has not been well studied theoretically

MODEL



- Single compartment Hodgkin and Huxley neurons, with parameters drawn from Börgers *et al*, PNAS, 2005 and Wang & Buzsaki, J Neurosci, 1996. N_E=800; N_I = 200.

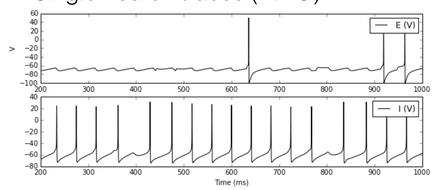
GitHub

- https://github.com/voytekresearch/syncological

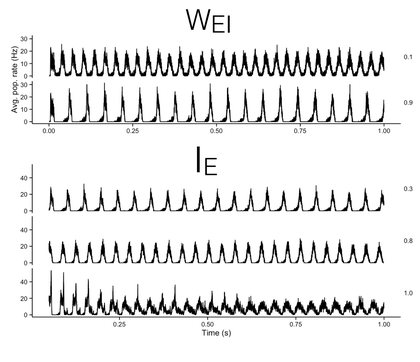
RESULTS

EXAMPLE DATA

Single neuron traces (PING)

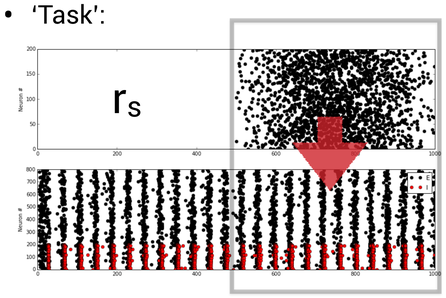


E population firing (PING)



METHODS

- 'Task':



- Power is the average power between 20 and 40 Hz.
- Synchrony was measured using the ISI metric defined by Mulansky, M. et al., arXiv preprint, 2015.
- Code fidelity was estimated using the Levenshtein distance.
- All models implemented in Brian2, in Python 2.7.
- N = 50 iterations per simulation condition.

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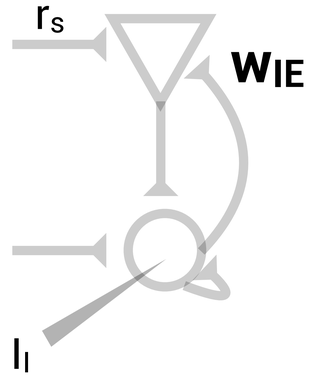
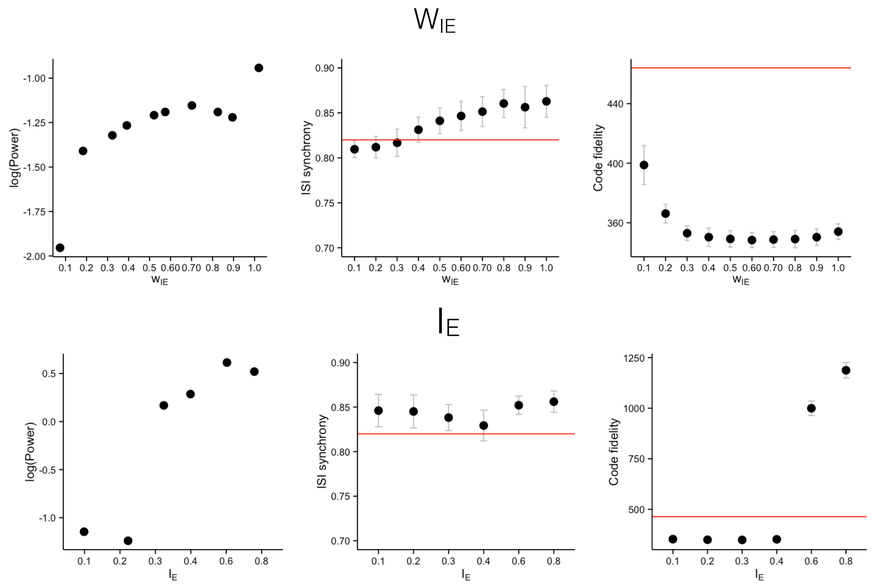
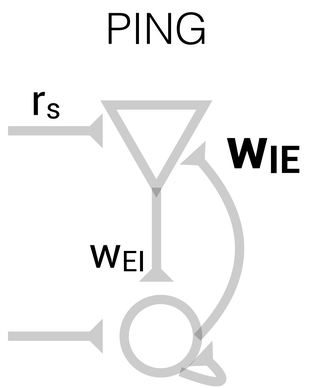
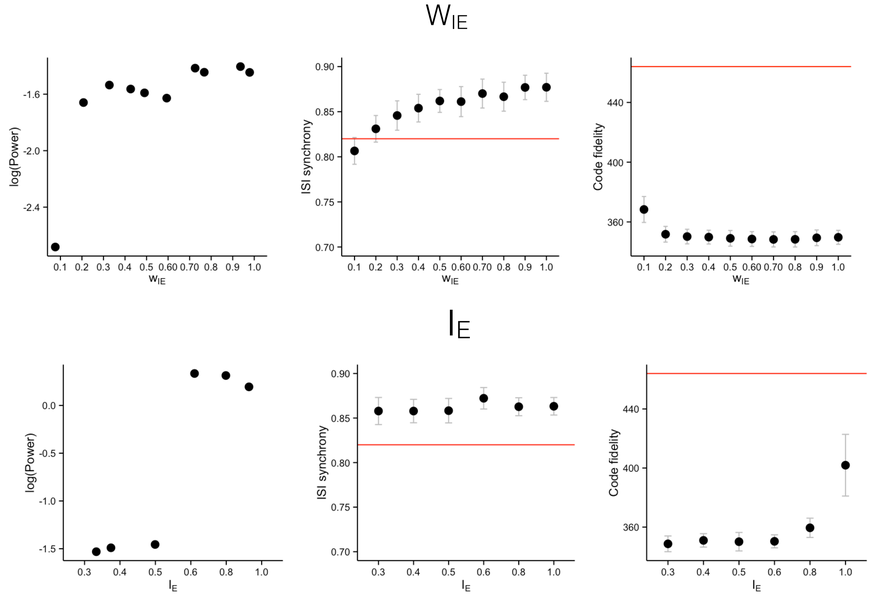


POWER, SYNCHRONY, AND FIDELITY:
The effect I-E conductance and E excitability.



PING





CONCLUSIONS

- Increasing I to E conductance increases oscillatory power and synchrony, while enhancing or maintaining neural code fidelity.
- Increasing E excitability increases oscillatory power *but not* synchrony. Very high power oscillations degrade neural code fidelity.