Collective excitability in a mesoscopic neuronal model of epileptic activity

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At the mesoscopic scale, the brain can be understood as a collection of interacting neuronal oscillators, but the extent to which its sustained activity is due to coupling among brain areas is still unclear. Here we address this issue in a simplified situation by examining the effect of coupling between two cortical columns described via Jansen-Rit neural mass models. Our results show that coupling between the two neuronal populations gives rise to stochastic initiations of sustained collective activity, which can be interpreted as epileptic events. For large enough coupling strengths, termination of these events results mainly from the emergence of synchronization between the columns, and thus it is controlled by coupling instead of noise. Stochastic triggering and noise-independent durations are characteristic of excitable dynamics, and thus we interpret our results in terms of collective excitability.

[1] Jedynak, M., Pons, A. J., & Garcia-Ojalvo, J. (2018). Collective excitability in a mesoscopic neuronal model of epileptic activity. *Physical Review E*, *97*(1), 012204.