Feilim Mac Gabhann, PhD and Jason Papin, PhD
Co-Editors-in-Chief
PLOS Computational Biology

Dear Dr. Gabhann and Dr. Papin,

I am writing to submit my manuscript entitled, “PIPPET: A Bayesian framework for generalized entrainment to stochastic rhythms” for consideration as a PLOS Computational Biology research article in the Neuroscience section. This manuscript offers a new perspective on neural and sensorimotor entrainment as a problem of real-time inference based on interaction between event timing and temporal expectations. The mathematical framework provides a simple and highly flexible generative model for rhythms and then adapts point process filtering techniques to perform variational Bayesian inference on underlying phase and tempo. This filtering solution reproduces a remarkable range of experimentally observed aspects of human entrainment behavior that have not been adequately explained by other computational models.

Given a recent increase in interest in a predictive processing perspective on music and in Bayesian brain hypotheses more generally, we believe that the findings presented in my paper will appeal to at least two groups of PLOS Comp Bio readers: cognitive neuroscientists interested in bringing Bayesian methods to understanding behavioral data, and computational neuroscientists interested in building more flexible and sophisticated predictive processing models of human sensorimotor processes.

The model may also prove interesting to readers interested in neuro-mechanistic models of specific neurophysiology: it is motivated in part by a hypothesis (currently in a late stage of revision for publication as a Trends in Cognitive Science opinion article by myself and Dr. Aniruddh Patel, attached as a “related manuscript”) that attributes specific roles to supplementary motor area and basal ganglia in entrainment to beat-based rhythms. I draw this connection in the manuscript with the intent of motivating experimental research that would link this theoretical perspective on entrainment with its neurophysiological basis, and modeling research that might propose a neural mechanism for the algorithm.

My manuscript addresses the phenomenon of human entrainment and synchronization, which has been explored from other perspectives in the recent PLOS Comp Bio papers “A neuromechanistic model for rhythmic beat generation” by Bose, Byrne, and Rinzel, and “A Kuramoto model of self-other integration across interpersonal synchronization strategies” by Heggli et al. It also provides a framework that can serve as a novel element in hierarchical Bayesian cognition models as described in the classic PLOS Comp Bio paper “Hierarchical models in the brain” by Friston.

I believe this manuscript might be a good fit for Associate Editor Dr. Jean Daunizeau, who has published extensively on predictive processing models. It also might be well suited to Drs. Ulrik Beierholm and Mingbo Cai.

Thank you for your consideration. Sincerely,
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