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Title. Neural substrates of rapid consolidation of procedural motor skill.

Abstract:
Procedural motor skills are crucial for activities of daily living. Recent work demonstrated that virtually all performance improvements during early learning develop during rest intervals interspersed with practice (microoffline learning), a form of rapid consolidation of skill [1]. Implementation of a crowdsourcing strategy showed this result to be highly reproducible in large number of subjects performing the task in their own environment, outside the lab [2]. Further work demonstrated that the mechanisms by which the brain binds discrete brain representations into consolidated, temporally resolved procedural skill sequences during waking rest involve wakeful neural replay. Neural replay is the temporally compressed reactivation of neural activity patterns representing behavioral sequences during rest [3]. Magnetoencephalography (MEG) activity during acquisition and rapid consolidation of a procedural sequential motor skill showed (a) the presence of waking neural replay during the same rest periods in which rapid consolidation occurs, (b) that wakeful neural replay is temporally compressed by approximately 20-fold relative to the acquired skill, (c) that increase in replay rates during rest periods is selective for the trained sequence and predicts the magnitude of skill consolidation, and (d) that the neural representation of replay events engage not only the hippocampus and entorhinal cortex but also the contralateral sensorimotor cortex. Overall, these results document the presence of hippocampo-neocortical replay that supports rapid wakeful consolidation of skill [4].

References
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2. Bonstrup, M., et al., Mechanisms of offline motor learning at a microscale of seconds in large-scale crowdsourced data. NPJ Sci Learn, 2020. 5: p. 7.
3. Genzel, L., et al., A consensus statement: defining terms for reactivation analysis. Philos Trans R Soc Lond B Biol Sci, 2020. 375(1799): p. 20200001.
4. Buch, E.R., et al., Consolidation of human skill linked to waking hippocampo-neocortical replay. Cell Rep, 2021. 35(10): p. 109193..

Short CV:

Dr. Cohen received his MD from the University of Buenos Aires. He did his neurology residency at Georgetown University and received postdoctoral training in Clinical Neurophysiology at the Department of Neurology, University of California (Irvine) and in Motor Control and Movement Disorders at the Human Motor Control Section, NINDS. In 1998, Dr. Cohen became chief of the Human Cortical Physiology Section, NINDS. He is a recipient of the prestigious Humboldt Award (Humboldt Foundation) and Barbro B Johansson Award in Stroke Recovery (World Stroke Organization), and is an elected member of the American Neurological Association. The focus of his research has been neuroplasticity associated with learning and translational neurorehabilitation. His expertise lies in the use of neuroimaging including MEG and brain stimulation to understand mechanisms of neuroplasticity, particularly learning. The HCPS

configuration is designed to include fellows and students who interact, helping and participating in each other's studies in a multidisciplinary and collaborative way. A vast majority of HCPS graduates are independent investigators and clinician scientists in academia. Their most recent work has focused on understanding the neural mechanisms underlying procedural learning in young adults, particularly neural replay, using MEG and sophisticated machine learning techniques.