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Professional Interests

The goal of the work on neuro-computational models is to understand the neural bases of motor learning. We are notably investigating motor plasticity in the cerebellum, cortical map plasticity and reorganization in the sensorimotor cortex, multiple task learning, and adaptive decision-making during motor learning in healthy and lesioned brains. When appropriate, we test our predictions by conducting behavioral and/or brain imaging (fMRI and TMS) experiments either at USC or with our collaborators at ATR in Japan or at INSERM in France.

The goal of the work on learning optimization is to enhance re-learning of motor skills in patients with stroke. Despite great progress in psychology and neuroscience, physical therapists treating patients with stroke rely on non-specific guidelines to determine task practice schedules for functional motor skill re-acquisition. Using algorithms that combine neuroscience-based models and artificial intelligence, we aim at defining and testing adaptive practice schedules, with particular emphasis on the micro-schedules of the practice.

Education

- Post-doc, Human information science Group, ATR, Kyoto Japan
- PhD, University of Southern California, Los Angeles.
- M.S., Ecole Nationale Supérieure de Mécanique, Nantes, France
- "Mathématiques Spéciales P1", Lycée Descartes, Tours, France

Selected Publications

- Kim, S.S., Ogawa K., Lv. J., **Schweighofer N.**, and Imamizu H. (2015) *Neural substrates related to motor memory with multiple timescales in sensorimotor adaptation* (corresponding author; the last two authors have contributed equally), PLoS Biology, In press.
- Park H., Kim S., Winstein C., Gordon J., and **Schweighofer N.** (2015) *Intensive, short-term, adaptive training improves long-term reaching performance in individuals with chronic stroke*, Neural Rehabilitation and Repair, In press.
- **Schweighofer N.**, Xiao Y., Gordon, J., and R.Osu (2015). *Effort, Success, and Non-use Determine Arm Choice* Journal of Neurophysiology, 114: 551-559.
- Bains A., and **Schweighofer N.** (2014) *Time-sensitive reorganization of the somatosensory cortex post-stroke depends on interaction between Hebbian plasticity and homeoplasticity: a simulation study*. Journal of Neurophysiology: 112.12 (2014): 3240-3250.
- Han C.E., Kim S.J., Chen, S., Lai, L., Lee, J., Osu, R., Lee, J.Y.*, Winstein C., and **Schweighofer N.** (2013) *Quantifying Arm Non-use in Individuals Post-stroke*, Neural Repair and Neurorehabilitation. 27:439-47
- Hidaka Y., Han C.E., Wolf S., Winstein C.J., and **Schweighofer N.** (2012) *Use it and improve it, or lose it: interactions between arm use and function during stroke recovery in humans*, PLoS Computational Biology 8(2):e1002343
- Abe M., Schambra H., Wassermann E., Luckenbaugh D., **Schweighofer, N.**, and Cohen L.G. (2011) *Reward, not punishment, improves long-term retention of a newly acquired skill through improved consolidation*. Current Biology, 21: 557-562
- Kawato M., Kuroda S., and **Schweighofer N.** (2011) *Cerebellar supervised learning revisited: bioinformatics modeling and degrees-of-freedom control*. Current Opinion in Neurobiology, 21:1-10

- **Schweighofer N.**, Lee, J.Y., Goh H.T., Choi Y.G., Kim, S.S., Stewart J., Lewthwaite R. Winstein C.(2011) *Mechanisms of the contextual interference effect in individuals post-stroke.* (the first two authors have contributed equally) Journal of Neurophysiology 106: 2632-41
- **Schweighofer N.**, Han, C., Wolf, S., Arbib, M.A and Winstein C. (2009) *Understanding the Functional Threshold: Predictions from a Computational Model and Supporting Data from the Extremity Constraint-Induced Therapy Evaluation(EXCITE) Trial.* Physical Therapy, 89(12)
- Choi Y.G., Gordon, J., Kim D., and **Schweighofer N.** (2009) *An Adaptive Automated Robotic Task Practice System for Rehabilitation of Arm Functions after Stroke.* IEEE-Transactions in Robotics, 25: 556-568
- Lee J.Y., **Schweighofer N.** (2009) *Dual-adaptation supports a parallel architecture of motor memory.* Journal of Neuroscience, 29:10396-404
- Han C.E., Arbib M.A. and **Schweighofer N.**(2008) *Stroke rehabilitation reaches a threshold.* PLoS Computational Biology, 4(8): e1000133
- **Schweighofer N.**, Bertin, M., Shihida K., Tanaka S., Okamoto Y., Yamawaki S., and Doya K (2008). *Serotonin modulation of delayed reward discounting in humans.* Journal of Neuroscience, 28:4528-32
- **Schweighofer N.**, Shihida K., Han C.E., Tanaka S., Okamoto Y., Yamawaki S., and Doya K. (2006) *Humans can adopt optimal discounting strategy under real-time constraints.* PLoS Computational Biology 11: 1349-1356
- Schaal, S. and **Schweighofer N.** (2005) *Computational motor control in humans and robots.* Current Opinion in Neurobiology, 25: 1-8
- **Schweighofer N.**, Doya K., Chiron J.V., Fukai H., Furukawa T., and Kawato M. (2004) *Chaos may enhance information transmission in the inferior olive.* Proceedings of the National Academy of Science USA, 101: 4655-4660
- Kuroda S., **Schweighofer N.**, and Kawato M.(2001) *Exploration and prediction of signal transduction pathways in cerebellar long-term depression by kinetic simulation.* Journal of Neuroscience 21: 5693-702
- **Schweighofer N.** and Ferriol G. (2000) *Diffusion of nitric oxide can facilitate cerebellar learning.* Proceedings of the National Academy of Science USA. 97: 10661-5
- **Schweighofer N.**, Arbib, M.A. and Kawato, M.(1998) *Role of the cerebellum in reaching movements in human. I. Distributed Inverse dynamics control.* European Journal of Neuroscience. 10: 86-94