MASTER 2 Fundamental and Clinical Neurosciences

Internship proposal 2022-2023

(internship from January to June 2023)

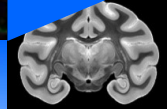**Host laboratory:** CRNL, 16 avenue du doyen lépine, 69500, BRON CEDEX

Host team : IMPACT

Internship supervisors : Claudio BROZZOLI, CRCN, claudio.brozzoli@inserm.fr

Project title : A motor tool for language learning

Project summary : The interest in learning during adulthood has brought neuroscience in the last decade to reconsider the common belief of a rigid brain structure in adult life. The cerebral cortex displays local changes in volume and thickness: brain structures active during training expand while learning and return to baseline afterwards. The transient expansion is thought to reflect "work in progress" within brain regions involved in learning, meant to integrate new skills in existing neural circuitries, via strengthening and/or selecting local neuronal connections. The main hypothesis of this project is that the "work in progress" may be repurposed to benefit other functions, as long as they rely on the activity of the same brain territories.

State-of-the-art research documented neural overlap and functional interactions of motor and linguistic systems. We have evidenced that tool use and syntactic processes in one's own language share activity in the basal ganglia, whose patterns display representational similarity. This supports the existence of a supramodal syntactic function subserving both motor system and language. Learning transfer between the two abilities arises: shortly training one function enhances performance in the other, when tested immediately after. This opens several questions: can we leverage brain changes induced by long-term tool use learning to boost new language learning? What is the optimal duration of tool use training in order to observe benefits in language? Can tool use training also boost linguistic production?

Please send your proposal to marion.richard@univ-lyon1.fr for publication on the Master of Neuroscience website.

3-5 recent publications :

Thibault S, Py R, Gervasi AM, Salemme R, Koun E, Lövden M, Boulenger V, Roy AC, Brozzoli C. Tool use and language share syntactic processes and neural patterns in the basal ganglia. Science. 2021 Nov 12;374(6569):eabe0874. doi: 10.1126/science.abe0874.

C. Brozzoli, A. C. Roy, L. H. Lidborg, M. Lövdén, Language as a tool: Motor proficiency using a tool predicts individual linguistic abilities. *Front. Psychol.* **10**, 1–9 (2019).

Iriki, M. Taoka, Triadic (ecological, neural, cognitive) niche construction: A scenario of human brain evolution extrapolating tool use and language from the control of reaching actions. *Philos. Trans. R. Soc. B Biol. Sci.* **367**, 10–23 (2012).

M. J. D. Martins, R. Bianco, D. Sammler, A. Villringer, Recursion in action : An fMRI study on the generation of new hierarchical levels in motor sequences, 1–16 (2019).