PROGRAM

(updated 31/01/2025)

NeuroGraduate Summer School in Cognitive Neuroscience 2025

Lyon 1st-4th July 2025

Day 1 – Open cognitive (neuro)science & data collection

- *8h30-9h*. Registration and coffee
- *9h-9h30*. Welcoming words by the organizers and general introduction.
- *9h30-11h30*. **Lectures**. Introduction to open cognitive science:
    - The good, the bad and the ugly of cognitive (neuro)science
    - Statistical designs, power calculations and preregistrations
    - Science as a collective endeavour: open science and data management for analyses and meta-analyses
    - How to recruit, instruct, incentivize and debrief your research participants?
- *11h30-12h30*. **Short practical session** to briefly present and install Git, Anaconda, Python, and Nodejs
- *12h30-14h*. Lunch
- *14h30-15h30*. **Lecture**. Programming a behavioral task: key conceptual principles and implementation using HTML, Javascript and databases.
- *15h30-18h30*. **Practical session.** Learning how to set up a web server, host a behavioral experiment and perform key sanity checks for online and in-lab data collection.
- *18h30-20h30*. Science Pizza. Relaxed event centered around gamification

Day 2 — Data analysis and modeling

- *9h-10h45.* **Practical session.** Reading and preprocessing data collected on day 1 using Python (Jupyter, Pandas, Numpy and Matplotlib)
- *11h-13h00.* **Lectures**. Advanced data analysis and behavioral modelling:
    - Principles of statistical optimization and their application to general(ized) linear models
    - Making models sound: simulations, recovery and sanity checks in computational neuroscience
    - Reinforcement-learning: a success story at the cross-roads of neuroscience and artificial intelligence

  - Drift diffusion models, Bayesian models and their application to model-based analyses of brain signals.

- *13h-14h.* Lunch
- *14h-15h.* **Flash-talks** (5+5 minutes) by local PhD students and postdocs
- *15h30-18h30*. **Practical session**: analyzing and modeling the data preprocessed in the morning using reinforcement learning. For more proficient students, coding of an optimal Bayesian observer.
- *18h30-23h30*. Social event with students and speakers

Day 3 — Towards clinical and real-life applications

- *9h-10h30*. **Lectures**. Introduction to multimodal data acquisition:
  - Computational psychiatry and cognitive testing in clinical populations
  - Out of the lab: unraveling the full potential of remote experiments
  - Closing the loop: pitfalls and promises of real-time electrophysiology for BCI and beyond
- *10h45-12h45*. **Practical session:** synchronization of the behavioral experiment with an external apparatus to measure physiological signals using serial port communications and Arduinos. Signal alignment and analysis of psychophysiological interactions.
- *12h45-14h*. Lunch
- *14h-15h30*. **Lectures**. Virtual reality and AI for behavioral science:
  - TBA
- *15h30-17h30* **Interactive visit** of the Neuro-immersion platform at Impact
- *17h30-19h*. Q&A, closing discussion and presentation/preparation of the hackathon for those who registered
- *20h30-22h*. Live performance by Samon Takahashi & Stephen Whitmarsh

Day 4 — Hackathon to dive deeper in the experiment or to kickstart a personal project

In the collective project, participants will export the experiment (developed during the first 3 days) to smartphones and they will learn how to record and use sensor input (e.g. accelerometer) during the task. Once the core steps will be performed, participants will be invited to join the design/gamification track or to the multi-agent / live interaction track.