

ENS – IISER Network / BIOSANTEXC Project

Internship Proposal Form

(Discipline/Field name): Computer Science

Internship title: FORMAPSY: Formalizing Psychological Theories

Keywords related with the subject (minimum 3): Formal models, psychological theories, human memory.

Name of the laboratory at ENS: LMF

Name of the internship supervisor(s): Alain FINKEL

Email(s): alain.finkel@ens-paris-saclay.fr

Prerequisites for the internship: Master's student in the second year (M2). Obtained degree: Master's M1 in computer science or in applied mathematics.

Requested level: knowledges in computability, theoretical computer science, modelling, AI, NLP, LLM, cognitive neurosciences, statistics, and possibly in linguistics and psychology.

Foreseen internship dates: 15 April – 15 July 2025

Internship proposal (description and expected training outcomes / half page min, 1 page max):

I plan to explore various existing formalizations, including properties of memory systems, Glasser's control theory, Kahneman's dual-system theory of slow and fast thinking, and consciousness as modeled by the Global Neuronal Workspace theory, among others.

The work program will be chosen from the following points:

- Understand the recent formalization of Lazarus' stress theory using synchronized communicating finite automata.
- Learn the theories of human memory and in particular the effects of recency, primacy, peak–end rule and context.
- Make a survey of models like ACT-R, LIDA, GNW, Glasser, Friston, low/fast systems of Kahneman for their ability to model some memory properties.
- Model certain spatial and temporal properties of different memory systems.
- Model the theory of control of Glasser.
- Organize a state-of-the-art review of existing models for consciousness (including probabilistic models like Friston's and Blum's conscious Turing machine model and then develop a formal model for consciousness. Formalize elements of the Global Neuronal Workspace theory (where conscious access occurs when incoming information is made globally available to multiple brain systems via a network of neurons with long-range axons), for example, using the broadcast protocol model.
- Formalize a theory of emotions using the notion of territories.