The relational and informational organisation in the orbital and medial prefrontal cortex A study using virtual experimentation

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Bhargav Teja Nallapu, Frederic Alexandre
bhargav.teja-nallapu@inria.fr
INRIA, Institute of Neurodegenerative Diseases, LaBRI Bordeaux

Prediction learning

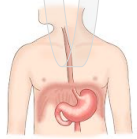
Value of Stimuli (Primary/Learned goals and sub-goals)

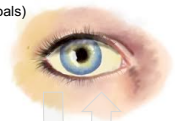
Decision Making

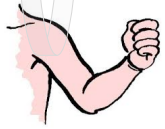
Value of Actions (motor decision, options, planning)

- Interoception
- Motivational and emotional evaluation

- Exteroception
- Sensorimotor relations

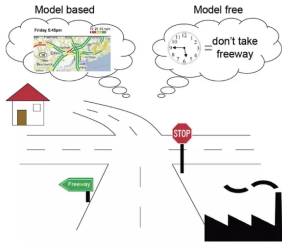


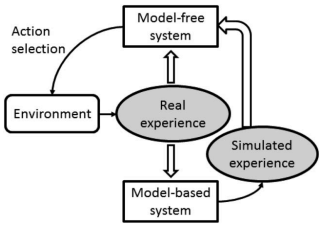




Behavior and Cognition: A matter of loops ...

Model-free Model-based Reinforcement learning





- Model-free (MF): long to learn, compact
- Model-based (MB): use forward models, more flexible but heavy to compute
- With forward models, goal-driven strategies more tractable than

- MF controls the behavior
- MB trains MF by replays (retrospective memory) and simulations (prospective memory)

Autonomous learning

We define our goals by ourselves :
- detection of primary reinforcers
- learning of secondary reinforcers
- attentional processes

We have a motivation to act :
- Fundamental needs
- intrinsic motivation
- goal-driven behavior

and…
- We self-evaluate our performances
- We associate different kinds of learning and information representation
- We cumulate and re-exploit previously learnt knowledge and strategies in different context

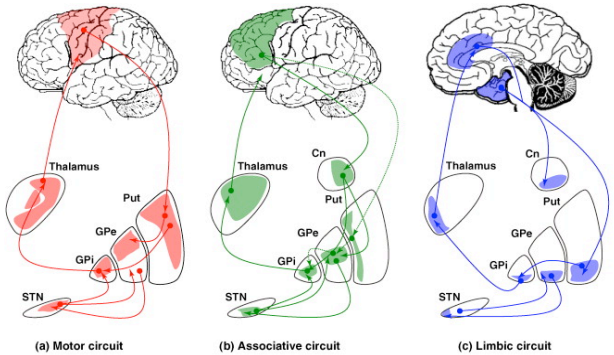
Defining executive control for a cognitive agent in ecological conditions by autonomous learning

- Role of the loops between the frontal cortex and the basal ganglia for predicting values, decision making and planning
- The limbic loops decide for the goal and the action
- The associative loops bias the default behavior
- The motor loops execute the behavior
- Forward models associated with limbic and associative loops

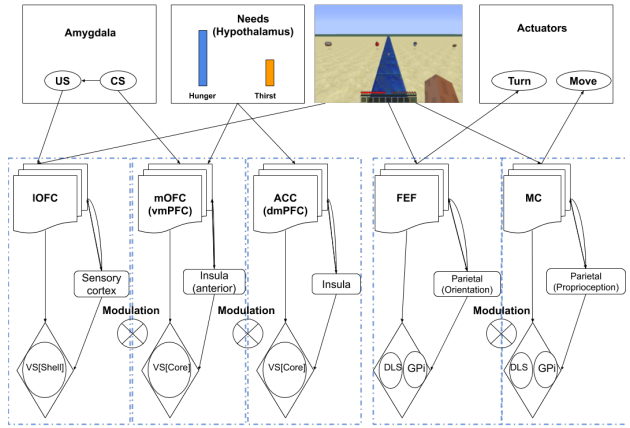
Role of the limbic loops : Foraging or decision between several targets ?

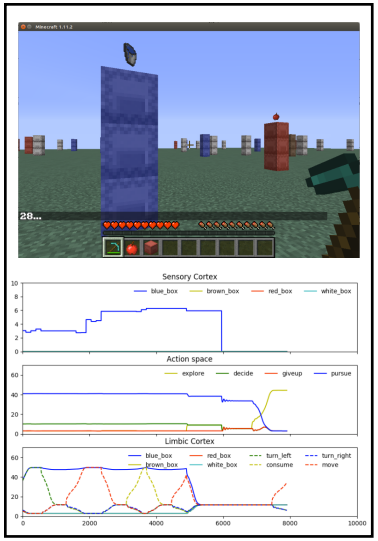
lOFC: learns values of stimuli (pavlov); menu dependent; sensory representation of rewards, consummatory behavior, Model Based; select the best two options
mOFC: reward representation for preparatory behavior (operant, Model Free), integrate levels of need; value difference signal; decide for the goal
ACC: integrate cost of effort to decide for the action; inverse value difference signal; if strong signal of conflict, ask for a switch

Main circuits for value prediction, decision making and planning



limbic and motor loops interactions





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