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► To cite this version:

Bhargav Teja Nallapu, Frédéric Alexandre. The relational and informational organisation in the orbital and medial prefrontal cortex A study using virtual experimentation. NeuroFrance, the international conference of the french society of Neuroscience, May 2019, Marseille, France. 2019. hal-02388181

HAL Id: hal-02388181

<https://inria.hal.science/hal-02388181v1>

Submitted on 1 Dec 2019

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The relational and informational organisation in the orbital and medial prefrontal cortex

A study using virtual experimentation
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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

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

IOFC: 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

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

Main circuits for value prediction, decision making and planning

(a) Motor circuit
 (b) Associative circuit
 (c) Limbic circuit

limbic and motor loops interactions

US - CS (Amygdala)
 Hunger / Thirst (Hypothalamus)
 Turn / Move (Actuators)

IOFC, mOFC (vmPFC), ACC (dmPFC), FEF, MC

Sensory cortex, Insula (anterior), Insula, Parietal (Orientation), Parietal (Proprioception)

Modulation: VS(Shell), VS(Core), VS(Core), DLS (GPI), DLS (GPI)

Sensory Cortex
 Action space
 Limbic Cortex

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