From computational neuroscience to computational learning science: modeling the brain of the learner and the context of the learning activity

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From computational neuroscience to computational learning science:

Modeling the brain of the learner and the context of the learning activity.

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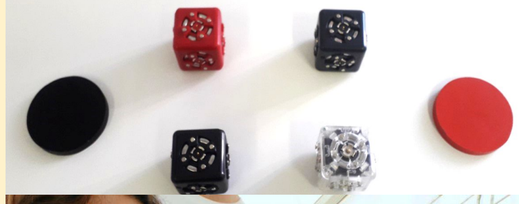
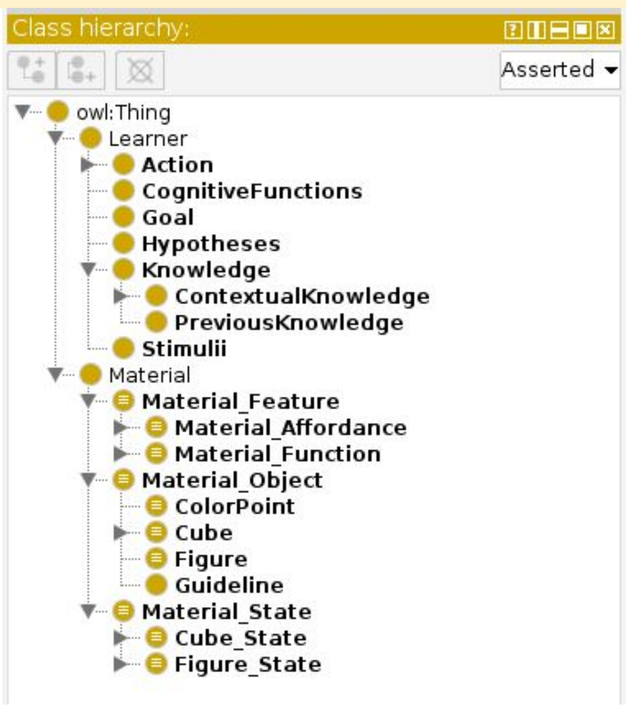
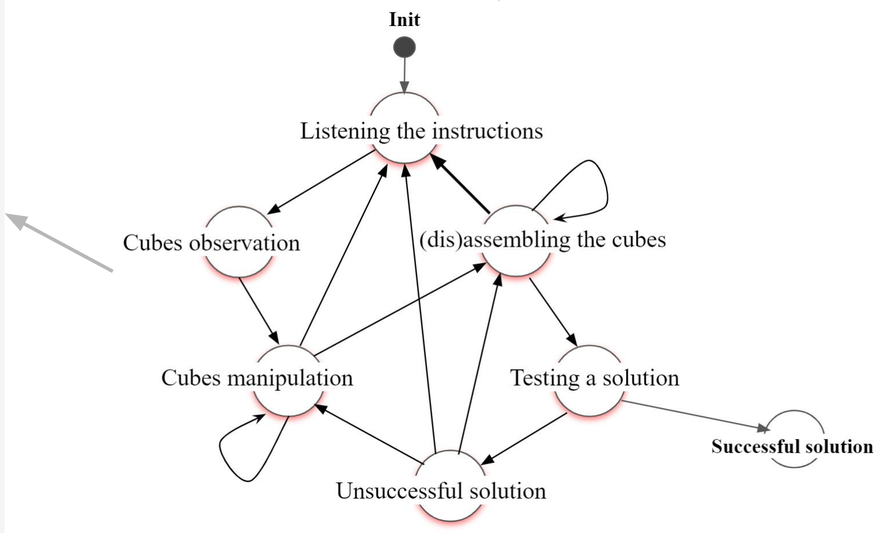
In **Computational neuroscience and bioinspired artificial intelligence (AI)**, different studies aim at understanding the mechanisms of perception such as shape recognition and sensori-motor coordination such as grasping or pinching. A step further, as in the Mnemosyne research program, cognitive mechanisms are analyzed to better understand brain circuits responsible for reasoning and problem-solving, by a biological or algorithmic agent.

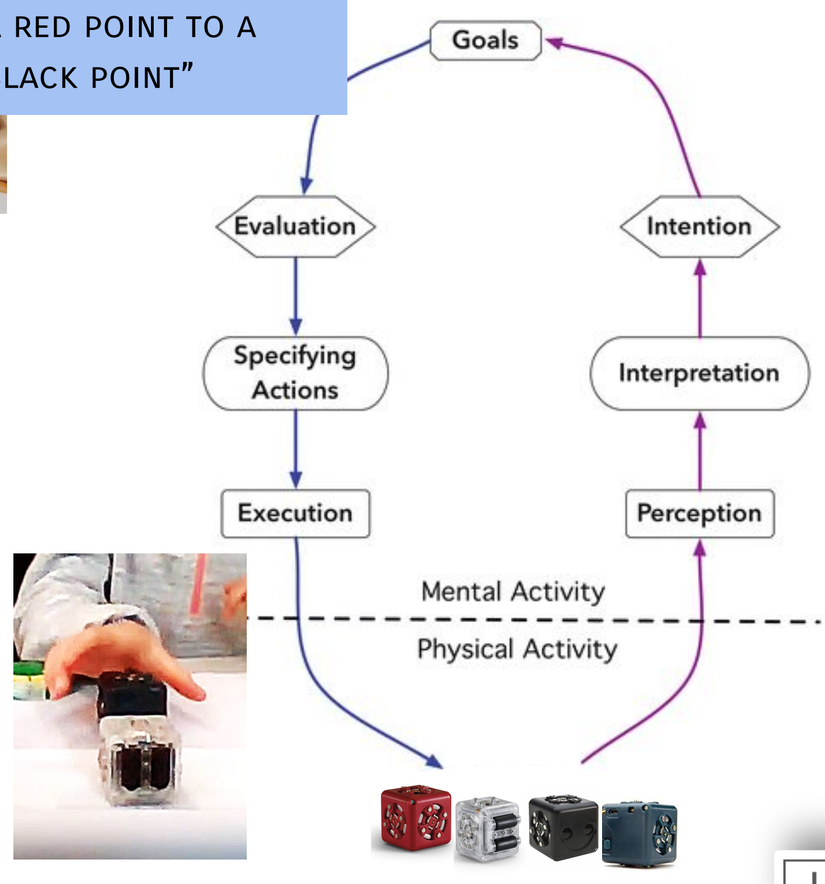


Ill-defined problem engaging the participants in a task which goal requires to explore the four unknown cubes placed in front of the participant. The affordances are important in the process of understanding the material and its features to configure it in a way to solve the problem (goal state)

Goal : "build a vehicle moving from a red point to a black point"





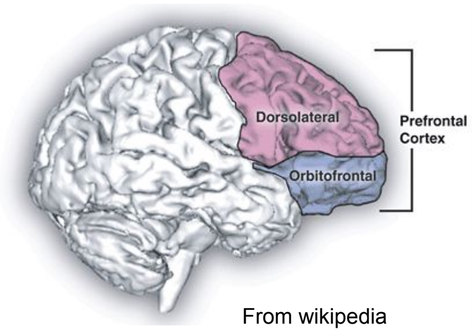


Even on simple tasks of problem-solving, we do not yet have a model that encounters the underlying **cognitive processes of the learner's brain**, in link with the dynamic state of the activity system assessment that takes place at the task level. ⇒ The AIDE research program aims to build such models to better understand the **interaction between brain processes and problem-solving activity from a behavioral perspective** analysed based on learning analytics generated automatically, also through the human analysis of this activity based on coding schemes.

LINE research lab has developed a methodology for the analysis of **human creative problem-solving** through a digital manipulative task-oriented approach.

Cognitive neuroscience modeling of executive functions allows to model the learner involved in a precise learning task. For instance, the prefrontal cortex encodes the outcome, or value, of an action (orbitofrontal), while action decision making and working memory is located in the dorsolateral part, in link with the basal ganglia for action selection and action reward processing and other brain Structures.

Considering this effective functional model of brain functions allows us to provide an operational model of the learner behavior, in link with machine learning algorithms, such as reinforcement learning.



From wikipedia

Measuring learning analytics during unplugged or tangible playful activities with low-cost devices in order to use them in concrete learning environment:

Here computational thinking competences related to algorithm, data representation and information coding is targeted, in an autonomous learning setup.
Monitoring such activity influences the learning paradigm, involving the learner in a learning to learn process.

GTnum 9 #Scol_IA Créativité, IA et Education

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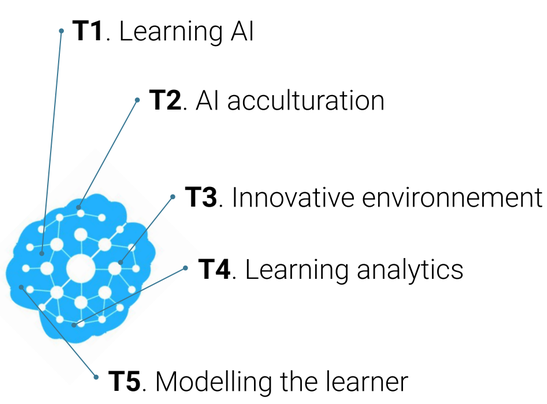

The French National Direction of Digital Education (DNE) at the Ministry Of Education (MENJS) has selected the LINE research team for being responsible of one of the 9 thematic workforces. The GTnum 9 is devoted to the advancement of Artificial Intelligence in Education.