ETIS laboratory

Equipes Traitement de l'Information et Systèmes

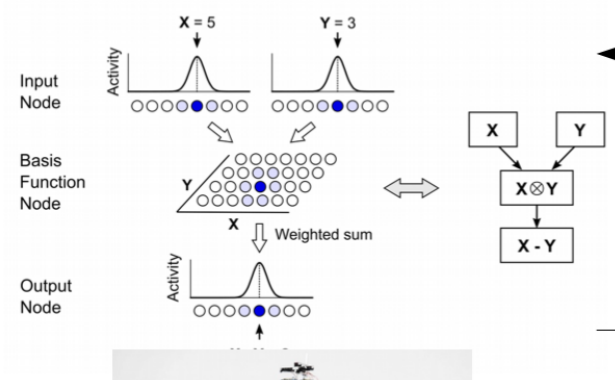
BIO-INSPIRED INTELLIGENCE
SOCIAL & DEVELOPMENTAL ROBOTICS
EMBODIED AI
COMPUTATIONAL NEUROSCIENCE

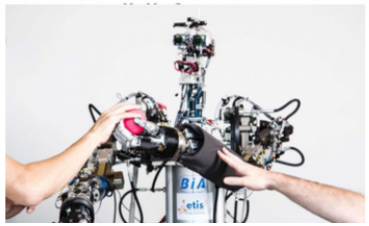
CY Cergy Paris Université, ENSEA and CNRS

Scientific perimeter

NEURO is a team working in the field of the **Bio-inspiration** for intelligent systems design applied for computational engineering, Brain science, Cognitive science, and, Robotics.

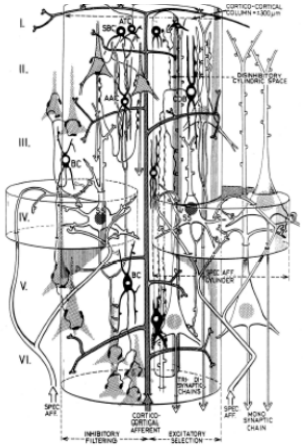
Models

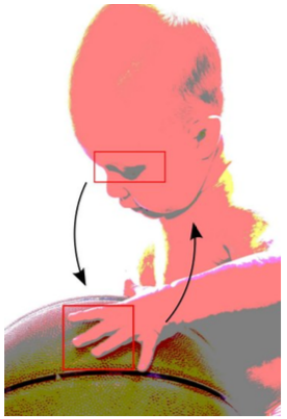




Robots

Cognitive Neurosciences





Main research activities

3 main axis

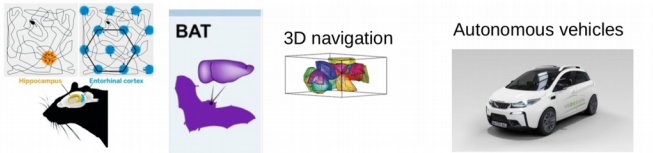
Navigation

Learning

Human-machine interaction

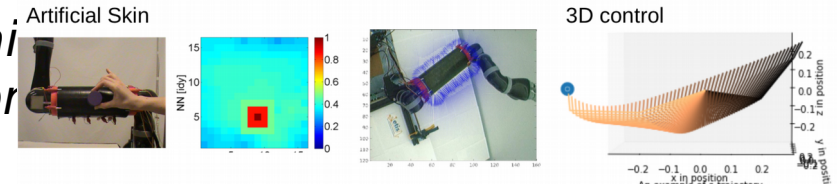
Autonomous navigation & neurocomputional model

- *2D & 3D Bio-inspired navigation contro*



Autonomous Robot learning & control

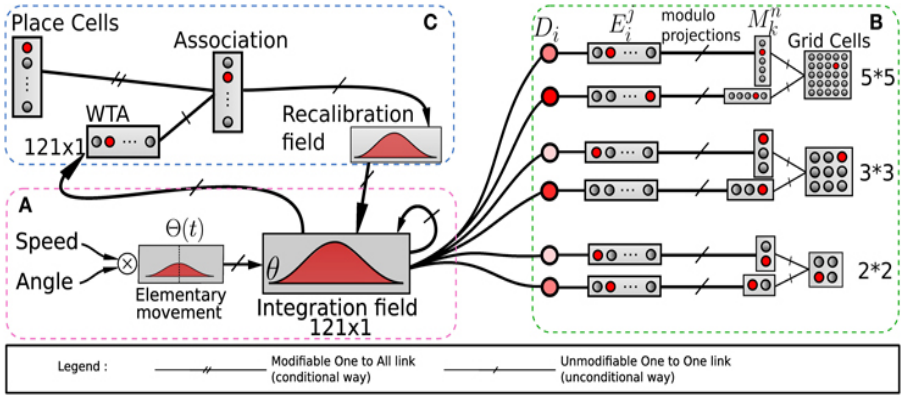
- *Brai*
  repr

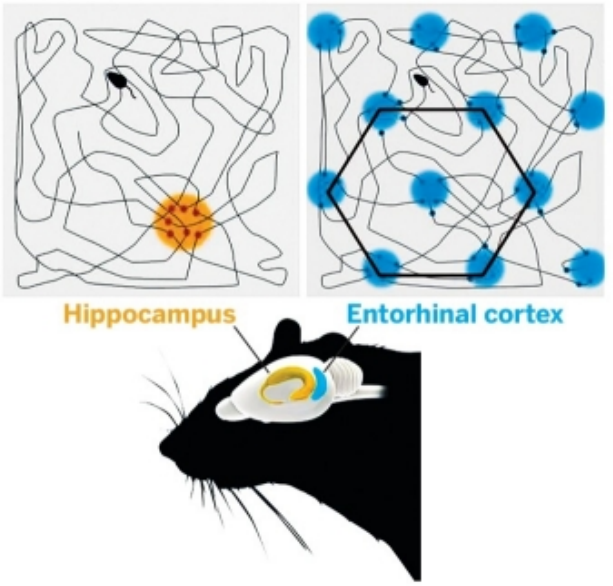


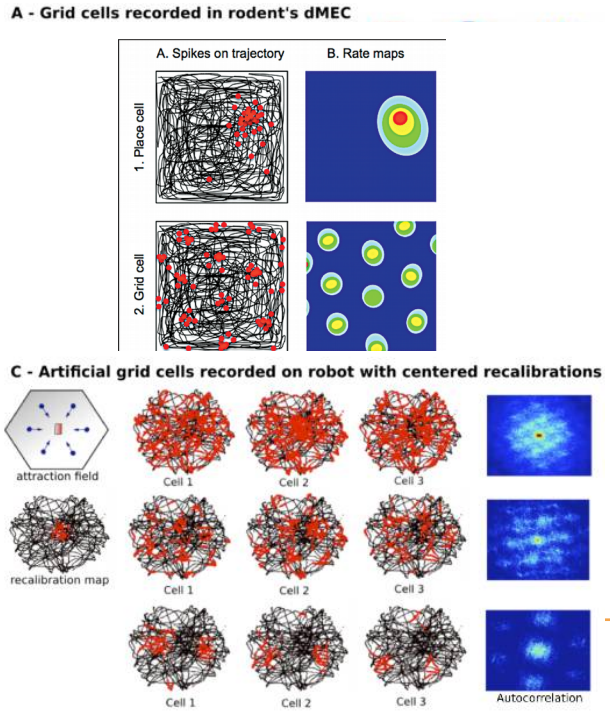
Human-machine interaction

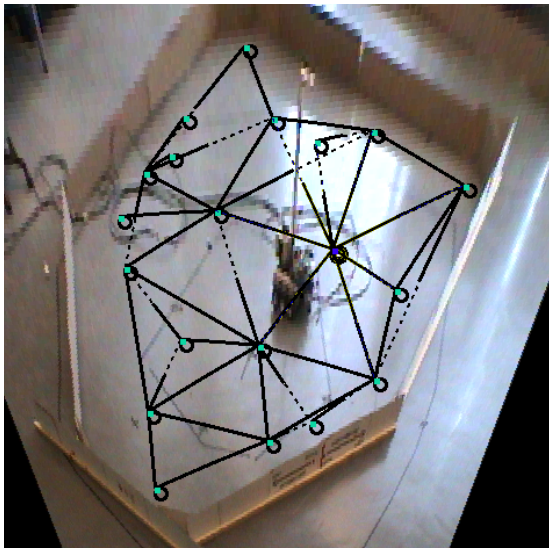
- Cognitive model of social interaction
- Model of diseases
- Emotional interaction
- Sound perception

Hippocampus model

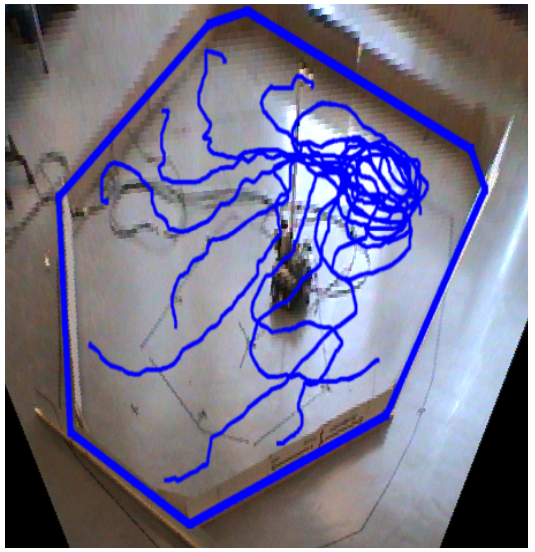








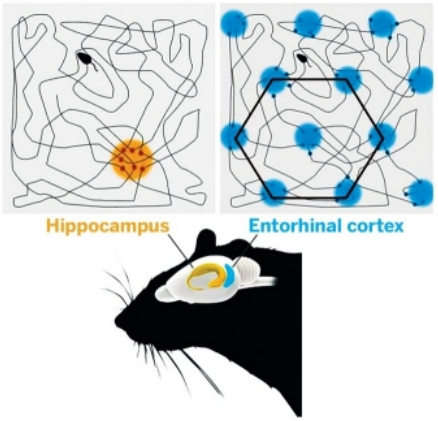
Place cells mapping

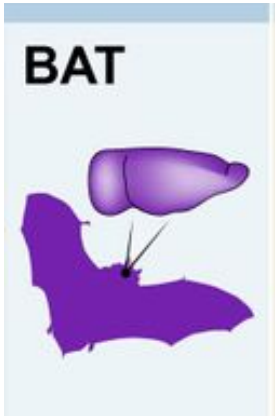


Goal-oriented behavior

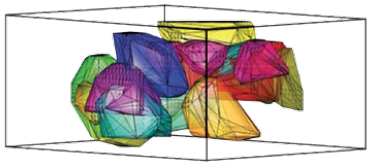
Grid cells [Hafting, 2006, Gaussier 2008~2013]

2D & 3D Bio-inspired navigation control

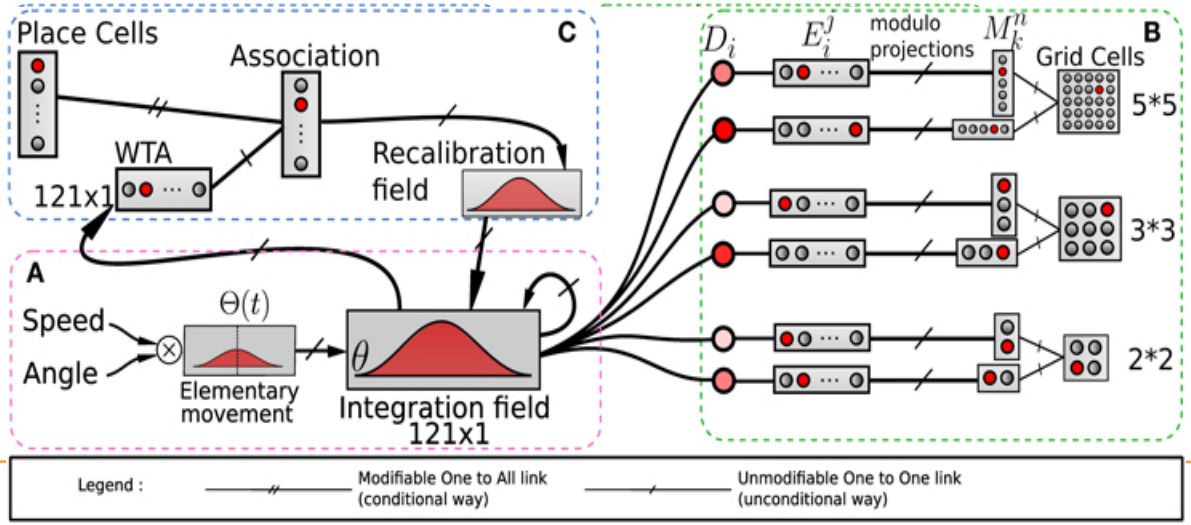




3D navigation



Autonomous vehicles



Drones

Autonomous robot, hippocampus model

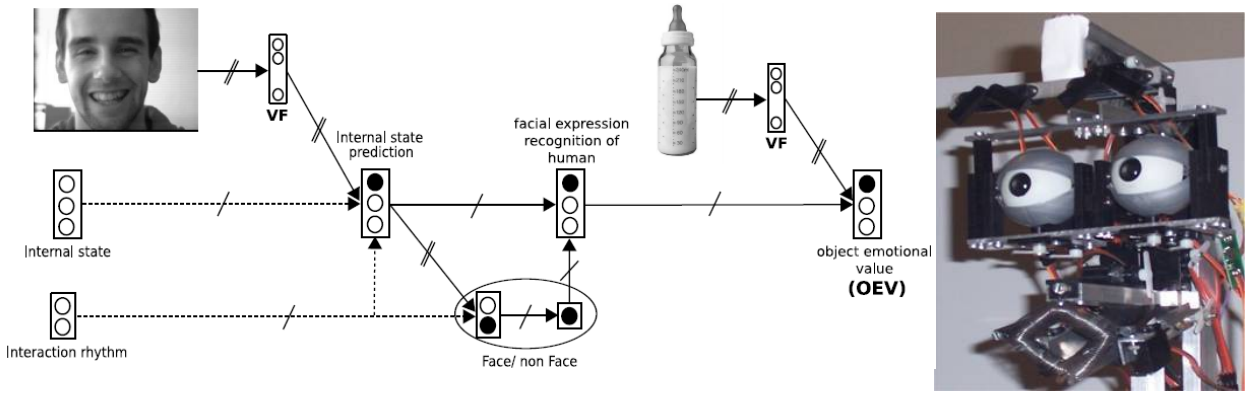
Berenson : Robot Art Connaisseur
Human Robot Interaction

Musée du Quai Branly (Paris) 2012, 2015

[Karaouzene *et al* 2012~]

Facial and emotional recognition and social interaction

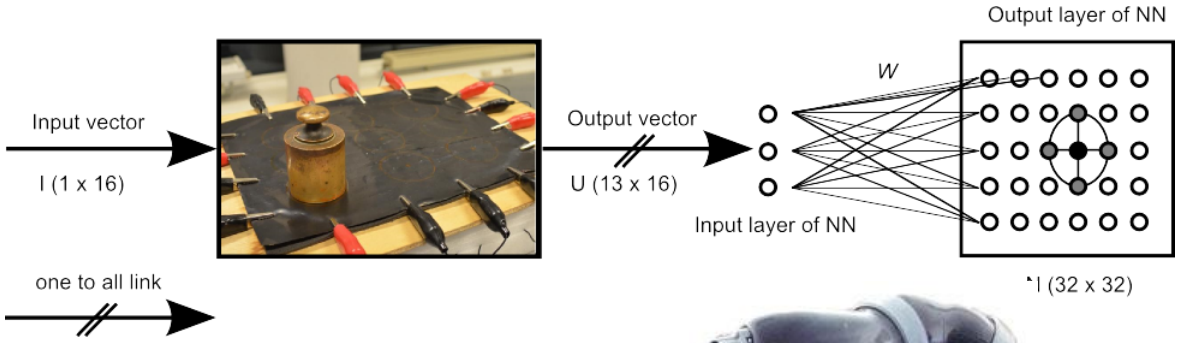
Reinforcement learning for Emotion Generation

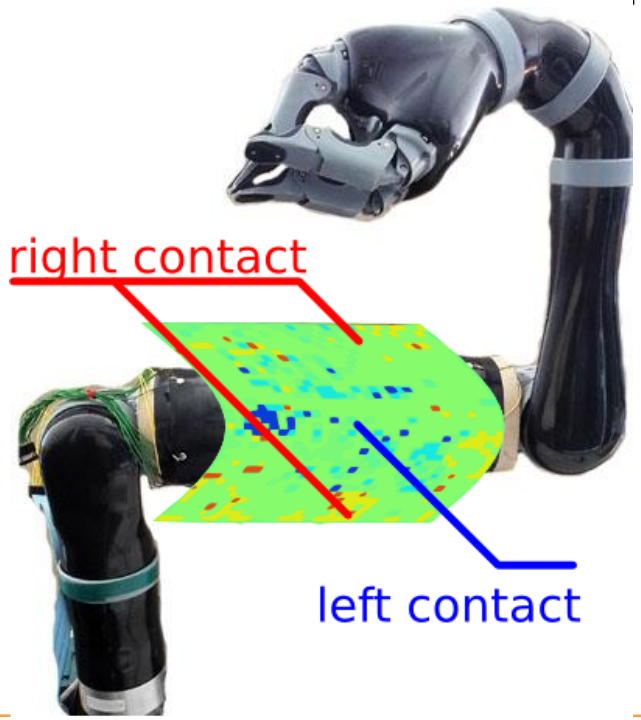


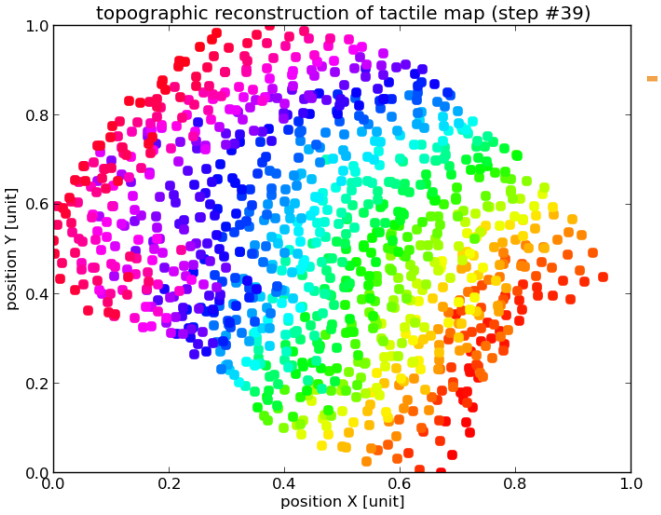
Emotion recognition

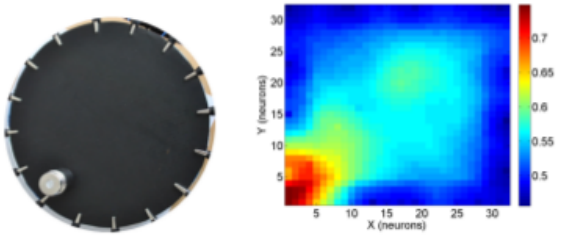
Neonate imitation

Conception of an artificial skin for robots

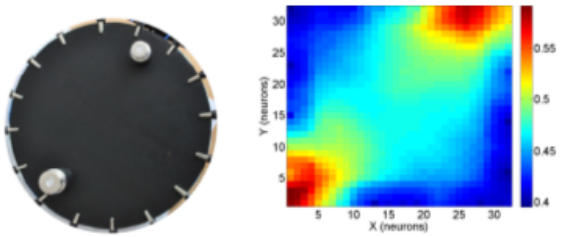




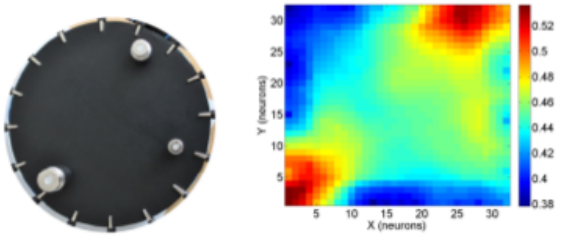




(a) Single contact point (weigth of 100g).

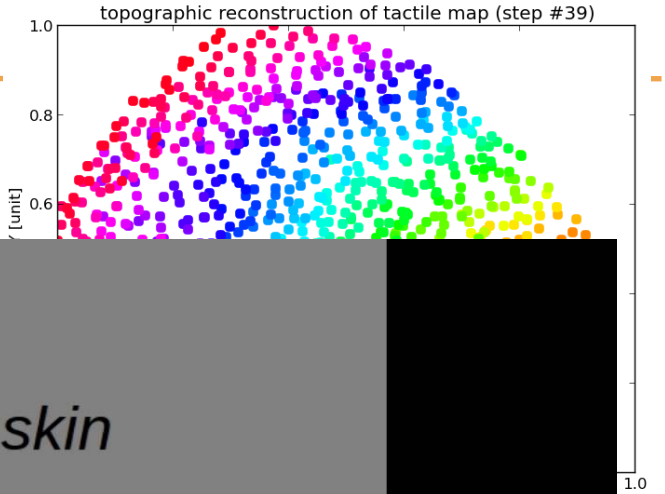


(b) Two contact points (weigths of 100g and 50g).



[Pugach, 2012~]

Conception of an artificial skin for robots

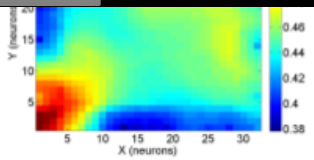


Conception of an artificial skin

Neural learning of topographic information

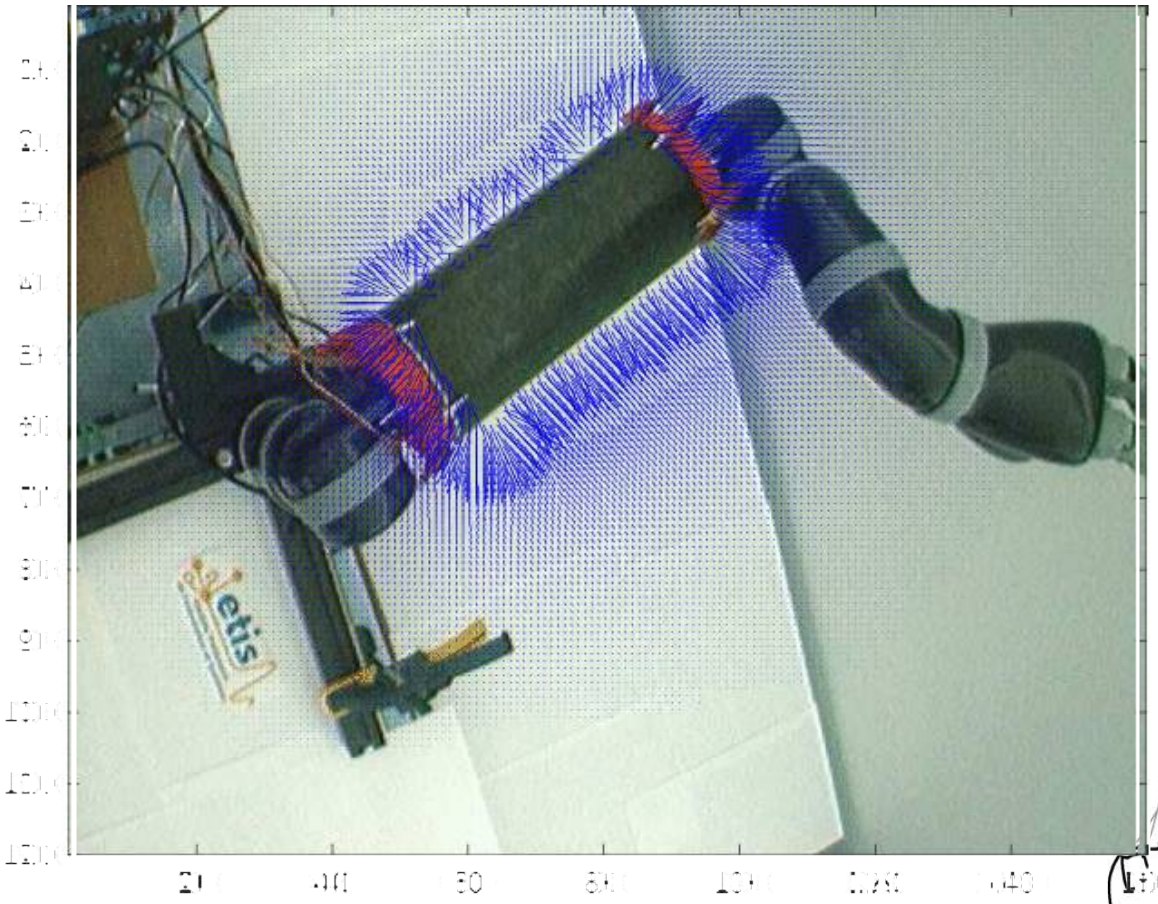
Ganna Pugach, Artem Melnyk, Alex Pitti, Philippe Gaussier

ETIS Laboratory
CNRS, ENSEA,
Cergy-Pontoise University

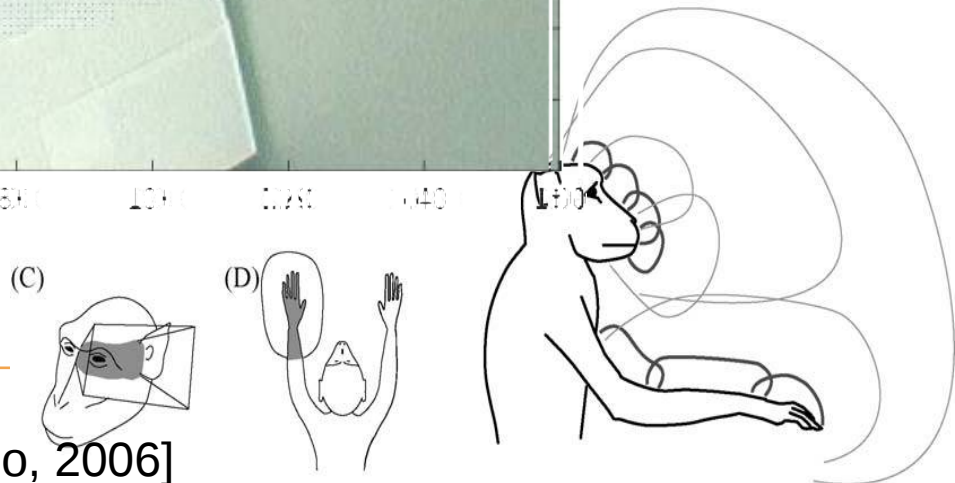


[Pugach, 2012~]

Proximal neurons, Body schema representation

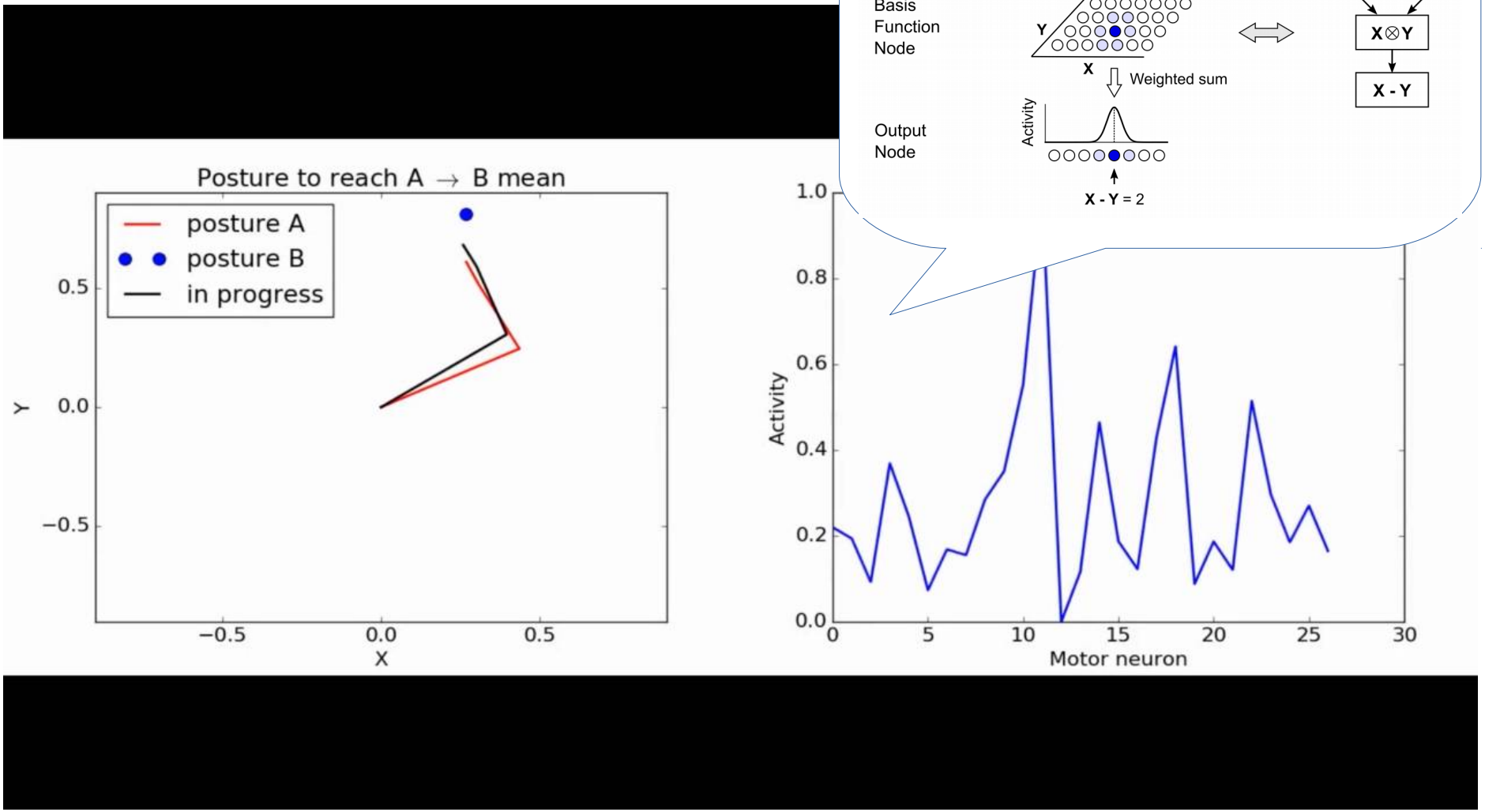


[Pugach, 2019]



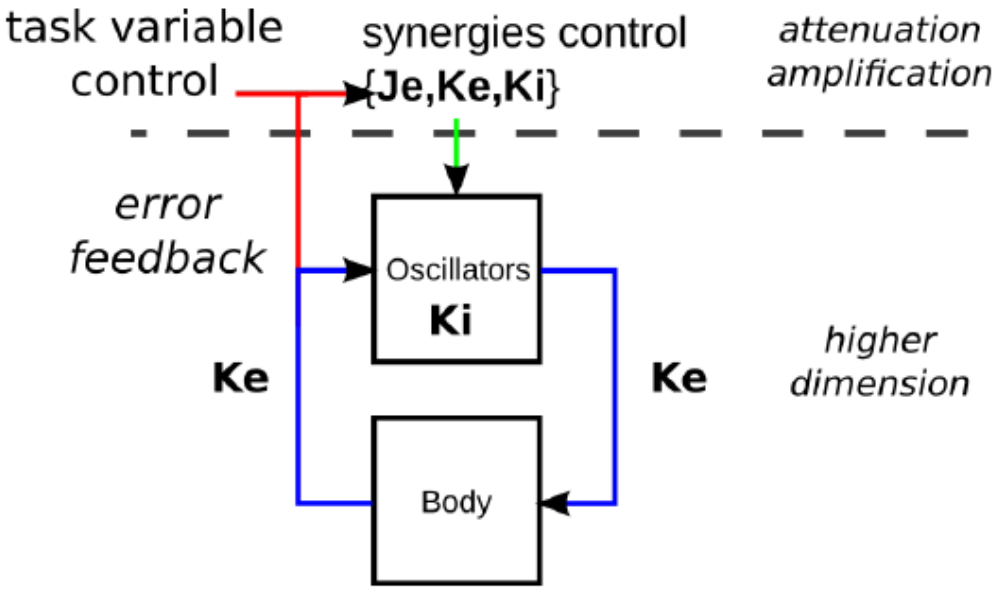
[Graziano, 2006]

Motor primitives learning



[Abrossimof, 2019]

Postural control with perturbation



PD Control on **JE** based on Y vertical

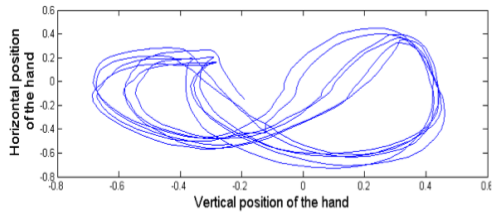
$$u_i = \mathbf{JE} sin(\vartheta_i)$$

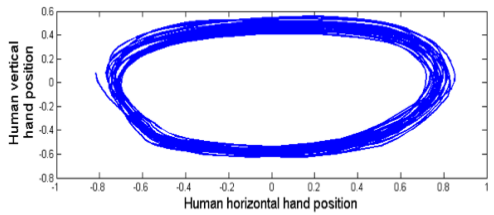
Kuramoto oscillators = Central Patterns Generators

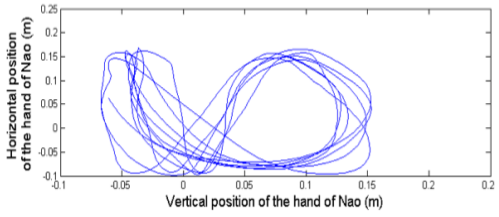
[*Melnyk et al. - Advanced Robotics 2018*]

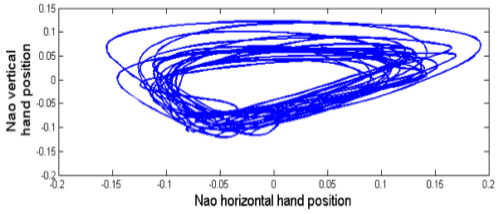
Rythmical entrainment in HRI

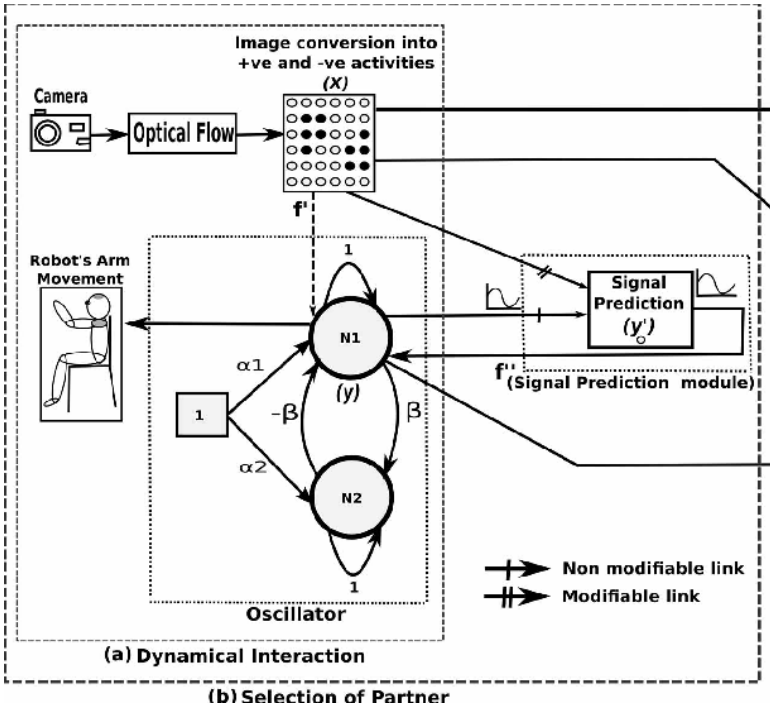
- Imitative movement generation and coupling











[Ansermin et al., SAB, 2016].

Oscillator coupling and reinforcement

TINO

https://www-etis.ensea.fr//fr/laboratoire.html

https://www.etis.ensea.fr//neurocyber/web/fr/index.php

Alexandre Pitti
alexandre.pitti@cyu.fr