Module 2: connecting the brain
General question: how does the brain connect with the environment?

- **artificial agents**
  - seeing
  - acting
  - communicating

- **smart objects**
  - situated objects
  - design strategies
  - navigation

- **decision**
  - preferences and biases
  - the evolutionary social brain

- **ethics**
  - nudges, moral robots
guest speaker: Olivier Marre, Institut de la vision

**Visual perception**

- **topics**
  - retina
  - cortical visual processing
  - signal detection theory and psychophysics
  - visual uncertainty and Bayesian modelling

- **contents**
  - neural coding and decoding in the visual system
  - functional models of retinal processing
  - retinal implants and visual restauration
  - 3D vision

- **biblio**
Neuro-inspired robotics

● topics
  ○ embodied AI, embodied computational neuroscience
  ○

● contents
  ○ sensors: from electrophysiology to hardware
  ○ control architectures:
    ○ actuators

● biblio
Artificial agents 3
(Emmanuel Dupoux)

Conversational agents: from speech to meaning.
or, Deconstructing SIRI

● Topics
  ○ speech features
  ○ phonetic units
  ○ language models
  ○ parsing

● Contents
  ○ global architecture (probabilistic framework, lattice reranking)
  ○ overview of algorithms (signal processing, HMM, Baum-Welch, CYK)
  ○ evaluating automatic systems against human performance
  ○ supervised versus unsupervised learning (infant learning)

● Biblio
  ○ S. Pinker - the Language Instinct
  ○ D. Jurafsky & J. Martin - Speech and Language Processing
Things that make us smart

- Contents
  - A theoretical framework: the engineering of cognitive advantages
  - Information enhancers, external memories, situated representations, cognitive bridges, information shunts, inferential shortcuts.
- Case studies
  - notations, maps, diagrams... and proposals for improving on some of them
- Biblio
  - Students are invited to look up the research blog www.mangrovia-collective.org and to (1) pick up a case for discussion in class (2) post a comment of max 1000 characters (e.g. a question, a suggestion, a research proposal)
Guest speaker - tentative (G. Puccetti, Visual Design, NYU Abu Dhabi)

**Smart objects for wayfinding**

- **Contents**
  - Primitive navigation vs Assisted navigation
  - Low and hi-tech, from the trail affordance to the map to the GPS
  - Visual constraints and social constraints

- **Case studies**
  - Muscat vs Paris; the universality of sign systems; color; the Sans Serif predicament; pragmatic effects.

- **Biblio**

Improving complex (indoor, multi-floored) environments

- Contents
  - Spatial memory, wayfinding: what do we know in flat-land that can help in studying complex environments?
  - Experimental infrastructure (Saclay)
    - (more with Giuseppe Attoma)

- Cases studies
  - Some complex environments, with EDF's cases

- Biblio
  - Google Maps: https://www.google.fr/maps/
Preferences and decisions

• topics
  ○ How people should/do evaluate options and their consequences?
  ○ How people should/do deal with uncertain options?

• contents
  ○ Basic model of decision making (optimal choice on the basis of well-structured preferences)
  ○ Expected utility theory for choice under uncertainty
  ○ Empirical ‘anomalies’ w.r.t. the basic model (biases such as framing effects or preference reversals) and expected utility theory (Allais’ paradox)

• biblio
The evolutionary approach to social cognition

- topics
  - Emotions and reasoning
  - Cooperation and fairness
  - Biological basis of preferences

- contents
  - Proximate explanations and evolutionary explanations
  - Evolution and cooperation: models and experiments
  - proper function and actual function

- biblio
  - Pinker, S. Comment fonctionne l’esprit
  - Pinker, S. Comprendre la nature humaine
  - Boyer, P. Et l’homme créa les dieux
Aiding to decide

- topics
  - How to improve decisions?
  - What does make an aide convincing, legitimate and useful?

- contents
  - Decision aiding process as construction of consensual shared cognitive artifacts.
  - Values, likelihoods and opinions and their subjective dimension.
  - Axiomatic, algorithmic and pragmatic aspects of decision aiding.
  - Human based and computer based assistance to decision making.
  - Mathematical and logical problems in aggregating preferences, judgements and information.
  - Convincing to act: robust recommendations with respect to scenarios, parameters and adversaries.

- biblio


nudges

- topics
  - liberal paternalism
  - biases and individual welfare

- contents
  - survey of some examples (default options, Save More Tomorrow, RECAP, etc)
  - philosophical discussion of nudges: are they defensible? Do they comply with ‘libertarian paternalism’?

- biblio

general discussion