

« Oculo Nimbus: New statistical models to understand and predict oculometric data »

Labs : GIPSA-lab (#5); LJK (#3); LIG (#1); LPNC (#4)

**Eye movements (EM):** Sequences of fixations (gaze stabilization) and saccades

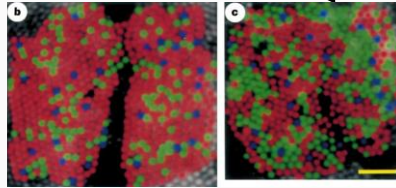
EM are driven by bottom-up factors (visual stimuli) but also by top-down factors (tasks, motivations, ...)



✓ Common : stimuli

✓ Specific : inter-individual differences

Low level : retinal mosaic, color vision



High level : task/strategy

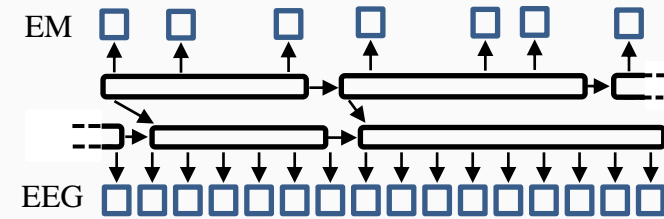
**I. Statistical tools:** Spatial Point Process models, HMMs, coupled HMMs

✓ Predict point location: Modelling the spatial positions and the temporal dynamics by Spatial Point Processes

- Need to separate the contribution of each factor
- Challenge: non-parametric estimation on large dataset

✓ Infer exploration strategies from HMM

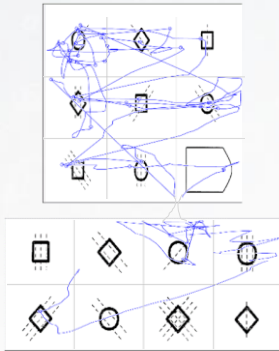
- Challenge: heterogeneous sources with  $\neq$  dynamics (EM + EEG; EM + mouse tracking)



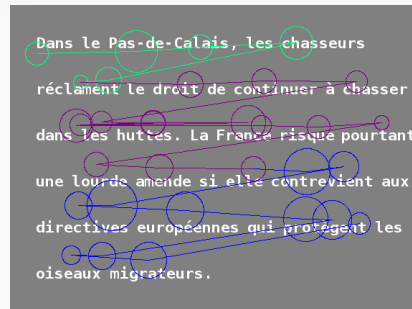
## II. Eye movements to explore high-level cognitive processing

High level tasks: reading, reasoning (Raven's matrices), visual exploration  
 ≠ strategies → ≠ stat. characteristics in EMs

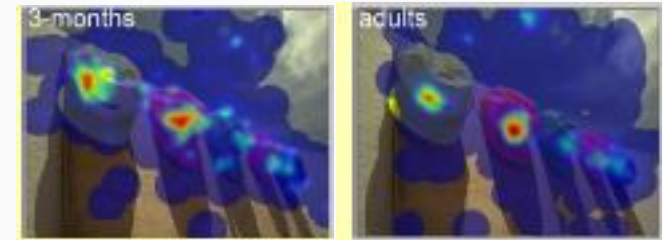
Development of visual perception for scene exploration in 3- to 12-month-old infants



Raven's matrices



Read & Decide task



3 months

adults

## III. Eye movements to explore low-level perception mechanisms

- ✓ Inside fixation: fixational eye movements
  - Functional role ?, Study in the context of multistable perception
- ✓ Role of color in visual processing of natural scenes
  - Quantify statistical redundancy between luminance and chrominance
- ✓ Inter-individual differences in color vision
  - Assessment by complex psychophysical experiments
  - New proposal for the Minimum Motion paradigm

