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MAC-Brain

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Human Brain Project

NEXUS

Emergent Attention Laboratory
www.attention-lab.net

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Visual selective attention:

- What is it? What purpose does it serve?
- How is it controlled?

What is it? What purpose does it serve?



How is it controlled?

The traditional dichotomy:

- **Top-down**
(goal-driven) control

- **Bottom-up**
(stimulus-driven) control



In addition attention is summoned by stimuli with a strong emotional-motivational connotation



wiseGEEK



But there's more...

Other factors that are now known to exert control of attention (an incomplete list):

- Short-term and long-term memory
 - Stimulus **statistics** (Statistical learning, Predictive coding)
 - Semantic **associations**
 - Stimulus-**reward** and stimulus-**punishment** associations

The goal of **MAC-Brain** will be to understand how different sources of attentional control are integrated in the (human and non-human) primate brain, and this will be done by:

- Developing and validating a set of robust and reliable behavioral paradigms to be used with both humans and macaques
- Taking a comparative perspective
- Implementing a cross-disciplinary and multi-methodological approach
- Assessing behavior, local brain activity, functional connectivity and dynamic network re-configuration both in humans and macaques

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Electrophysiology
in macaques & TMS
in humans

Some relevant publications:

Ferrante O., Patacca A., Di Caro V., Della Libera C., Santandrea E., **Chelazzi L.** (2017) Altering spatial priority maps via statistical learning of target selection and distractor filtering. **Cortex**. In press.

Sani I., Morrone M.C., Santandrea E., **Chelazzi L.** (2017) Temporally evolving gain mechanisms of attention in macaque area V4. **Journal of Neurophysiology**, 118, 964-985.

Eštočinová J., Lo Gerfo E., Della Libera C., **Chelazzi L.**, Santandrea E. (2016) Augmenting distractor filtering via transcranial magnetic stimulation of the lateral occipital cortex. **Cortex**, 84, 63-79.

Marini F., Demeter E., Roberts K.C., **Chelazzi L.**, Woldorff M.G. (2016) Orchestrating proactive and reactive mechanisms for filtering distracting information: Brain-behavior relationships revealed by a mixed-design fMRI study. **Journal of Neuroscience**, 36, 988-1000.

Chelazzi L., Eštočinová J., Calletti R., Lo Gerfo E., Sani I., Della Libera C., Santandrea E. (2014) Altering spatial priority maps via reward-based learning. **Journal of Neuroscience**, 34, 8594-8604.

Funding:



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Relevant recent publications:

- Astrand E, Wardak C, Baraduc P, Ben Hamed S (2016) Direct two-dimensional access to the spatial location of covert attention in macaque prefrontal cortex. *Current Biology*. 26(13): 1699-04.
- Astrand E, Ibos G, Duhamel JR, Ben Hamed S (2015) Differential dynamics of spatial attention, position, and color coding within the parietofrontal network. *Journal of Neuroscience*. 35(7): 3174-89.

Electrophysiology
in macaques

Funding agencies



ITMO Neurosciences,
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Human Brain Project



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Inserm

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ImpAct Team

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Two relevant publications

- Macaluso E, Ogawa A. (2017) Visuo-spatial orienting during active exploratory behavior: Processing of task-related and stimulus-related signals. *Cortex*. [Epub ahead of print] doi: 10.1016/j.cortex.2017.08.032.
- Nardo D, Console P, Reverberi C, Macaluso E. (2016) Competition between Visual Events Modulates the Influence of Saliency during Free-Viewing of Naturalistic Videos. *Front Hum Neurosci*. 10:320. doi: 10.3389/fnhum.2016.00320.

fmRI in humans

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EEG-ERPs & TMS
in humans

Two relevant publications

- Green, J. J., Boehler, C. N., Roberts, K. C., Chen, L. C., Krebs, R. M., Song, A. W., & Woldorff, M. G. (2017). Cortical and subcortical coordination of visual spatial attention revealed by simultaneous EEG–fMRI recording. *Journal of Neuroscience*, 37(33), 7803-7810.
- Langford, Z. D., Schevernels, H., & Boehler, C. N. (2016). Motivational context for response inhibition influences proactive involvement of attention. *Scientific Reports*, 6, 35122.

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Computational
modeling



Human Brain Project

Many thanks for your attention!

<http://www.attention-lab.net/>

How can the different sources of control be combined, or integrated?

What is a priority map?

