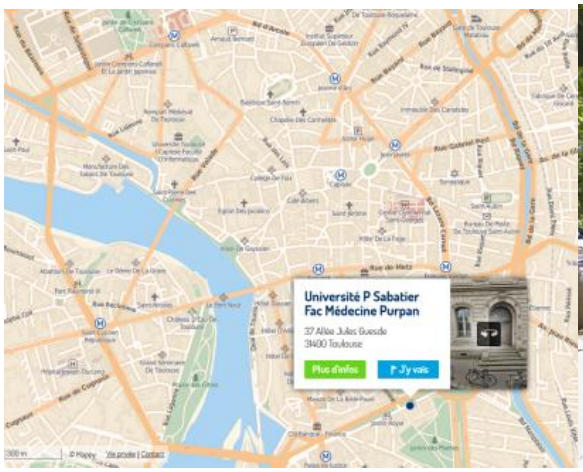
Program - GDR-Vision 2016

Faculté de Médecine Purpan - Université Toulouse Paul Sabatier

Toulouse, 37 allées Jules Guesde: Amphithéâtre B



Tramway B Terminus **Palais de Justice** (direct from airport)
Métro B Palais de Justice (from Train Station change at Jean Jaurès)
Station vélo Toulouse **n° 67** 35 allées Jules Guesde
http://www.velo.toulouse.fr/Les-stations/

Organization:
Jean-Michel Hupé, CerCo lab, Université de Toulouse Paul Sabatier & CNRS

Thursday, November 3

9h00 Statistics Workshop
Building up Confidence Intervals with R *Jean-Michel Hupé*
Working on exercises using R and R Studio.

(10h30:10h45 Coffee Break)

12h15 Lunch (on site)
Installation of posters.

13h45 Introduction *Jean-Michel Hupé*

Session 1, moderator: Rufin VanRullen

14h00 Keynote Lecture
Gilles Laurent: "Studying vision in non-classical species"

I will present our approaches to studying vision in non-traditional experimental systems (reptilian cortex and cephalopods), with an eye towards deriving computational principles of neural architecture, circuit computation and brain dynamics. These studies are still at a relatively early stage of development and my talk will thus focus mainly on strategies and technical developments.
http://brain.mpg.de/research/laurent-department.html

15h00: Andrei Gorea, Matteo Lisi, Leonardo Miele, and Gianluigi Mongillo. Explicit and implicit confidence levels during perceptual decision-making.

15h20: Joan López-Moliner, David Aguilar-Lleyda, and Elisabet Tubau. Temporal and spatial-based gain functions in a timing task.

15h40 Poster Session

16h00 Coffee Break (& Posters)

Session 2, moderator: Anna Montagnini

16h20: Jean-Bernard Damasse, Laurent Perrinet, Jérémie Jozefowiez, Laurent Madelain, and Anna Montagnini. Reinforcement contingencies modulate anticipatory smooth eye movements.

16h40: Cécile Vullings and Laurent Madelain. Reinforcement contingencies affect the allocation of saccades in time.

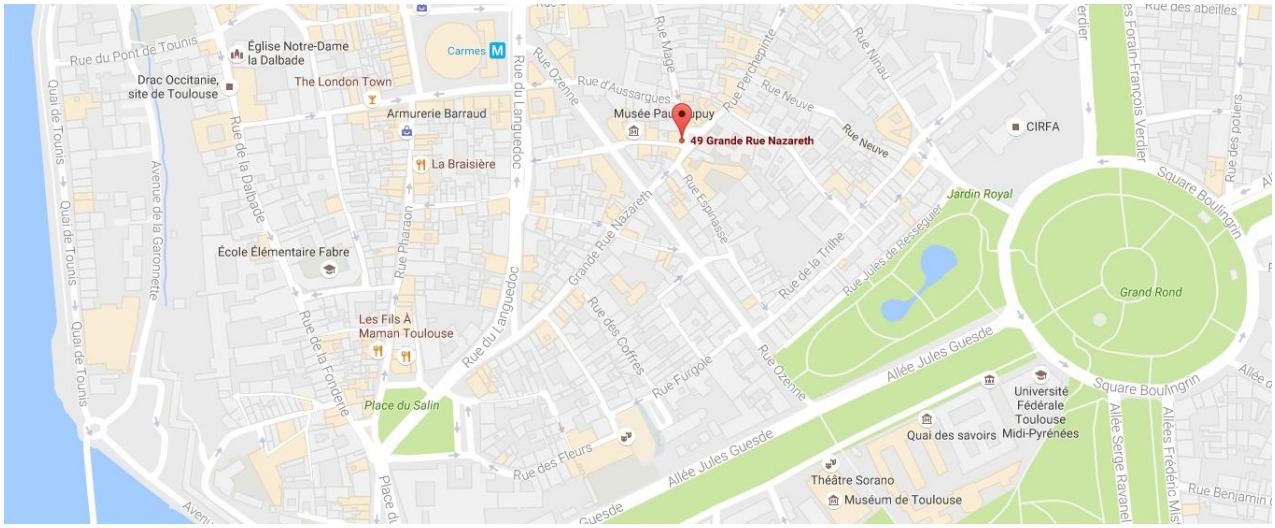
17h00: Valentina Vencato, Mark Harwood, and Laurent Madelain. Effects of foreperiod, stimuli size and presence of a distractor on saccade latency distributions in the overlap paradigm.

17h20: Françoise Vitu, Hossein Adeli, and Gregory Zelinsky. Reading without a lexicon: An illiterate model of saccade programming in the superior colliculus predicts where readers move their eyes!

17h40: Eric Castet. Letters and symbols: no evidence for different crowding processes.

18h00 Welcome Cocktail (& Posters)

20h00 Social Dinner at "Chez Navarre" (49 grande rue Nazareth)



Friday, November 4

Session 3, moderator: Lionel Nowak

9h00 Keynote Lecture
Kevan Martin: "Organizing Principles of Visual Cortical Circuits and Their Function"

Of all brain structures, the neocortex, which forms over 80% of the volume of the human brain, is arguably the most critical structure that makes us what we are and allows us to create the societies in which we thrive. The visual cortex has been the test bed where many of the computational questions asked about neocortical structure and function have been addressed. Our underlying assumption is that visual cortex is exemplary of the local and long distance circuits found in the neocortex of all mammals, from mouse to man. These local circuits are linked by sparse long-distance circuits that are integrated at different layers of the local circuit. The experimental evidence supports the idea that the local circuits of visual cortex are determined by the laminar distribution of relatively few types of excitatory and inhibitory neurons organized according to common principles of connectivity, and that this pattern underlies the 'canonical' computations that form the basis of neocortical function.
https://www.ini.uzh.ch/research/36644

10h00 Poster Session

10h30 Coffee Break (& Posters)

Session 4, moderator: Suliann Ben Hamed

10h50: Thérèse Collins and Pierre Jacquet. Frontal versus parietal contributions to extra-retinal signals in perception and action.

11h10: Philippe Vindras and Laure Pisella. The Pointing Errors in Optic Ataxia Reveal the Role of "Peripheral Magnification" of the PPC.

11h30: Laura Dugué, Elisha Merriam, David Heeger, and Marisa Carrasco. Specificity of visual areas for endogenous and exogenous attention orienting and reorienting.

11h50: Judith Nicolas, Aline Bompas, Romain Bouet, Olivier Sillan, Eric Koun, Christian Urquizar, Alessandro Farnè, Aurelie Bidet-Cauler, and Denis Pélisson. Alpha and Gamma Modulations During An Attentional Capture Task After Saccadic Adaptation

12h10: Suliann Ben Hamed, Fabio Di Bello, Sameh Ben Hadj Hassen, and Elaine Astrand. Distractor suppression and distractor interference in the light of direct real-time access to the covert attentional spotlight from the frontal eye fields.

12h30 Lunch (& Posters)

Session 5, moderator: Eric Castet

14h00 Keynote Lecture
Rüdiger von der Heydt: "Neurophysiological Studies on Figure-Ground Organization"

Before much was known about neural signals, Gestalt psychologists imagined figure-ground organization as a pre-attentive process based on lateral interactions within the retinotopic visual cortex, and this is also the favorite scheme of modern computational models. I will review neurophysiological evidence showing that figure-ground organization does occur pre-attentively, but uses grouping circuits that connect higher level areas with the V1/V2 retinotopic feature representations. Within less than 80ms after stimulus onset these mechanisms group local features to larger entities that we may call "proto-objects". This process does not rely on object recognition, and the grouping network is distinct from the object categorization pathway in the ventral stream. While figure-ground organization is generally viewed as a process that facilitates object recognition in cluttered scenes, I will argue that the primary functions of the grouping mechanism are to enable object individuation, provide permanence, and create a structure for selective attention.
http://vlab.mb.jhu.edu/

15h00: Anne Giersch. Sequential effects during simultaneity asynchrony judgments.

15h20: Jean-Michel Hupé and Camilo Miguel Signorelli. Hierarchical competition of motion integration and depth ordering in the multistable perception of moving plaids.

15h40 Coffee Break

16h15: Business meeting *Laurent Madelain*

17h00: Closing

Explicit and implicit confidence levels during perceptual decision-making

Andrei Gorea*[1], Matteo Lisi , Leonardo Miele , and Gianluigi Mongillo

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Résumé

Are our decisions – and hence confidence therein – based on a full knowledge of the prior and likelihood probability functions as imposed by the normative Bayesian theory? We answer this negatively by means of a new experimental paradigm. Each trial consisted of two consecutive decisions on whether a given signal was above or below some reference value. The first decision was to be made on a signal randomly drawn from a uniform distribution. Correct/incorrect responses resulted into signals randomly drawn from respectively the positive/negative sub-intervals to be judged when making the second decision. Observers were told so. The experiment was repeated with new observers who were asked to provide for each decision their confidence on a continuous scale. A non-Bayesian observer was designed to have discrete confidence levels instantiated by one, two or three second-decision criteria representing different levels of the point-estimates of the evoked neural response. Synthetic data-sets reliably discriminated Bayesian from non-Bayesian observers. The non-Bayesian observer with two or three confidence levels systematically outperformed the Bayesian observer in predicting the actual behavior. Predicted second decision choices based on observers' *explicit* and *inferred* confidence in their first decision agreed only partly inasmuch as observers' *explicit* confidence reports were idiosyncratic: some observers showed a quasi-optimal confidence in their first decision but made non-optimal use of it in their second decisions; others reported non-optimal confidence in their first decision but made quasi-optimal use of it in their second decision. Overall the data plead against observers being optimal decision-makers.

*Intervenant

Temporal and spatial-based gain functions in a timing task

Joan López-Moliner*[1], David Aguilar-Lleyda[1], and Elisabet Tubau[1]

[1]Universitat de Barcelona – Andorre

Résumé

Normative theories establish that optimal decision-makers base decisions on both their variability and the task's utility function. However, in sensorimotor situations requiring interaction with moving objects, utility can be defined either as a function of time or space. In that context, to what extent does performance depend on the domain of the utility function? In our task, participants stopped a target approaching a line and, depending on the condition were rewarded according to their temporal or spatial proximity. Performance was determined more by the strategy adopted by participants than by just acting according to the task's domain. Participants basing their responses on a temporal criterion were more stable across speeds, thus winning more than those using spatial cues. This can be explained by the sampling resolution of the visual system increasing spatial variability with larger speeds. Our results evidence the need to consider system constraints when debating sensorimotor decision-making.

*Intervenant

Reinforcement contingencies modulate anticipatory smooth eye movements

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Résumé

Natural environments potentially contain several interesting targets for goal-directed behavior. Thus sensorimotor systems need to operate a competitive selection based on behaviorally meaningful parameters. Recently, it has been observed that voluntary eye movements such as saccades and smooth pursuit can be considered as operant behaviors (Madelain et al, 2011). Indeed, parameters of saccades such as peak-velocity or latency (Montagnini et al, 2005) as well as smooth pursuit behavior during transient blanking (Madelain et al, 2003) or visually-guided pursuit of ambiguous stimuli (Sch´utz et al, 2015) can be modified by reinforcement contingencies. Here we address the question of whether expectancy-based anticipatory smooth pursuit can be modulated by reinforcement contingencies. When predictive information is available, anticipatory smooth pursuit eye movements (aSPEM) is frequently observed *before* target appearance. Actions that occur at some distance in time from the reinforcement outcome, such as aSPEM -which occurs without any concurrent sensory feedback- suffer of the well-known *credit assignment problem* (Kaelbling et al, 1996). We designed a direction-bias task as a baseline and modified it by setting an implicit eye velocity criterion during anticipation. The nature of the following trial-outcome (reward or punishment) was contingent to the online criterion matching. We observed a dominant graded effect of motion-direction bias and a small modulational effect of reinforcement on aSPEM velocity. A yoked-control paradigm corroborated this result showing a strong reduction in anticipatory behavior when the reward/punishment schedule was not contingent to behavior. An additional classical conditioning paradigm confirmed that reinforcement contingencies have to be operant to be effective and that they have a role in solving the *credit assignment problem* during aSPEM (Damasse et al, 2016).

*Intervenant

Reinforcement contingencies affect the allocation of saccades in time

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Résumé

Saccadic latencies are conventionally viewed as reflecting the accumulation of information during decision-making process (e.g. Carpenter and Williams, 1995) but we have previously shown that latency distributions may be strongly affected by reinforcement contingencies (Madelain et al., 2007). Here, we probe the possibility to control saccadic latencies in a choice paradigm.
Six subjects made saccades within 80-300 ms following a target stepping horizontally by 10 deg between two fixed locations. For each subject we selected two classes of latencies, 'short' and 'long', using the first and last quartiles of the baseline distribution (e.g. [80;151] ms and [185;300] ms respectively). We then concurrently reinforced each class in three blocked conditions (approximately 20000 saccades per subject) with different probabilities such that the relative frequencies of reinforcing 'short' versus 'long' latencies were either 9/1, 1/9 or 1/1.

Latency distributions varied depending on the experimental conditions: distributions shifted toward the shorter or longer values or became strongly bimodal. Moreover, the relative proportions of 'short' and 'long' latencies matched the relative proportions of reinforcers earned from each option (slope up to 0.95). We used the LATER model (Reddi and Carpenter, 2000) to investigate which parameters might best explain these changes in latency distributions.
Our results reveal that learned contingencies considerably affect the allocation of saccades in time, and provide strong evidence for a voluntary control of saccadic latency. The functional significance of this control extends well beyond information accumulation.

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Effects of foreperiod, stimuli size and presence of a distractor on saccade latency distributions in the overlap paradigm.

Valentina Vencato*[1,2], Mark Harwood[3], and Laurent Madelain[1,4]

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Résumé

Previous studies showed that a temporal overlapping of the fixation-target with the saccade-target onset induce a shift of saccade reaction time distributions toward longer values. Here we present four studies probing how an overlap paradigm, combined with the manipulation of either the foreperiod, the size of targets and the addition of a distractor, modulates the saccadic reaction time distributions. Saccadic reaction times of four participants were measured in each study. In the first study we parametrically manipulated the temporal overlap using a range of intervals (from 0 to 200 ms). In the second study we observed the effects of the foreperiod (i.e. the duration of the fixation period prior to saccade-target onset) on an overlap paradigm using two overlap intervals. In the third study both the saccade-target and fixation-target size were manipulated in a two intervals overlap paradigm. Lastly, in the fourth study a distractor ring around the fixation-target was shown after the saccade-target appearance with a variable delay, with an overlap interval fixed at 140 ms. Results show a rightwards shift of latency distributions depending on the overlap interval. Furthermore all the additional manipulations also affect the latency distribution with different trends of the curves.

To conclude overlap interval manipulations produce a strong effect on latency, which cumulates with all the other manipulations.

The PACE Project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodwska-Curie grant agreement No 642961.

*Intervenant

Reading without a lexicon: An illiterate model of saccade programming in the superior colliculus predicts where readers move their eyes!

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Résumé

Most models of eye-movement control during reading assume that saccadic behavior primarily reflects ongoing word-identification processing. Here we show, in contradiction with this view, that an image-based model of saccade programming in the superior colliculus (SC) can predict the highly stereotyped saccadic behavior observed during reading, simply by averaging early visual signals. Twenty-nine French-native speakers read 316 French sentences presented one at a time on a computer screen, while their eye movements were recorded. Images of the sentences were input to the model. Like participants, the model initially fixated the beginning of each sentence. On each fixation, it first performed gaze-contingent blurring of the sentence to reflect visual acuity limitations. A luminance-contrast saliency map was then computed on the blurred image and projected onto the fovea-magnified space of the SC, where neural population activity was averaged first over the visual map and then over the motor map. Averaging over the most active motor
population determined the subsequent saccade vector. The new fixation location was in turn inhibited to prevent later oculomotor return. Results showed that the model, like participants, mainly made left-to-right, forward saccades, with just a few (21% and 20% respectively) regressive saccades. The model also successfully captured benchmark, and here-replicated, word-based eye-movement patterns: a greater likelihood to skip shorter and nearer words, a preferred landing position near the centers of words, a linear relationship between a saccade's launch site and its landing site, a greater likelihood to refixate a word when the initial fixation deviated from the word's center, and more regressions following word skipping. Thus, eye movements during reading primarily reflect fundamental visuo-motor principles rather than ongoing language-related processes. The proof is that a model of the SC, which treats sentences as a meaningless visual stimulus, reproduces readers' eye-movement patterns, despite being unable to recognize words!

*Intervenant

Letters and symbols : no evidence for different crowding processes

éric Castet*[1]

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Résumé

Some researchers assume that different categories of items (such as letters vs. symbols) are differentially affected by crowding, allegedly as a result of different levels of familiarity. It has notably been shown that the classic W-shape of letter-in-word identification performance disappears when symbols are used instead of letters. With a 5-item string, this is due to outer symbols (first and fifth positions) having a very low performance compared to outer letters. One problematic aspect in many studies of this type is an insufficient control of the difference in spatial complexity between distinct categories. To avoid this problem, we created 9 symbols that were matched with 9 consonants (one-to-one correspondence) based on perimeter and area. Twenty adult skilled readers had to identify a letter (or symbol) within a 100 ms string of 5 letters (or symbols) centered at fixation (category was blocked). A post-cue indicated the target position (from 1 to 5). Each string was a random sample (without replacement) drawn from the 9-item set. Results show that the W-shape of the identification curve is maintained with symbols, thus arguing against specialized crowding mechanisms that would have evolved to optimize visual processing of letter strings (vs. symbol strings).

*Intervenant

Frontal versus parietal contributions to extra-retinal signals in perception and action

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Résumé

Every eye movement displaces the retinal image of the world, yet we perceive the world as seamless and stable. How this stability arises from the continuously varying input is one of the fundamental questions of vision science. Philosophers proposed that the retinal consequences of eye movements were cancelled out by an extra-retinal signal carrying information about the eye movement. Physiologists and psychologists have since measured such a signal in the brain and its consequences on behavior. The current study aimed to investigate the neurophysiological underpinnings of extra-retinal signal use in humans using transcranial magnetic stimulation. Two classic tasks that require self-movement information about eye movements were tested while TMS was applied over frontal eye fields, posterior parietal cortex, or vertex: the double-step task and the saccadic suppression of displacement task. Results show that while TMS over FEF interferes with saccade characteristics – increasing amplitude, duration, and velocity – these changes are represented in the extra-retinal signal. TMS over PPC interferes with trans-saccadic perceptual localization in a manner compatible with a decrease in the gain of the extra-retinal signal. These contrasting effects of frontal versus parietal stimulation shed light on the existence of various extra-retinal signals in humans.

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The Pointing Errors in Optic Ataxia Reveal the Role of "Peripheral Magnification" of the PPC

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Résumé

Interaction with visual objects in the environment requires an accurate correspondence between visual space and its internal representation within the brain. Many clinical conditions involve some impairment in visuo-motor control and the errors created by the lesion of a specific brain region are neither random nor uninformative. Modern approaches to studying the neuropsychology of action require powerful data-driven analyses and error modeling in order to understand the function of the lesioned areas. In the present paper we carried out mixed-effect analyses of the pointing errors of seven optic ataxia patients and seven control subjects. We found that a small parameter set is sufficient to explain the pointing errors produced by unilateral optic ataxia patients. In particular, the extremely stereotypical errors made when pointing toward the contralesional visual field can be fitted by mathematical models (complex logarithmic functions) similar to those used to model central magnification in cortical or sub-cortical structure(s). Our interpretation is that visual areas that contain this footprint of central magnification guide pointing movements when the posterior parietal cortex (PPC) is damaged and that the functional role of the PPC is to actively compensate for the under-representation of peripheral vision that accompanies central magnification. Optic ataxia misreaching reveals what would be hand movement accuracy and precision if the human motor system did not include elaborated corrective processes for reaching and grasping to non-foveated targets.

*Intervenant

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Specificity of visual areas for endogenous and exogenous attention orienting and reorienting

Laura Dugué*[1,2], Elisha Merriam[2], David Heeger[2], and Marisa Carrasco[2]

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Résumé

Covert visual attention can be exogenously captured by a sudden stimulus or endogenously allocated according to goals. The neural processing underlying exogenous and endogenous attention have been investigated in separate experiments, But none has compared cortical activity evoked or modulated by these two types of attention in visual areas using the same task, stimuli and observers.
We used fMRI to measure cortical activity while observers performed a two-alternative forced-choice orientation discrimination task. Two sinusoidal grating stimuli briefly appeared in the lower left and right quadrants of the visual field. A response cue indicated which grating was the target. Observers reported the orientation of the target stimulus. In the endogenous condition, a central cue instructed observers to attend to one of the two stimulus locations. In 75% of the trials the cue and target locations matched (valid), and in the remaining trials they did not (invalid). In the exogenous condition, a peripheral cue automatically attracted attention to one of the two stimulus locations. The cue was non-informative (50% valid). Within each previously defined visual region (V1-V4 and visual-TPJ areas), average activity was measured for valid and invalid trials, independently for endogenous and exogenous conditions.

In visual TPJ areas, activity was greater for invalidly-cued trials in the right visual-TPJ-posterior (vTPJpost) for both types of attention; and in the left vTPJpost and the right visual-TPJ-central (vTPJcent) for endogenous attention. In the early visual areas (V1-V4), activity was greater for validly-cued trials for both types of attention, increasingly so from V1 to V4.
To conclude, endogenous and exogenous attention boost the signal to noise ratio in early visual areas, and the reorienting of exogenous and endogenous attention is mediated by different visual sub-areas of TPJ.

*Intervenant

Alpha and Gamma Modulations During An Attentional Capture Task After Saccadic Adaptation

Judith Nicolas*[1], Aline Bompas , Romain Bouet[1], Olivier Sillan[1], Eric Koun[1], Christian Urquizar[1], Alessandro Farnè[1], Aurelie Bidet-Cauler[1], and Denis Pélisson[1]

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Résumé

Attention and saccadic adaptation are critical components of visual perception, the former enhancing sensory processing of objects of interest in our visual environment, the latter maintining, throughout life, the accuracy of saccades toward these objects of interest. Recent studies propelled the hypothesis of a tight functional coupling between saccadic adaptation and covert spatial attention. Adaption of reactive saccades towards the left hemifield indeed enhances discrimination of unpredictable stimuli (Habchi et al., 2015) and conversely attentional load boosts saccadic adaptation (Gerardin et al. 2015). This hypothesis agrees with the possibility that these two mechanisms share some neural substrates (Gerardin et al. 2012). Here we used magnetoencephalography to gain a deeper understanding of the neurophysiological bases of such a coupling.

We compared spatial discrimination performances of 12 healthy subjects before and after an adaptation or control task involving reactive saccades. The magnetic signal of each subject has been collected during the entire protocol. The neurophysiological analysis focused on the discrimination task, concerning both the brain response evoked by the target presentation and the gamma oscillatory activities during the pre-target period.

While the behavioral results may point to a lack of sensitivity to track fine changes in attention abilities using the discrimination task, our preliminary analyses point toward an effect of saccadic adaptation on gamma band power, namely a wide-spread increased amplitude after the saccadic adaptation session as compared to the control session.

Saccadic adaptation may thus interfere with the excitatory processes subtended by gamma band oscillations, a possible basis for improving discriminative abilities.

*Intervenant

Distractor suppression and distractor interference in the light of direct real-time access to the covert attentional spotlight from the frontal eye fields

Suliann Ben Hamed*[1], Fabio Di Bello , Sameh Ben Hadj Hassen , and Elaine Astrand

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Résumé

The frontal eye fields (FEF) plays a key role in top-down attentional control (Moore et al., 2003; Ekstrom et al., 2008, Ibos et al., 2013) and distractor suppression (Lennert et al., 2011, Suzuki et al., 2013). The inactivation of this brain area leads to a perturbation of visual attention processes which could be interpreted as deficits in attention shift commands (Wardak et al. 2006) and distractor suppression (Suzuki et al., 2013). Crucially, using classification methods applied to the ongoing time-resolved simultaneously recorded FEF multi-unit activity, we demonstrate direct two-dimensional (x,y) access to the spatial location of covert attention, i.e. to the attentional spotlight (Astrand et al., 2016). Surprisingly, this attentional spotlight is rarely anchored at the cued location, but moves around on the work screen. Here, we further demonstrate that overt behavior and distractor interference can only be interpreted if we take in account the precise location of this covert attentional spotlight at a given moment in the task. Specifically, we recorded bilateral neural activity from the frontal eye fields of two monkeys during a cued target detection task in which, in the half of the trials, a distractor was presented at a varying distance from the target. We reproduce the observation that the proportion of false alarm responses to a distractor decreases as the physical target-distractor distance increases. This is classically interpreted as an indication of a higher distractor interference effect at the cued location, where attention is assumed to be. We however show that this observation only holds when the attentional spotlight, as accessed from the FEF activity, is far away from both the distractor and the target. In contrast, if the attentional spotlight is either close to the target or to the distractor, distractor suppression is enhanced and fewer false alarms are produced. In summary, this work shows that the description of a central cognitive function, namely attention, remains flawed in the absence of a real-time access to its underlying covert processes as estimated from ongoing prefrontal neuronal activities and challenges our current understanding of distractor interference and suppression mechanisms.

*Intervenant

sequential effects during simultaneity asychrony judgments

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Résumé

We tested whether sequences of information are predicted in vision by exploring sequential effects in simultaneity/asynchrony tasks, their impairment in patients with schizophrenia and their possible role in the feeling of time continuity. On each trial two items were displayed on the screen in the right-left vs left right-left direction, with a SOA between 0 and 100 ms. Subjects decided whether stimuli were simultaneous or asynchronous and gave their response by pressing a right or left response key. We tested whether subjects responses on trial N were influenced by the SOA and stimulus direction on trial N-1. The results show trial-to-trial influences in healthy volunteers that suggest they retain information from trial N-1 and compare it with information on trial N: performance improved when the two consecutive trials shared the same SOA but the stimulus direction was reversed. This effect differs from a priming effect. It was impaired in patients, related to a previously described difficulty to predict/follow events at a short time scale, and related to a disruption of thought continuity, as evaluated clinically. We then explored to which amount sequential effects can be observed when Soas are below 20 ms. We showed similar biases at these SOAs in healthy volunteers, suggesting successive stimuli are followed automatically over ultra-short intervals, but also integrated across intervals of more than 1 second. All in all the results suggest both prediction and postdiction mechanisms. We discuss what these results tell us about how visual information is processed over time.

*Intervenant

Hierarchical competition of motion integration and depth ordering in the multistable perception of moving plaids

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Résumé

The perception of ambiguous moving rectangular plaids with transparent intersections is tristable rather than bistable. Not only does it alternate between coherent and transparent motion, but also for transparent motion which grating is perceived in front is ambiguous and alternates. The dynamics of perceptual tristability can inform us about how the visual system deals conjointly with two computational challenges among the most important in perceptual organization: motion integration vs. segmentation and depth ordering. We measured in the same subjects the dynamics of (1) bistable depth ordering in purely transparent plaids, (2) coherent and transparent motion in bistable plaids (using occlusion cues) and (3) tristable plaids. Switching rate was not correlated across subjects between the two bistable paradigms, with depth ordering switches much slower than coherent/transparent switches in most subjects. Switching rate of depth ordering was faster with faster grating speed, in agreement with Levelt IV proposition. The duration of transparent percepts was shorter during tristability than depth ordering bistability, suggesting a hierarchical architecture, with depth ordering secondary to motion integration. In addition, preliminary results suggest that the longer duration of the first coherent percept, an intriguing hallmark of plaid tristable perception, may be due to the slower switching rate of depth ordering. Altogether, the complex dynamics of plaid tristable perception call for models with a complex architecture, with the promise of a better understanding of the articulation of motion integration and depth ordering in perceptual organization.

*Intervenant

Independence of luminance and chrominance information in natural scenes strongly depends on data pre-processing

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Résumé

Color vision is an impressive ability of human visual system. Three different types of cones in the retina, and then three postreceptoral cone-opponent mechanisms enable us to extract both luminance and chromatic information from our environment. Theories of efficient coding argued that the visual system evolved this way to optimally process natural scenes. Therefore, the study of statistical properties of this class of images has great potential value to expand our understanding of visual perception.
Several studies investigated luminance and color joint distribution in images and claimed that luminance and chromatic edges were not independent of each other (Fine et al. 2003) and that most edges were defined by luminance contrast with color information being redundant (Zhou & Mel 2008). In 2009, Hansen and Gegenfurtner showed using mutual information that luminance and chromatic edges constitute independent sources of information and that their independence increases along successive stages of visual processing.
Here we replicated their analysis in over 1000 images taken from the McGill calibrated color image database (Olmos & Kingdom, 2004) and found that the results concerning mutual information strongly depend on several parameters, such as cone fundamentals choice, luminance definition or data pre-processing. It suggests that separating luminance and chrominance information in natural images is not a trivial task and may have important implications on results concerning their dependency and their respective functions in visual processing.

*Intervenant

A " cognitive " color space? Estimation of subjective distance between the 11 basic color terms with a VAS scale.

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Résumé

Objective : To evaluate the subjective proximity between cognitive representations of color, and how they are predicted by perceptive distances between focal colors in the color space.
Method : 79 young observers were presented with the 55 pairs of color words, representing all the combinations between each of the 11 basic color terms (e.g. "Bleu" – "Noir") in a random order and they had to point with the mouse on a horizontal line presented on the screen (Visual Analogical Scale) whether the two terms were close (left end of the line) or far (right end of the line). Mouse responses were converted to a number ranging from 0 (close) to 100 (far).
Results and discussion : For each of the 11 basic colors, an ANOVA taking the second term of the pair (the 10 other color terms) as an intergroup factor and specific two-by-two Bonferroni comparisons were made. Results for the six so-called "landmark" basic colors (red, green, blue, yellow, black and white) showed that the cognitive distances mapped onto the perceptive opponencies yellow/blue, red/green and black/white, as well as the trichromacy theory (e.g. green was far from red but close to both blue and yellow). But some results were consistent with other strategies, such as color order according to the one-dimensional wavelength scale (e.g. blue is estimated closer to green than to red) and this explained most of the results found for the other five basic colors (orange, pink, brown, purple, and grey). The subjective estimation between color concepts is therefore not fully explained by the perceptive distance between focal colors in the color space.

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Rhythmic entrainment source separation: Optimizing analyses of neural responses to rhythmic sensory stimulation

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Résumé

Steady-state evoked potentials (SSEPs) are rhythmic brain responses to rhythmic sensory stimulation, and are often used to study perceptual and attentional processes. We present a data analysis method for maximizing the signal-to-noise ratio of the narrow-band steady-state response in the frequency and time-frequency domains. The method, termed rhythmic entrainment source separation (RESS), is based on denoising source separation approaches that take advantage of the simultaneous but differential projection of neural activity to multiple electrodes or sensors. Our approach is an extension of existing multivariate source separation methods that are combined to optimize usability for narrow-band activity. We demonstrate that RESS performs well on both simulated and empirical data, and outperforms conventional analyses based on selecting electrodes with the strongest SSEP response.

*Intervenant

The rhythm of attentional stimulus selection during visual competition

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Résumé

Recent research indicates that sustained attention could in fact process information rhythmically, as a sequence of successive cycles with its own intrinsic frequency. When two items must be attended, an intriguing corollary of this "blinking spotlight" notion could be that the successive cycles are directed alternately to each target; as a result, each item would effectively be sampled at half the intrinsic rate of attention. Here, we tested this prediction in two experiments. In an endogenous attention task, subjects (n=8) covertly monitored one or two peripheral images (one house, one face) in order to detect a brief contrast change. In the sustained occipital EEG power, attending to two vs. one item resulted in a relative increase around 4Hz and a relative decrease around 10-11Hz. In a second experiment, we tested if comparable oscillations could be observed in the stimulus-evoked EEG visual representational content. Subjects (n=9) saw a first peripheral image (house or face) displayed alone for 600ms, before a second one (face or house) also appeared for the same duration, but at a different peripheral location. In monkeys, a similar protocol was found to trigger low-frequency 5Hz oscillations in inferotemporal single-cell activity, reflecting competitive interactions between neural populations selective to the two objects (Rollenhagen & Olson, 2005). Using time-resolved MVPA on EEG evoked-responses, we were able to create item selective classifiers that constantly indicated which stimulus was on the screen (peak AUC=0.8 around 100 ms after image onset). The time-course of single-trial classifier decision values presented a relative peak around 11Hz when only one object was present, and around 4-5Hz when two objects were on the screen. Taken together, these results are compatible with a blinking spotlight of attention, sampling information periodically around 10-11Hz, and resulting in a half-frequency effective sampling (around 4-5Hz) when there are two items to attend.

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Another reason for following an object with one's eyes if one intends to intercept it

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Résumé

The most obvious reason for looking at an object that one is trying to intercept is that doing so maximizes the spatial resolution of judgments about the object's position. In order to intercept the object one needs to know its future position, for which an estimate of the target's motion is needed. Biases in motion perception will therefore lead to systematic errors. As motion perception is based on a combination of retinal and extra-retinal signals, eye movements may influence such biases. Here, we examine whether following the object with one's eyes makes interception less susceptible to biases in motion perception. We asked participants to tap on disks that moved across a large screen. Disks moved to the right at various constant velocities. There were solid disks and patterned ones. We biased motion perception by moving the pattern within the patterned disks. The pattern's motion either corresponded with a projection of how the pattern would move if the disks were rolling balls (so that the pattern within the disk moved up to twice as fast as the disk itself), or to how it would move if the disks were balls with backspin (so that the pattern moved more slowly than the disk). On each trial, the instruction was either to follow the disk with one's eyes or to fixate the position at which one will try to hit it. The different instructions, velocities and kinds of targets were randomly interleaved. When subjects fixated the interception point, moving the pattern within the disk caused large systematic errors. These errors almost disappeared when participants followed the disks with their eyes. Thus, following moving objects with one's eyes has the additional advantage of making one less sensitive to the imperfections of motion perception.

*Intervenant

Abnormal connectivity in Parkinson patients using dynamic causal modeling of fMRI visual responses

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Résumé

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Introduction. We recently showed using fMRI and psychophysical tests a significant luminance contrast sensitivity loss with age along the visual pathway including the superior colliculus (SC), the lateral geniculate nucleus (LGN) and V1 (1). Moreover, additional results for Parkinsonian patients indicated a possible functional deficit in SC and LGN that might appear early in the disease course. L-Dopa treatment seemed to restore progressively SC and LGN functionality. V1 seemed unaltered. The aim of the present study was to further address the interactions between these visual regions, as well as how they might be affected by Parkinson disease and L-Dopa treatment.

Methods. We explored the interactions between our three regions of interest, SC, LGN and V1, as well as their possible modulation with the disease evolution and the dopaminergic treatment using Dynamic Causal Modeling (DCM). DCM (2) is a generic Bayesian framework used to infer directed connectivity between a pre-defined set of regions, based on fMRI time series from these regions. It enables to estimate and make inference about how one neural system influences another (i.e. effective connectivity), and how this can be affected by the experimental context (modulation). This is obtained by specifying and comparing alternative plausible models of connectivity between regions. A Bayesian procedure is then used to select the "best model" (i.e. with higher evidence) given the data. Analysis of connectivity parameters of the best model is then performed across subjects. Connectivity parameters are expressed in Hz and quantify the changes in activity in a target region when activity in the source region increases as well as changes in connectivity induced by experimental factors such as luminance contrast variation (modulation). In the present study, we specified and compared three connectivity models including the plausible interactions

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between our three regions based on *a priori* anatomical knowledge. Model comparison was performed for three groups: control subjects (N=30), newly diagnosed (*de novo*) patients without L-Dopa treatment (N=11) and patients under L-Dopa treatment (N=8).

Results. For control subjects, we found that the best model given our data connected directly LGN to V1 and to SC. These connections were modulated by luminance contrast: connectivity increased with increasing contrast. The same model was also selected for *de novo* patients without L-Dopa treatment but they exhibited weaker connectivity parameters. However, for patients under L-Dopa treatment a different model was selected including additional feedback connections from V1 to LGN and to SC. The strength of these connections was different depending on the disease progression and treatment duration (2 months, N=5, and 6 months, N=3, respectively after the initial diagnosis).

Conclusion. Our findings suggest that under normal conditions and at early stage of the Parkinson disease, LGN acts as a hub for luminance contrast processing. In addition, disease occurrence alters connectivity from the LGN to SC and V1. With the disease progression and the introduction of the L-Dopa treatment, a compensation mechanism might take place, with a more prominent role of the feedback connections from V1 to SC and LGN, which might contribute to the restoration of the LGN and SC activity.

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Keywords: Human Vision; Parkinson Disease; Neuroimaging; fMRI; Effective connectivity.

Investigating predictive position perception using the trans-saccadic ghost illusion

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Résumé

When the eyes move, targets in our visual field may be perceived at their predicted next location, displaced from their current retinal location. We investigate this predictive position perception using the ghost illusion. The ghost illusion occurs when a stimulus at saccade target is removed during saccade but is still perceived at the saccade-landing site. The ghost is an example of predictive position perception as the perception of a foveal post-saccadic stimulus occurs due to the prediction the stimulus will remain in position during saccade. Using electroencephalography (EEG) and multivariate pattern analysis (MVPA), we examined whether the brain is processing the saccade target at the fovea after the saccade even the stimulus has been removed. Preliminary results suggest we are able to decode post-saccadic activity relating to the stimulus that is removed during saccade (peak decoding = 61.6% at 260 ms after saccade onset, 95% CI [55.9, 67.4]; chance = 50%). However, we are yet to determine if this is remnant activity from the processing of the pre-saccadic stimulus. To discount remnant processing, we will test whether foveal activity relating to a peripheral target is only present after its offset if a saccade is executed. This study would supply neural evidence of predictive position perception across saccades.

*Intervenant

Predicted position error modulates pursuit initiation after interceptive saccades

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Résumé

In everyday life, we interact with objects that are not static, but move relative to our bodies. To optimize our vision of these objects we must dynamically orient our gaze to center the object on the fovea, a behavior that requires a coordination of saccadic and pursuit eye movements. In this study we investigated the interactions between saccadic and pursuit movements. We asked participants to intercept and track with their gaze a target moving around a circular trajectory centered on the initial fixation point. We computed a saccadic gain and compared it with the gain of early pursuit immediately after the saccade (from 20 to100ms after saccade landing). We found that the speed of pursuit immediately following the saccade landing is negatively correlated, on a trial-by-trial basis, with the saccadic gain. Since online visual information do not modulate pursuit speed during initiation (Lisberger, 2010), this modulation must originate from information gathered before the execution of the saccade. The most likely source for this modulation is the predictive remapping of the moving target trajectory, which could be used to anticipate the post-saccadic position error between gaze and the moving target and the target direction relative to the landing. Overall, these results reveal a new type of interaction between saccade and pursuit, and suggest that mechanisms involved in the maintenance of visual stability across saccades play also a role in the oculomotor tracking of moving objects.

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Voluntarily tracking moving clouds: Effects of spatial frequency bandwidth on human smooth pursuit

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Résumé

The properties of motion processing for driving smooth eye movements have bee investigated using simple, artificial stimuli such as gratings, small dots or random dot patterns. Motion processing in the context of complex, natural images is less known. We have previously investigated the human ocular following responses to a novel class of random texture stimuli of parameterized naturalistic statistics: the *Motion Clouds.* In Fourier space, these dynamical textures are designed with a log normal distribution of spatial frequencies power multiplied by a pink noise power spectral density that reduces the high frequency contents of the stimulus (Sanz-Leon et al. 2011). We have previously shown that the precision of reflexive tracking increases with the spatial frequency bandwidth of large ($> 30\circ$ diameter) patterns (i.e. the width of the spatial frequency distribution around a given mean spatial frequency; Simoncini et al. 2012). Now, we extend this approach to voluntary tracking and focused on the effects of spatial frequency bandwidth upon the initial phase of smooth pursuit eye movements. Participants were instructed to pursue a large patch of moving clouds (mean speeds: 5, 10 or $20\circ$/s) embedded within a smoothing Gaussian window of standard deviation $5\circ$. The motion stimuli were presented with four different spatial frequency bandwidths and two different mean spatial frequencies (0.3 and 1 cpd). We observed that smaller bandwidth textures exhibit a stronger spectral energy within the low spatial frequency range (below 1cpd), yielding to shorter latency of smooth pursuit eye movements. A weak and less consistent effect was found on initial eye acceleration, contrary what was previously observed with OFR. After 400ms, the steady-state tracking velocity matched the mean visual motion speed and pursuit performance was comparable with that observed with a control, small dot motion. Motion clouds offer an efficient tool to probe the optimal window of visibility for human smooth pursuit through the manipulation of both the mean and the variability of spatial frequency.

*Intervenant

Is the efference copy of a saccade influenced by a perceptual illusion?

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Résumé

The double-drift stimulus leads to a large discrepancy between the physical path of a moving gabor and its perceived direction. Surprisingly, saccades directed to the double-drift stimulus do not show any effect of the illusion. Here, we asked whether the efference copy of the saccade corresponded to the real saccade or to the illusory expected landing position. We ran two experiments to investigate this question. In the first experiment, a target was presented in the periphery for 200 ms. During the presentation, participants were asked to keep their eyes focused on a fixation dot while remembering the location of this target. Then the double-drift stimulus was presented and participants were instructed to, first, execute a saccade towards the double-drift in order to intercept it and then, to execute a second saccade toward the remembered location of the circle (presented first but targeted second). If the efference copy of the saccade is influenced by the illusion, the second saccade should not land accurately on the circle but should be deviated to the direction of the perceived location of the double-drift. Results of this first experiment did not show any shift in the landing position of the second saccade, indicating that the efference copy of the saccade was not influenced by the illusion.

In the second experiment, we presented the double-drift stimulus and participants had to intercept it. As soon as a saccade was detected, a blank of 250 ms occurred, and the double drift made a small forward or backward jump. Participants were asked to report the direction of the jump. We hypothesized that if the expected post-saccadic target location were influenced by the illusion, the psychometric function should be shifted to the direction of the perceived location of the double-drift. The first results obtained seem to indicate that this is not the case, suggesting that the perceived location does not play a role in the prediction of the location of the target after the saccade.

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Influence of visual motion on reversal speeds in an ambiguous Necker cube experiment: an eye-tracking study

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Résumé

Multistability is the oscillation between different perceptual states under constant physical stimulus. Although either or both bottom-up and top-down processing can explain such oscillations (Leopold & Logothetis, 1999), we focus here on bottom-up information processing in which perceptual reversal is associated with passive neural adaptation and noise, early in visual processing (Kornmeier & Bach, 2005). **Objectives.** We focused on bottom-up factors governed by low-level visual features, to study the effects of adaptation and noise on reversal speed. **Methods.** Inspired by the experimental design in (Blake, Sobel & Geloy, 2003) we manipulate the adaptation level by moving the stimulus following a smooth Lissajous trajectory (LJ). We expected a decrease in reversal speed compared to a fixed stimulus (FX), serving as our control condition. Ocular noise was controlled through pseudo-random movements of the stimulus (random walk, RW). Under this "random walk" condition, an increased reversal speed was expected by assuming a higher noise level. The three conditions were randomly sequenced. Participants were instructed to stare at a central point during the stimulus presentation (Necker cube) at the screen centre, and to report their perceptual changes by keypress. After removing outliers, data (eye movements and behavioural responses) from sixteen participants were analysed. **Results.** The hypothesis concerning the ocular noise was supported by a significant increase of reversal speed (RW $>$ FX) as a consequence of a continuous spatial jitter of the retinal image. However, we also found LJ $>$ FX, in contrast to our initial hypothesis following (Blake, Sobel & Geloy, 2003). Upon further inspection of eye fixational movements during the "Lissajous" condition, we observed a systematic smooth gaze pursuit following the centre of gravity of the moving stimulus, increasing retinal image stability. Through this stabilisation, adaptation could set in earlier, provoking faster reversals.

*Intervenant

A cortical substrate for the retention of saccadic eye movements plasticity

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Résumé

How movements are continuously adapted to physiological and environmental changes is a fundamental question in systems neuroscience. Using saccadic adaptation as a classical model of sensorimotor adaptation, many studies have elucidated the mechanisms underlying adaptation acquisition and short-term maintenance (_˜ 10 to 60 minutes), some of them starting to reveal the involvement of the cerebral cortex (frontal and parietal areas, temporo-parietal junction –TPJ) (Blurton et al 2012; Gerardin et al 2012, Panouillères et al 2014). In contrast, despite retention of oculomotor memories is known to be much longer-lasting, the neural substrates of such longer-term memory (> 3-5 days) are virtually unknown.
Here, we examine in human subjects whether the temporo-parietal junction (TPJ) is causally involved in the induction and/or the retention of reactive saccades. Twelve subjects were tested in 4 adaptation sessions combined with single-pulse transcranial magnetic stimulation (spTMS) delivered over the right TPJ at, respectively, 30, 60, 90 or 120 ms after the onset of each saccade. In two other groups (n= 13 and 12), the same adaptation procedure was achieved either alone (control) or combined with spTMS applied onto the vertex (Sham). The timing of spTMS over the rTPJ only marginally affected the speed of adaptation induction (slight facilitation of the 60 msec timing relative to the 3 others and relative to the control groups), but not the immediate adaptation after-effect. Interestingly, after pooling together the data of the 4 timings of rTPJ stimulation, we found that nearly half of the amount of adaptation induced in the 1st session remained in the 2nd session performed 10 days later (retention = 42 %, IC=[0.29/.55]). No such retention was measured in the control (13% [-0.12/.37]) and sham (11% [-0.12/.34]) sessions.
These findings demonstrate for the first time that, while possibly contributing to a limited extent to the acquisition of saccadic adaptation, the right temporo-parietal junction appears to play a major role in the long-term retention of saccadic oculomotor memories.

*Intervenant

Evaluation du port en orthèse de prismes congruents de faible déviation gauche chez des patients héminégligents avec ou sans hémianopsie latérale homonyme associée

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Résumé

- L'équipe de Marc Jeannerod **[1]** a postulé l'existence d'un système interne de coordonnées dans lequel est définie la position des objets dans l'espace par rapport au corps (position égocentrée). Il définit ainsi le référentiel égocentrique comme une représentation interne d'un plan virtuel grossièrement superposable au plan sagittal du corps qui divise le corps et l'espace attenant en deux : le " droit-devant ". La détermination de la position spatiale des objets vers lesquels sont dirigés les mouvements nécessite alors une transformation de coordonnées permettant de reconstruire leur position égocentrée à partir de leur position rétinienne et de la position des différentes parties du corps (les yeux, la tête, le tronc) recueillie par la proprioception des muscles oculaires et du cou. Ainsi, la négligence spatiale unilatérale (NSU) serait la conséquence d'un décalage massif du système de coordonnées égocentriques par rapport au système référentiel rétinien dans lequel l'information visuelle est initialement captée.
- L'équipe de Yves Trotter **[2]** a montré que les mouvements oculaires centripètes qui amènent le regard d'une position excentrée vers la position corporelle " droit-devant " sont toujours initiés et exécutés plus rapidement que ceux qui dirigent le regard vers l'extérieur (centrifuges). Lors de l'étude, des taches pro et anti saccades sont réalisées afin de dissocier les directions des mouvements oculaires (centripète / centrifuge) des positions (droit devant/ excentrées) des éléments visuels qui les stimulent. Il en résulte que la plus forte dynamique des prosaccades centripètes s'explique à la fois par des déterminants oculomoteur et visuel qui agissent respectivement sur l'exécution et l'initiation des saccades oculaires. Les neurones de l'aire visuelle primaire du singe, lorsque leur champ récepteur est en position " droit-devant ", déchargent plus fortement pour distinguer cette position privilégiée de traitement visuel **[3].**

Les patients souffrant de NSU ont un déficit latéralisé pour prendre en compte, réagir à, et s'orienter vers, des stimuli présentés dans leur hémi-espace gauche, suite à une lésion cérébrale droite. Le champ visuel fonctionnel est non seulement " amputé " de sa partie gauche mais il est de surcroit décalé par rapport au centre du corps (tronc et tête) du patient. Ce décentrage

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par rapport au " droit-devant " entraine souvent des positionnements anormaux compensatoires qui entravent les activités de la vie quotidienne (domestique comme professionnelle). Ce syndrome polymorphe est souvent associé à une hémiplégie, à une hémianesthésie et à une hémianopsie latérale homonyme (HLH) gauche ce qui aggrave l'intensité de la déficience qu'il génère. En particulier, chez les patients héminégligents avec HLH gauche, la partie négligée de l'espace est souvent majorée par la partie aveugle du champ visuel (CV gauche).

Nous avons commencé à expérimenter les effets du port de prismes congruents de faible déviation vers l'hémichamp gauche en orthèse chez des patients héminégligents avec ou sans HLH associée. Les résultats préliminaires de trois patients seront présentés. L'hypothèse est que ces prismes ré-établissent une vision centrale " droit-devant ". En effet, la déviation prismatique gauche va permettre d'élargir et de recentrer le champ visuel fonctionnel en transposant une partie du champ visuel sain dans la partie négligée ou aveugle.

Originalité et caractère innovant de l'étude :

Les prismes jusqu'à maintenant utilisés en orthèse étaient de plus grande puissance, de plus mauvaise qualité optique (Prismes de Fresnel) [**4**] [**5**] [**6**] ou utilisés en demi-prismes [**7**]. Ils étaient mal supportés par les patients. Ici il s'agit de prismes de faible déviation conservant une qualité visuelle qui sont très bien supportés par les patients, et sont suffisants pour apporter un bénéfice sur les tests de négligence, reposant probablement sur la récupération d'une vision centrale "droit-devant".

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Visual discrimination task as reinforcer to control saccade gain

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Résumé

Saccade adaptation is a form of motor learning that may be induced by reinforcement learning in the absence of a visual position error. Previously, an arbitrary reinforcer was used such as an auditory tone to control saccades or viewing the target on the fovea. We now ask whether changes in saccade amplitude may be induced by the ability to perform a visual discrimination task. An experimental paradigm was used in which the post-saccadic retinal error was abolished by extinguishing the target at saccade onset. The target at the fixation point remained visible during 1200 ms ± 300ms and then stepped (by 7.5○, 10○, 12○, or 14○) following a 45-degree angle. The background consisted of a 72*54 grid of small "8" gray symbols. If the saccade met a gain amplitude criterion (e.g., less than the median horizontal gain of the 50 previous trials), the "8" symbols covering the background were all transiently replaced by one of four symbols (2,3,5 or E) for 60 ms. Otherwise, one of four irrelevant symbols (9, 6, e or a) were displayed. Participants had to report which symbol they saw but only correctly reporting 2, 3, 5 or E would be rewarded. One participant performed a 'gain increase' condition and another a 'gain decrease' condition. The percentage of gain change was –21.4% and +53% respectively for each subject in the two reinforcement conditions. We conclude that the ability to perform a visual task might induce saccade adaptation in the absence of post-saccadic position error signals.

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