CIMeC Seminars 2013

11 December 2013 4pm
Palazzo Fedrigotti, Seminar Room, 3° floor, Rovereto
Speaker:

- Gaëtan Sanchez, PhD Student at the Lyon Neuroscience Research Center

Title: **Towards new neurocognitive experiments using real-time electrophysiology in order to optimize advanced hypothesis testing of perceptual learning models.**
Abstract:
In my PhD work, I mainly focused on context-dependent perceptual learning in humans. I tackled questions like: what are the implicit mental and neuronal processes that express during the experiment in order to shape and optimize behavior ?
Therefore I combined experimental work in healthy subjects with state-of-the-art methods and models. I will illustrate these two aspects in this talk.
In the first part, I will describe one behavioral and one MEG experiments where I studied context-driven adaptive processes in a tactile frequency discrimination tasks.
In the second part, I will describe some methodological work where adaptive decision making is used to implement real-time design optimization. Using synthetic data, I will demonstrate the face and construct validity of this approach to test non-linear dynamical models in general and perceptual learning neurocognitive hypothesis in particular.
Sponsored by Nathan Weisz within the ERC project Win2Con

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10 December 2013 11am
Palazzo Fedrigotti, Seminar Room, 3° floor, Rovereto
Speaker:

- Jorien van Paasschen, CIMeC

Title: **Emotion perception in abstract visual artworks**
Abstract:
Abstract artworks make for an interesting type of visual stimulus to study emotion perception as they contain no recognisable objects and – to naïve observers – provide no reference to a narrative context. Hence, any emotional response to these artworks must be at least partially based on low-level visual characteristics. In a series of experiments, we explored what mechanisms enable the percept of emotions in abstract art. Contrary to an influential model of art perception, we show that people's emotional percept of abstract art on a valence/arousal continuum is highly consistent across observers with no background in art. Artworks with a high number of edges and dark colours were rated as more arousing and more negative compared to paintings containing clear lines, bright colours and geometric shapes. To further explore the idea that bottom-up visual stimuli drive emotional percept of the artworks, we used abstract artworks and emotional faces in an emotional priming paradigm. We observed priming effects using abstract artworks as primes, even when the target was an emotional face. In a third experiment, we show that art experts rate abstract art higher than inexperienced viewers on more cognitive aspects such as how beautiful the artwork is. However, art expertise plays no role in emotional experience of the artworks. Finally, I will present preliminary neuroimaging data from a study in which we investigated neural activation related to emotional experience of abstract visual art compared to other categories of visual stimuli.
This project was a collaboration between CIMeC and the Mart, funded by the Caritro Foundation.
Hosted by David Melcher

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3 December 2013 9.00 am
Palazzo Fedrigotti, Seminar Room, 3rd floor, Rovereto
Speaker:

- Gregor Thut, University of Glasgow, UK

Title: **Controlling brain rhythms with brain stimulation**
Abstract:
This talk will cover recent attempts to generate known oscillatory signature of mental processes (identified by electroencephalography) through targeted (frequency-tuned) interventions into brain oscillations (controlling of brain rhythms by brain stimulation). This to bias brain oscillations and thereby task performance in specific directions. The talk will focus on the regulation of perception by brain rhythms in terms of "when in time" a stimulus is perceived, "where in space" it is perceived, and "what of the stimulus" is perceived (stimulus content). The results demonstrate rapid cycling of visual perception at frequencies of underlying brain rhythms after their phase reset (by external stimulation), spatial biasing of perception across the visual fields after promotion of parietal alpha signatures through rhythmic transcranial magnetic stimulation (TMS) and biasing of perception towards local or global stimulus features after parietal rhythmic TMS at beta versus theta frequency. Overall, this suggests a causal role of parieto-occipital brain oscillations in the regulation of perception, amenable to controlled interventions by brain stimulation.
Hosted by: Lorella Battelli, Francesco Pavani

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3 December 2013 10.30 am
Palazzo Fedrigotti, Sala Convegni 1st floor, Rovereto

Speaker:

- Prof. Arnaldo Benini, professor of Brain surgery and Neurology at the University of Zurich

Title: **Xenomelia: Clinical features and brain correlates of a particular disorder of bodily self-consciousness**
Abstract:
Xenomelia (also called "body integrity identity disorder") is a variant of the relationships between body and nervous mechanisms of self-consciousness. It constitutes the frequently compelling desire of a healthy individual to have a fully functional limb (generally the left leg) amputated. As a rare state of self-consciousness, xenomelia was originally approached mainly from the psychiatric field. Later, brain-based accounts of xenomelia were motivated by comparing xenomelic individuals' self-consciousness with reports by patients with right parietal lobe lesions. With magneto-encephalographic studies, McGeoch et al. (2011) showed an unresponsive superior parietal lobule to tactile stimulation of the foot of an "undesired" left leg. Magnetic resonance imaging and surface-based morphometry of the cortex of 13 individuals with amputation desire, examined by Hilti et al.(2013), revealed - in the right hemisphere - reduced cortical thickness in the superior parietal lobule and reduced cortical surface area in the primary and secondary somatosensory cortices, in the inferior parietal lobule as well as in the anterior insular cortex. These findings suggest that the desire for the amputation of a healthy limb could be the consequence of a breakdown in a network subserving the establishment and maintenance of body ownership, which appears to be imprinted in the brain. Further data should clarify if the structural anomalies of the right hemisphere are the true and the only cause of the horrible distress.
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Hosted by: Giorgio Vallortigara

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7 November 2013 11.30 am
Palazzo Fedrigotti, Sala Convegni 1st floor, Rovereto
Speaker:

- Paolo Manganotti, Neurology, Department of Neurological Sciences and Movement. University of Verona.

Title: **Brain oscillations and perturbational approach by brain stimulation in vigilance and sleep deprivation state. Prospective EEG-TMS applications.**
Abstract:
Dynamic changes in spontaneous electroencephalogram (EEG) rhythms can be seen to occur in awake state or in sleep with a high rate of variability and recent technical advances, as transcranial magnetic stimulation (TMS), allow an external modulation of these rhythms by triggering oscillatory brain activity with a perturbation method. EEG-TMS co-registration can be performed healthy subjects in different states can be used to characterized dynamic changes in the regional neural oscillatory activity of the cortical areas and to possibly related modulation of these induced oscillations to the different brain state. Synchronizing/desynchronizing effect on slow and fast oscillatory activity in response to focal, standardized TMS after sleep deprivation and sleep has been observed in different studies. While during sleep deprivation there is a slighter desynchronization of alpha and even an absence of beta reactivity, sleep applications highlight the pronounced interference of external brain stimulation on the cortex modulated by the vigilance state and in cognitive processes and opens prospects for clinical applications such as disturbed consciousness (i.e., minimal consciousness state).
Hosted by: Giorgio Vallortigara

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29 October 2013 4.30 pm
Palazzo Fedrigotti, Seminar Room, 3° floor, Rovereto
Speaker:

- Michael Maslin, Research Fellow at the School of Psychological Sciences, University of Manchester (UK)

Title: **Unilateral deafness following surgery: a unique model for studying plasticity in adult humans**
Abstract:
Individuals with profound unilateral deafness offer a useful model for studying plasticity of binaural systems in humans. Stimulation of the intact ear reveals hyperactivity in the auditory pathway, primarily ipsilateral to the intact ear. Furthermore, there is a unique opportunity to study the time course, and physiological mechanisms, of such plasticity in individuals undergoing surgery for removal of an acoustic neuroma, since baseline measures can be obtained prior to removal and onset of deafness.
Recent work in our lab has characterised plasticity at cortical and sub-cortical levels in humans following unilateral deafness from a period of minutes up to 3-years post-deafness. Cortical auditory evoked responses were found to change over a period of 1- to 6-months post-deafness. However, electrophysiological measurements obtained during the course of surgery indicate an almost immediate (within minutes to hours) increase in neural activity in the central auditory pathway after the onset of unilateral deafness. This broad time-course of events is consistent with the action of multiple physiological mechanisms.
Other work has, for the first time, shed light on the link between physiological and perceptual changes following unilateral deafness by revealing improved intensity discrimination abilities in the intact ear. Further studies are planned, which aim to establish the functional consequences of these changes e.g.,

in relation to changes in sound localisation abilities via monaural cues, or speech discrimination in noise. Other aims include investigating rhythmical brain activations, since there is a high prevalence of individuals reporting both tinnitus and hyperacusis following abrupt onset unilateral deafness.
Hosted by: Nathan Weisz within the framework of the ERC project Win2Con

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29 October 2013 10.30 am
Palazzo Fedrigotti, Seminar Room, 3° floor, Rovereto
Speaker:

- Donato A. Grasso, Dipartimento di Bioscienze, Università di Parma

Title: **Communication in ant societies: study models for a comparative and multidisciplinary approach**
Abstract:
All aspects of animal social life are characterized by communicative events that are crucial for their organization. Hence, a comprehensive understanding of animal social systems could not leave the analysis of their communication strategies out of consideration. Here I will examine the most important processes of communication evolved by a group of insects that has reached one of the pinnacles of complexity in social organization: the ants. Their complex colonies are considered as true superorganisms whose emerging properties, however sophisticated may be, derive by simple and parsimonious mechanisms that mediate social interactions. The study of these mechanisms necessarily implies the analysis of the chemical signals used by colony members to communicate, since most of the information involved in ant social organization is transmitted through the olfactory channel. In the last years, my co-workers and I conducted many investigations on several ecologically relevant species belonging to different genera (Messor, Formica, and Polyergus). This gave us the opportunity to tackle the most important aspects of ant chemical communication processes (sexual attraction, recruitment, nestmate and colony recognition, alarm/defence, host-parasite relationships). The multidisciplinary approach based on eco-ethological, chemical and morpho-functional analyses showed the high versatility of the chemical system of these insects and its crucial role in their evolutionary radiation and ecological success. Starting from the behaviour, we will reach the cellular and the molecular levels to shed light upon many peculiar aspects of the complex colonial organization of these organisms that are among the most suitable models for the study of social phenomena.
Hosted by: Giorgio Vallortigara within the framework of the ERC project PREMESOR

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22 October 2013 10 am
Palazzo Fedrigotti, Seminar Room, 3° floor, Rovereto
Speaker:

- Winfried Schlee, Researcher in Clinical & Biological Psychology at the University of Ulm (Germany)

Title: **Tinnitus: brain connectivity and its dynamics**
Abstract:
The human brain activity is in permanent change and dynamically adapts to external and internal demands. Thereby the brain adapts to environmental changes and altered sensory input, it reorganizes itself as an effect of sensory loss or malfunction and also adjusts to brain dysfunctions in case of injuries or infections. This continuous change is largely advantageous and functional in a way that it helps to optimize the information processing and output of the central nervous system. The timeline of this change can be a within milliseconds, from one situation to the other, or within years in the case of age-related changes over the life-span.
The brain activity related to tinnitus is often associated with increased functional connectivity between the auditory cortex, the dorsolateral prefrontal cortex, the orbitofrontal cortex, the insula, the anterior and posterior cingulate cortex. Given the adaptive nature of the human brain, the pattern of functional connectivities in the tinnitus brain is also in perpetual change. In this talk I will review several lines of research investigation this adaptive changes of tinnitus-related brain networks and its behavioral relevance. At first, this comprises connectivity changes as a function of tinnitus duration. Secondly, I will discuss the influence of age on the tinnitus perception and the associated brain networks. As a third point I want to tackle the largely under-investigated topic of short-term changes in tinnitus perception.

Tinnitus patients report that their tinnitus perception can change from one situation to the other. How often does that happen and is it a regular pattern? What are the reasons for this variation? Is this moment-to-moment variation of tinnitus perception related to the dynamic changes in functional brain connectivity? What are the methodological limitations in assessing moment-to-moment tinnitus variation and how can they be solved? I will try to answer some of these questions and show some first attempts in investigating the moment-to-moment tinnitus variation.
Hosted by: Nathan Weisz within the framework of the ERC project Win2Con

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15 October 2013 11 am
Palazzo Fedrigotti, Sala Seminari 3° floor, Rovereto
Speaker:

- Dr Thomas Thesen, Assistant Professor of Neurology & Radiology & Director of Intracranial Neurophysiology Research New York University School of Medicine

Title: **Intracranial Electrophysiology to study perception and cognitions in humans**
Abstract:
Every brain imaging method comes with its inherent strengths and limitations. Functional MRI (fMRI) possesses high spatial resolution and provides an unambiguous source localization. However, the BOLD signal is only a secondary marker of neuronal activity that is not completely understood and its response is very sluggish, resulting in a temporal resolution far below that of regular cognitive processes. Magnetoencephalopgraphy (MEG), and its electrical counterpart, scalp EEG, on the other hand possess a temporal resolution on the millisecond scale and are thus able to track changes in neuronal responses in real-time as they unfold in cortex. The downside is that these measures are recorded at or near the scalp and that there are significant limitations imposed by the inverse problem in localizing their neural generators with certainty, especially when brain activity is widely distributed. Recordings directly from electrodes implanted intracranially on the surface of the brain offer both high spatial and temporal resolution, making them an attractive tool for studying brain dynamics. However, they do not cover the whole brain and are very invasive and thus only available in patients with epilepsy undergoing surgery for seizure monitoring.
In this talk Dr Thesen will present data from studies of different cognitive processes (i.e. reading and multisensory integration) investigated with fMRI, MEG and intracranial EEG, both in patients and healthy controls, and in some cases, the same patient. Such a multimodal neuroimaging approach has the potential to avert some of the disadvantages imposed by any single modality in isolation and offers a more comprehensive examination of brain dynamics during perceptual and cognitive processing in humans.
Invited by: *Prof. David Melcher within the framework of the ERC project CoPeST*

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4 October 2013 10 am
Palazzo Fedrigotti, Sala Seminari 3° floor, Rovereto
Speaker:

- dott.ssa Sabrina Brigadoi, PhD- Dipartimento di psicologia dello sviluppo e della socializzazione, Università di Padova

Title: **Methodological innovations in optical imaging of the brain**
Abstract:
Functional Near-Infrared Spectroscopy (fNIRS) and diffuse optical tomography (DOT, a multi-channel fNIRS approach) are non-invasive optical neuroimaging techniques, which use near-infrared light to infer cerebral activity. They are widely used on preterm and term infants, children and difficult populations (e.g. stroke patients) thanks to their portability and non-invasiveness. When a DOT approach is used, depth-resolved images of the concentration changes of oxy (HbO) and deoxy (HbR) hemoglobin can also be reconstructed.
The measured fNIRS signal is usually contaminated by motion artifacts and physiological noise, which is composed of heart beat, respiratory waves, vasomotor waves (or Mayer's wave, which has a frequency very similar to that of the brain activity) and very low-frequency oscillations. In order to properly estimate the hemodynamic brain response and before reconstructing any images, it is very important to remove this noise.
Although many techniques to correct for motion artifacts have been published in the literature (Spline

Interpolation, PCA, Kalman filtering, Wavelet filtering, Correlation-Based Signal Improvement), no standard procedure to select the best technique has been proposed. We performed a comparison of these techniques on real cognitive data and we concluded that wavelet filtering seems a very promising and powerful technique, which has the potential to become a standard method for the motion correction step in the fNIRS processing pipeline. Moreover, the metrics proposed in our approach can be applied by users to find the best motion correction technique for their data.
In order to solve the problem of physiological noise contamination, the use of a short-separation channel (a channel with source-detector distance < 1 cm) has been recently proposed. The short-separation channel measures the same physiological noise of the normal channels, without recording brain activity. We proposed a new short-separation channel based methodology to improve the estimate of event-related hemodynamic responses. The two-steps algorithm combines the modeling of noise-only data measured from a short-separation channel and a Bayesian filter applied on a per-trial basis.
Image reconstruction in DOT requires individual MRIs as a spatial prior, but this undermines many of the advantages of diffuse optical methods (e.g. portability and applicability to challenging population). The use of registered atlases to model the individual's anatomy is thus becoming a standard. However, while many adults MRI atlases have been proposed in the literature and are commonly used, infants ones are very rare. Moreover, because infant's brain grows very rapidly, newborns require carefully age-matched atlases. We proposed a 4D neonatal head-model, to be used in diffuse optical imaging studies with babies aging 29 to 44 weeks post-menstrual age. Our head model atlas can be used to optimize probe location, improve image reconstruction, thus increasing the interpretability of diffuse optical techniques in the newborn population.

Hosted by: Elisa Frasnelli

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2 October 2013 11am
Palazzo Fedrigotti, Sala Seminari 3° floor, Rovereto

Speaker:

- prof. Hans–Joachim Bischof University of Bielefeld, Behavioural Biology, Germany

Title: **Organization and Function of the Avian Visual Wulst**
Abstract:
The visual wulst is an area of the avian forebrain which has been claimed to be homologue to the visual cortex of mammals. Concerning the intrinsic organisation, this homology is still controversely discussed. To contribute to this discussion, we have started to investigate the function and structure of the visual wulst in the zebra finch, a typical songbird with laterally placed eyes, and to compare our results with data obtained in mice. By using optical imaging of intrinsic signals (OIS) and of mitochondrial flavoprotein autofluorescence imaging (AFI), we have demonstrated that the visual wulst as like as the visual cortex comprises several retinotopic maps, which have different physiological properties, receive efferences from separate regions of the thalamus, and are interconnected by intrinsic tangential nerve fibers. This suggests that at least the functional properties of the avian visual wulst are comparable to those of the visual cortex in mammals.
Hosted by: Giorgio Vallortigara