

# CIMeC Seminars 2017

## IIT Talk

*When:* Tuesday, 12th December, 11 - 12 AM

*Where:* CIMeC, 1st floor seminar room, Palazzo Fedrigotti, Corso Bettini 31 - Rovereto

*Speaker:*

- Prof. Stefano Vassanelli, professor of Neurophysiology at the University of Padova, Dept. of Biomedical Sciences and leader of the NeuroChip laboratory

*Title:* **Building nanoelectronic synapses between brain and artificial neurons**

*Abstract:* Recent substantial improvements of brain-chip interfaces are expanding our capabilities to record neuronal networks in vitro and in vivo at high spatial resolution and to provide controlled feedback by tuneable stimulation. As such, on-chip neural interfaces represent an attractive bi-directional gateway between brain networks and nanoelectronic devices and circuits that emulate fundamental properties of biological neurons as action potential firing and synaptic plasticity. We will present our first attempt to physically connect brain and artificial neuronal networks as developed in the RAMP project (<http://www.rampproject.eu/>), where nanoscale memristors work as synaptic-like elements between biological and electronic neurons to create a hybrid network. Results are discussed under the perspective of application in the fields of neuroprosthetics and neuromorphic computing for autonomous systems.

*Host:* Alessandro Gozzi

## Transfer Talk

*When:* Tuesday, 5th December, 10.30 - 11.30 AM

*Where:* CIMeC, 3rd floor seminar room, Palazzo Fedrigotti, Corso Bettini 31 - Rovereto

*Speaker:*

- Jane E. Barker, neo-PhD graduate in Cognitive Neuroscience at University of Colorado Boulder (USA)

*Title:* **How do children begin to engage executive functions in self-directed contexts?: Linking environmental structure to emerging endogenous control**

*Abstract:* Young children often struggle to accomplish their intended goals in a self-directed way, without instructions or reminders from adults. Across development, children show an increasing ability to meet goals endogenously, in the absence of reminders signaling how and when they should act. Although the emergence of endogenous control is a critical precursor to goal-directed behavior in complex, real-world environments, few studies have investigated whether these abilities can be changed through experience. I will present findings from two studies relating children's exposure to adult-structured environments to their performance engaging endogenous control during a semantic verbal fluency task. In Study 1, we find that 6- and 7-year-old children who spend more time in less-structured, self-guided activities showed better endogenous switching in verbal fluency, and that children who spend more time in adult-structured activities, including adult-led lessons, homework, and chores, show a trend-level negative association in the opposite direction. In Study 2, we build on this work by investigating causal paths between earlier time in structured activities and later verbal fluency switching, drawing on data from the Colorado Longitudinal Twin Sample. Phenotypic cross-lagged models show that twins who participated in more structured activities at age 4 showed worse switching ability at age 7, controlling for earlier verbal fluency ability and concurrent time in structured activities at age 7. These relationships persisted after controlling for differences in intelligence and vocabulary and could not be explained by genetic mediation in follow-up models. Findings will be interpreted within a theoretical

framework linking structure (and its absence) to the development of abstract representations and monitoring abilities supporting endogenous control, and will be explored within a computational model of verbal fluency production.

*Host:* Giorgio Coricelli

#### Transfer Talk

*When:* Monday, 4th December, 11 - 12 AM

*Where:* CIMeC, 1st floor conference room, Palazzo Fedrigotti, Corso Bettini 31 - Rovereto

*Speaker:*

- Wolfgang Martin Pauli, Postdoctoral Scholar, Computational and Neural Systems, California Institute of Technology (USA)

***Title: Evidence for model-based mechanisms during Pavlovian conditioning***

*Abstract:* Prominent computational theories of learning during Pavlovian conditioning posit that by pairing a conditioned (CS) with a unconditioned stimulus (US), the CS acquires a scalar value, which is proportional to how reliably the CS predicts the US. Critically, this mechanism is model-free, because this scalar value representation does not include any information about state transitions leading up to US delivery. While these model-free computational theories account for a wealth of data, most prominently the patterns of phasic dopamine neuron activity during Pavlovian conditioning, it is still an open question whether learning during Pavlovian conditioning involves the development of cognitive maps of state transitions, which are at the core of model-based reinforcement learning, but rarely considered within the context of Pavlovian conditioning. To investigate this question, we scanned human participants with high temporal and spatial resolution fMRI, while they participated in an appetitive higher-order Pavlovian conditioning paradigm. The paradigm was specifically designed to allow multivariate pattern analyses of striatal representations of future rewards and of future states. The analyses revealed that the human striatum represents cognitive maps of state transitions, providing evidence that model-based learning mechanisms are engaged during Pavlovian conditioning, even though participants have no means of influencing state transitions.

*Host:* Giorgio Coricelli

#### IIT Talk

*When:* Tuesday, 28th November, 2 - 3 PM

*Where:* CIMeC 3rd floor seminar room, Palazzo Fedrigotti Corso Bettini 31 - Rovereto

*Speaker:*

- Prof. Shih Yen-Yu, Assistant Professor of Neurology and Director of Small Animal MRI at the Biomedical Research Imaging Center at the University of North Carolina at Chapel Hill

***Title: The source of negative fMRI response in the striatum***

*Abstract:* The relationship between hemodynamics and neuronal activity may not always be straightforward. An intriguing negative fMRI response in the striatum was observed in cases such as peripheral noxious stimulation, epileptic slow-wave discharge, dopamine D2/D3 agonism, or electrical stimulation of striatal input/output nuclei, wherein the response was independent of direct activity changes within the striatal neurons or regional metabolism. Conversely, positive fMRI responses have been shown in various cognitive tasks, reward processing, or experimentally by dopamine D1/D5 agonism. These collective findings suggest that striatal fMRI responses may present in a dichotomous fashion. To further shed light on the unique neurovascular coupling in the striatum, we employed multimodal fMRI with electrophysiology, pharmacology, and cutting-edge brain modulation approaches to dissect the source of striatal fMRI responses. Given the diverse and critical roles of striatum in cognition, motivation, sensorimotor function and a multitude of disease states (including neurodegenerative and psychiatric disorders), this dissection is of paramount importance to

better interpret striatal functions using fMRI in both animal models and human subjects. Through our studies, we learned that 1) the polarity of hemodynamic response in the striatum is circuit dependent, 2) selective activation of midbrain dopaminergic neurons induces positive fMRI responses, 3) selective activation of striatal medium spiny neurons induces negative fMRI responses, and 4) negative fMRI responses could appear in areas with positive local field potential or spiking activities.

*Host:* Alessandro Gozzi

### CRASK Talk

*When:* Tuesday, 28th November, 10:30 - 11:130 AM

*Where:* CIMeC, 1st floor conference room, Palazzo Fedrigotti - Rovereto

*Speaker:*

- Gabriella Liuzzi, PhD Candidate, Laboratory for Cognitive Neurology, KU Leuven

***Title:* Neuroanatomy underlying the semantic processing of written words, spoken words and pictures**

*Abstract:* In this talk, I will focus on the role of the perirhinal cortex and the pars triangularis of the left inferior frontal gyrus (LIFG) in representing the semantic meaning of words in different input modalities. I addressed this topic by applying multi-variate pattern analysis (MVPA) and representational similarity analysis (RSA). The primary objectives of my first fMRI study (Liuzzi et al., 2015) were to evaluate whether the semantic similarity effect for written words in left perirhinal cortex extended to the spoken modality. Whilst we found semantic similarity coding for the written modality, no semantic similarity effects were detected for the spoken words. These contrastive results raised two questions: 1.If perirhinal cortex is not a convergence zone, what is the brain region where modality specific semantic pathways converge in order to access the same semantic representations? 2.To what extent does the semantic similarity effect in perirhinal cortex depend on the type of information that has to be retrieved? A second fMRI study was conducted (Liuzzi et al., 2017) where a cross-modal semantic similarity effect in the pars triangularis of the LIFG was found. Finally, by means of a third fMRI study (Liuzzi et al., in preparation), we determined whether the semantic similarity effect in perirhinal cortex depends on the type of information to retrieve - visual vs nonvisual (e.g. Entity: dog. Visual property: is it brown? Nonvisual property: can it be bred?). A semantic similarity effect for written words only and for written words combined with visual properties was detected. These results have led us to propose a role of the perirhinal cortex in the learnt association between the written word and its referent.

*Host:* Scott Fairhall's lab

### CIMeC PhD Colloquium

*When:* Thursday, 23th November, 3:15 - 4:15 PM

*Where:* Palazzo Istruzione Corso Bettini 84, Rovereto, Aula Magna

*Speaker:*

- Roi Cohen Kadosh, Full Professor Department of Experimental Psychology, University of Oxford Senior Research Fellow in Experimental Psychology, Jesus College, University of Oxford

***Title:* The effect of brain stimulation on cognitive training**

*Abstract:* Fluid cognitive skills, such as working memory, reasoning, and mathematics, are critical in most academic settings. Current attempts to improve cognitive skills have yielded mixed results and limited evidence of transfer beyond the immediate cognitive training materials. These failures have led some to suggest that cognitive skills are fixed. Another suggestion is that these failures are due to suboptimal approaches to exploit neuroplasticity. An innovative method to modulate neuroplasticity is using brain stimulation, with the assumption that concurrent brain stimulation and cognitive intervention interact synergistically, enhancing the benefits derived from the intervention. I will present a series of experiments that involved executive control,

arithmetic learning or executive functions training. The effect of brain stimulation was not beneficial in all the cases, but varied as a function of the neural system we tried to affect. The results lead to the idea that a consideration of the neurocognitive factors characterising the individuals in the experiment can lead to a much clearer understanding of effects than considering only the group they belong to. This approach yields advancement at the basic and translational level. It would enable the improvement and individualisation of interventions, and produce a better understanding of the underlying neurocognitive mechanisms.

*Host:* Clayton Hickey/Weiske van Zoest

### Premesor Talk

*When:* Thursday, 16th November, 12 - 13 PM

*Where:* ACN lab - seminar room, II floor, Piazza della Manifattura 1 - Building n. 14

*Speaker:*

- Carlo Brentari, Centro di Studi e Ricerche "Antonio Rosmini", Department of Humanities, University of Trento

***Title:* Constituting and Living the Umwelt. Two Cognitive Levels in Jakob von Uexküll's Theory of Animal Life**

*Abstract:* Between the 20th and 21st centuries, research on Jakob von Uexküll intensified, especially thanks to the interest shown by contemporary biosemiotics. Within this research perspective, two levels of analysis can be distinguished: first, the animal organism is seen as a cognitive subject that spontaneously constitutes the Umwelt; second, the animal's activity provides an active interpretation of first-level environmental elements. Both levels are actually present in Uexküll's thought. The first is linked on one hand, to the Kantian influence on the Estonian biologist and, on the other, to his training as a physiologist; the second one shows relevant thematic affinities with the first phase of Lorenz's ethology. This talk aims to offer an overview of both levels of cognitive activity of the animal subjects, in order to highlight the originality and richness of Uexküll's perspective.

*Host:* Giorgio Vallortigara

### IIT Research Seminar

*When:* Tuesday, 7th November, 2.30 - 3.30 PM

*Where:* Palazzo Fedrigotti, Corso Bettini, 31, Rovereto, 3rd floor seminar room

*Speaker:*

- Prof. Sebastiano Stramaglia, Università degli Studi Aldo Moro, Bari & National Institute for Nuclear Physics (INFN)

***Title:* Multiscale Causality Analysis**

*Abstract:* In the study of complex physical and physiological systems represented by multivariate time series, an issue of great interest is the description of the system dynamics over a range of different temporal scales. While information-theoretic approaches to the multiscale analysis of complex dynamics are being increasingly used, the theoretical properties of the applied measures are sometimes poorly understood, in particular those related to causality and notions like synergy and redundancy. I will introduce a framework for the analytical computation of information dynamics for linear multivariate stochastic processes explored at different time scales, and discuss possible extensions. The improved computational reliability of the proposed frame is exploited to disclose meaningful multiscale patterns of information transfer in physiological systems (heart-brain interaction) as well as between global temperature and carbon dioxide concentration time series, both in paleoclimate and in recent years.

*Host:* Alessandro Gozzi

## Transfer Talk

*When:* Thursday, 3rd November, 10 - 11 AM

*Where:* Mattarello, Via delle Regole 101 , Conference Room

*Speaker:*

- Lily Fitzgibbon, Postdoctoral Research Fellow, School of Psychology and Clinical Language Sciences, University of Reading (UK)

*Title:* **Counterfactual curiosity: Preschool children seek information about foregone alternatives**

*Abstract:* Preschool children are known to be curious. In the present study, we investigated if they are not only curious about what is, but also about what might have been ("counterfactual curiosity"). Children between 4 and 5 years (N = 32 in Experiment 1; N = 24 in Experiment 2) played a game in which they had to choose face-down cards to match them to a reference picture. Post-choice, children had the chance to use "x-ray glasses" to uncover the identity of unchosen cards. In Experiment 1, children spontaneously used the glasses, especially after a negative (non-matching card), not positive (matching card), outcome. In Experiment 2, children could use the glasses to look at either of two alternatives: a card that had been available for choice or a card that had been present but unavailable. Children predominantly used the glasses to learn about previously available cards, thus indicating that they were curious about what they could have chosen. The findings suggest that young children are curious not only about what is, but about what could or might have been—which might serve as a crucial precursor for counterfactual reasoning.

*Host:* Giorgio Coricelli

## Transfer Talk

*When:* Thursday, 2nd November, 4 - 5 PM

*Where:* Mattarello, Via delle Regole 101 , Conference Room

*Speaker:*

- Stefano Palminteri, PI at the Laboratoire de Neurosciences Cognitives (ENS, Paris)

*Title:* **The different facets of valence in human reinforcement learning**

*Abstract:* Valence is a fundamental concept in the learning and decision-making literature. However, in the reinforcement learning context, different facets of this psychological concept are often confounded and/or ill-defined. In the present talk we theoretically propose, mathematically formalize and experimentally investigate two different facets of valence: 'informational' and 'contextual'. Using different techniques in a series of studies, we found that these different aspects have dissociable computational and neural correlates, and exert powerful effects on human learning behavior.

*Host:* Giorgio Coricelli

## Transfer-Learning Talk

*When:* Tuesday, 24th October, 10.30 - 11.30 AM

*Where:* Mattarello, Via delle Regole 101 , Conference Room

*Speaker:*

- Andrea Pisauo, postdoc, University of Glasgow, UK

*Title:* **Studying the neural trade off between cooperation and competition through a newly designed economic game - Andrea Pisauo**

*Abstract:* In everyday life, our interactions with others entail different motivational goals eliciting both cooperative and competitive states of mind. Therefore, an optimal behaviour requires the brain to be able to quickly adapt to a constantly evolving social context to adjust decision making. To investigate the behavioural and neural trade-off between competition and cooperation, we collected fMRI data while participants played a novel social economic game. Without deception, couples of unfamiliar players made a time-constrained prediction about the location of a random target in a linear space and were rewarded according to the precision of their prediction and that of the other player, with the closest being the winner. In each trial, players could trade a higher chance of winning (competitive strategy) against a higher reward in case of a win (cooperative strategy). The continuous nature of the task allowed to measure the level of cooperation of each player in any trial. To manipulate the social context, we instructed the participants about different reward distributions implicitly informing them about the risk associated with defecting cooperation. Validating our new approach, participants played more competitively when the risk associated with defected cooperation was high, whereas they exhibit cooperative behaviours when that risk is absent. The extent of this contextual modulation was reflected in the activation of a network of areas implicated in decision making, evaluation and theory of mind, providing primary evidence that the brain continuously encodes the social context to set the trade-off between cooperation and competition.

*Host:* Giorgio Coricelli

### Talk

*When:* Tuesday, September 26th, 3 PM

*Where:* CIMeC 3rd floor seminar room, Corso Bettini 31- Rovereto

*Speaker:*

- Charley Wu, predoctoral fellow at Max Planck Institute for Human Development in Berlin

*Title:* **Generalization and Exploration in Vast Spaces**

*Abstract:* Many real world decisions occur in environments with a vast number of possible actions, where under time or resource constraints, optimal solutions are generally unobtainable. How do humans generalize and learn which actions to take when not all outcomes can be explored? From two behavioural experiments and a large-scale comparison 27 models for predicting individual search decisions, we find that a Bayesian function learning model, combined with an optimistic sampling strategy, robustly captures how humans use generalization to guide search behaviour. Taken together, these two form a model of exploration and generalization that leads to reproducible and psychologically meaningful parameter estimates, providing novel insights into the nature of human search in vast spaces. Importantly, our modelling results and parameter estimates are recoverable, and can be used to simulate human-like performance, bridging a critical gap between human and machine learning.

*Host:* Folco Panizza & Giorgio Coricelli's lab

### Transfer-Learning Talk

*When:* Thursday, 27th July, 4 - 5 PM

*Where:* Mattarello, Via delle Regole 101, Conference Room

*Speaker:*

- Carlo Reverberi, Department of Psychology, Università Milano - Bicocca, Milano, Italy

*Title:* **Long range connectivity patterns reflect progressive learning and global strategy shifts**

*Abstract:* People learn and improve their performance in a task by both incremental optimisation of the implemented strategy or by discovering a new more effective strategy. We re-analyzed a recent fMRI experiment (Schuck et al., 2015) where subjects had to press one of two buttons based on spatial features of the visual stimulus - the instructed strategy - or based on the stimulus color - a more effective but uninstructed

strategy. Here we used a new fMRI analysis technique, CPDC (Allegra et al, 2016), to investigate brain network dynamics and its association with learning. Using CDPC with sliding-windows allows to cluster voxels with similar time-series in activation level and to integrate the resulting information in a connectivity network whose nodes are optimised on the basis of the clustering results. CPDC can detect even short-lived (e.g. 20 seconds) coherence clusters. We identify a network of correlated activity involving areas in the visual cortex, the parietal cortex, the precuneus, and the prefrontal cortex. For subjects following the instructed strategy, incremental learning reflected into a progressive strengthening of several network links parallel to a reduction in response times. In the sudden passage from the spatial to the color strategy, we observed a weakening of some network links, including those that previously showed the strongest strengthening. Our results contribute to the current debate on network neuroscience and learning. CDPC proved to be highly effective for tracking network dynamics and could be fruitfully applied to other tasks.

*Host:* Giorgio Coricelli

### CIMeC Seminar

*When:* Wednesday, 26th July, 2 - 3 PM

*Where:* CIMeC 3rd floor seminar room, Corso Bettini 31- Rovereto

*Speaker:*

- Franco Pestilli

***Title:* Multidimensional encoding of brain connectomes: building quantitative biological networks with preserved edge properties to study the visual white matter and brain aging**

*Abstract:* The ability to map brain networks in living individuals is fundamental in efforts to chart the relation between brain and behavior in health and disease. We present a framework to encode brain connectomes and diffusion-weighted magnetic resonance data into multidimensional arrays. The framework goes beyond current methods by integrating the relation between connectome nodes, edges, white matter fascicles and diffusion data. We demonstrate the utility of the framework for in vivo white matter mapping and anatomical computing by evaluating more than 3,000 connectomes across thirteen tractography methods and four data sets in normal and clinical populations. We show that this framework allows mapping connectivity matrices, edge anatomy, and microstructural properties of the white matter tissue in each connectome edge. The framework is based on statistical evaluation principles introduced with the Linear Fascicle Evaluation and virtual lesions methods (LiFE; Pestilli et al., 2014). In short, instead of building networks by relying uniquely on the terminations of fascicles into the cortex, we exploit the full measured signal available for each connectome edge by extracting a forward-prediction of the biological tissue properties of the edge. We validated the framework by comparing results with standard connectome measures (fiber count and density). To do so, we generated ten repeated-measures connectomes in each individual brain in various datasets, using different tracking methods. For each connectome estimated in an individual, we computed the mean network clustering coefficient across repeated measures. We demonstrate high reliability of the clustering coefficients. We also demonstrate profound differences in connectomes across brains, beyond what can be captured using standard measures (fiber density). We also show that the proposed method is highly sensitive to differences between individuals by improving subject classification into various diagnostic groups. Finally, we show that the framework is useful in clarifying fundamental properties of the human visual white matter as well as identifying useful network science biomarkers for predicting degenerative changes in the Alzheimer's brain. We publish the method with software compatible with data from the Human Connectome Project, the Alzheimer Disease Neuroimaging Initiative, and Indiana Alzheimer Disease Center Data. The software integrates the Brain Connectivity Toolbox and is available open source [GitHub.com/brain-life](https://github.com/brain-life).

*Host:* Paolo Avesani

*Co-Host:* David Melcher

## Transfer-Learning Talk

*When:* Thursday, 20th July, 4 - 5 PM

*Where:* Mattarello, Via delle Regole 101 , Conference Room

*Speaker:*

- Grégoire Borst

*Title:* **Cognitive control, neurocognitive development and education from childhood to adulthood**

*Abstract:* I will present researches conducted in my lab on the role of cognitive control in neurocognitive development and school learnings from childhood to adulthood. In particular, I will present data showing (a) that the progressive ability to solve logicomathematical problems, to adopt a third person perspective and to generate creative ideas is rooted on the growing ability to inhibit misleading strategies, (b) that cognitive control can generalize over different tasks and can operate outside of consciousness and (c) that the sulcal morphology of the brain, a stable feature of the brain determined in utero and not affected by brain maturation, constraints the development of cognitive control and reading in children, adolescents and adults.

*Host:* Giorgio Coricelli

## Transfer Learning Seminar

*When:* Thursday, 13th July, 3.30 - 4.30 PM

*Where:* Mattarello, Via delle Regole 101 , Conference Room

*Speaker:*

- Mehdi Keramati, UCL (UK)

*Title:* **Planning, under cognitive limitations**

*Abstract:* The computational theory of reinforcement learning offers several ways of evaluating possible actions and making choices. Habitual decision making, forward planning, backward planning, and pruning are some of those strategies that are proven to be particularly relevant to how humans and other animals make decisions. However, each strategy has its pros and cons in terms of cognitive resources and time it consumes. This suggests a competition and cooperation between these strategies in order to make the best use of cognitive resources, given the features of the task in hand. In this talk, I will review several works where we and others studied the involvement of these strategies in decision-making and their competition and cooperation in the face of different cognitive limitations.

*Host:* Giorgio Coricelli

## Talk

*When:* Thursday, 13th July, 10.30 - 11.30 AM

*Where:* CIMeC Corso Bettini 31, Rovereto 1st floor seminar room

*Speaker:*

- Matthias Niemeier, Associate Professor at the University of Toronto Scarborough

*Title:* **Right-brain lateralization for action and perception**

*Abstract:* The corpus callosum is a computational bottleneck that is believed to constitute a driving force of brain organization. Specifically it should cause lateralization of functions underlying tasks that require information integration (a) from and/or for both hemispheres, (b) that is irreducible, and (c) that is computationally expensive. All three criteria apply to the two sets of tasks that I will focus on in my talk. The first is bimanual grasping where two hands are used to prehend one object and where the sight of the object

needs to be used to holistically compute the points at which to grasp the object, arguably within one hemisphere. I will show that bimanual grasp control is right-brain dominant: It features a left visual field preference; transcranial stimulation suggests that it relies on grasp- and bimanual coordination-related areas in parietal cortex; and it yields motor priming benefits when people switch from unimanual grasping with their left (but not their right) hand to bimanual grasping. Furthermore, I will argue that similar mechanisms will be employed to compute grasp-like actions jointly performed with another person, consistent with the long-held assumption that sensorimotor control serves as a seed mechanism of social cognitions. The second focus of my talk is perceptual judgments of spatial magnitudes in the left and right visual field. These tasks have garnered interest in the context of functions of spatial attention and visual awareness and reveal deficits in right-brain damaged patients with spatial neglect. However, beyond the observations in patients the precise nature of the intact functions of attention and awareness, often called "pseudoneglect," remain unknown. I will present new paradigms and effects together with electrophysiological and functional imaging data to suggest that pseudoneglect is associated with a parietal and ventro-frontal network that attains right dominance through interhemispheric competition. Further I will show that pixel noise superimposed onto perceptual judgment stimuli, much like a TV image with poor reception, creates substantial behavioural biases to the left side opposite to spatial neglect. Our research suggests that this noise effect results from visual activation and that it is found for perceptual judgments but not during visual search, another measure of pseudoneglect. Crucially, visual search and perceptual judgments differ in that only the latter requires data-intensive integration of information across hemispheres, perhaps relying on iconic memory buffers in right frontal cortex. Our results suggest that lateralization together with computational affordances serve to attain a more fundamental understanding of the human brain's functions for action and perception.

*Host:* Simona Monaco

### Transfer-Learning Seminar

*When:* Wednesday, 12th July, 2 - 3 PM

*Where:* CIMeC Mattarello via delle regole 101, Conference room

*Speaker:*

- Andrea Brovelli

***Title:* Neural and computational bases of instrumental learning in individual and social context**

*Abstract:* I will present results from fMRI studies on the role of fronto-striatal circuits in the acquisition and early consolidation of arbitrary visuomotor associations (Brovelli et al., 2008; 2011). Then, I will describe a dual-system computational model that can predict both performance (i.e., participants' choices) and modulations in reaction times during learning (Viejo et al., 2015). Finally, I will present results from two fMRI studies investigating the neural circuits that govern associative learning by observation (Monfardini et al., 2013) and neural modulations due to social comparison effects (Brovelli et al., in preparation).

*Host:* Giorgio Coricelli

### Premesor Talk

*When:* Wednesday, 12th July, 11.30 AM

*Where:* ACN lab - seminar room, II floor, Piazza della Manifattura 1 - Building n. 14

*Speaker:*

- Mark E. Hauber, City University of New York and University of Illinois, Urbana-Champaign

***Title:* Self- and species recognition in brood parasitic birds**

*Abstract:* Obligate brood parasitic birds, including cuckoos and cowbirds, face critical constraints in their social recognition systems: in the absence of suitable referents (parents and siblings), they must use cues other than social partners to learn about their own species. Here I review 20 years of our research into the behavioral

and neural mechanisms of species recognition in brood parasitic birds and contrast these to the species recognition mechanisms of their hosts, focusing on the context of egg and nestling discrimination in parasitized broods.

*Host:* Giorgio Vallortigara

### Transfer-Learning Seminar

*When:* Monday, 10th July, 11 AM - 12 AM

*Where:* CIMeC, via delle Regole 101, Mattarello

*Speaker:*

- Kai Gørgen, Research Associate, Charité, University Hospital Berlin

***Title: The Same Analysis Approach: Detect, Avoid & Eliminate Confounds in Neuroimaging and other Data Analysis***

*Abstract:* Classical design principles (e.g. randomization) and control analyses (e.g. on behavioural errors, reaction time, age) are routinely applied in many studies. It is typically not tested however whether these work together with new analysis methods, that involving e.g. cross-validation, classifiers, or permutation testing. I will show that – counterintuitively – such standard practices can lead to the exact opposite of what they should achieve: Classical design principles can induce confounds instead of controlling them, and standard control analyses can give false certainty that confounds have been controlled, even if they have not. This can cause systematic positive or negative biases (such as significant below-chance accuracies), potentially yielding false positive results or suppressing real effects. As a remedy, I present "the same analysis approach (SAA)" — a framework to detect, avoid, and eliminate a large class of potential confounds and other potential errors. The main idea is to perform the to-be-employed analysis on (i) design variables, (ii) control data, and (iii) artificial simulations. Although our examples come from neuroimaging, similar arguments apply to other fields such as psychology or machine learning.

*Host:* Giorgio Coricelli

### CIMeC Talk

*When:* Thursday, 13th July, 10:30 AM - 11:30 AM

*Where:* CIMeC Corso Bettini 31, Rovereto 1st floor seminar room

*Speakers:*

- Matthias Niemeier, Associate Professor at the University of Toronto Scarborough

***Title: Right-brain lateralization for action and perception***

*Abstract:* The corpus callosum is a computational bottleneck that is believed to constitute a driving force of brain organization. Specifically it should cause lateralization of functions underlying tasks that require information integration (a) from and/or for both hemispheres, (b) that is irreducible, and (c) that is computationally expensive. All three criteria apply to the two sets of tasks that I will focus on in my talk. The first is bimanual grasping where two hands are used toprehend one object and where the sight of the object needs to be used to holistically compute the points at which to grasp the object, arguably within one hemisphere. I will show that bimanual grasp control is right-brain dominant: It features a left visual field preference; transcranial stimulation suggests that it relies on grasp- and bimanual coordination-related areas in parietal cortex; and it yields motor priming benefits when people switch from unimanual grasping with their left (but not their right) hand to bimanual grasping. Furthermore, I will argue that similar mechanisms will be employed to compute grasp-like actions jointly performed with another person, consistent with the long-held assumption that sensorimotor control serves as a seed mechanism of social cognitions. The second focus of my talk is perceptual judgments of spatial magnitudes in the left and right visual field. These tasks have garnered interest in the context of functions of spatial attention and visual awareness and reveal deficits in

right-brain damaged patients with spatial neglect. However, beyond the observations in patients the precise nature of the intact functions of attention and awareness, often called "pseudoneglect," remain unknown. I will present new paradigms and effects together with electrophysiological and functional imaging data to suggest that pseudoneglect is associated with a parietal and ventro-frontal network that attains right dominance through interhemispheric competition. Further I will show that pixel noise superimposed onto perceptual judgment stimuli, much like a TV image with poor reception, creates substantial behavioural biases to the left side opposite to spatial neglect. Our research suggests that this noise effect results from visual activation and that it is found for perceptual judgments but not during visual search, another measure of pseudoneglect. Crucially, visual search and perceptual judgments differ in that only the latter requires data-intensive integration of information across hemispheres, perhaps relying on iconic memory buffers in right frontal cortex. Our results suggest that lateralization together with computational affordances serve to attain a more fundamental understanding of the human brain's functions for action and perception.

*Host:* Simona Monaco

#### CIMeC PhD Colloquium

*When:* Friday, 7th July, 10AM - 11AM

*Where:* CIMeC, Corso Bettini 31 Rovereto, 1st floor Conference Room

*Speakers:*

- Valeria della Maggiore, Director of the Physiology of Action Lab Universidad de Buenos Aires

*Title:* **Impact of conflicting material on motor learning and consolidation**

*Abstract:* Anterograde interference (AI) usually refers to the impact of prior learning on the ability to successfully learn a subsequent, conflicting task. AI has been unambiguously reported in visuomotor and force-field adaptation tasks. It has even been suggested that AI may be stronger than retrograde effects, thereby masking the effect of interest in retrograde protocols aimed at studying consolidation. Yet, none of the work aimed at examining the magnitude of AI have actually quantified its effect on the speed of learning. In this seminar, I will show recent data from our lab in which we dissociated the impact of prior learning on the initial level of performance from its impact on the speed of learning and long-term memory. Contrary to current views, our results indicate that anterograde effects in visuomotor adaptation do not significantly affect the ability to learn conflicting material. Yet, it hampers memory retention, suggesting that it may however interfere with memory consolidation. Our findings may explain the failure of retrograde protocols to unveil memory consolidation in this type of motor learning.

*Host:* Luca Turella

#### CLIC Seminar

*When:* Monday, 19th June, 3.30PM - 5.00PM

*Where:* Seminar room, third floor, CIMeC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speakers:*

- Sudeep Bhatia (University of Pennsylvania)

*Title:* **Knowledge Representation in Decision Making**

*Abstract:* I discuss how insights from computational linguistics can be used to build models of judgment and decision making with human-like knowledge representations. In addition to specifying the psychological mechanisms people use to form beliefs and preferences, these models also represent the information on which these psychological mechanisms operate. Subsequently, they are able to deliberate over and respond to a large variety of naturalistic decision problems, and moreover, mimic human responses to these problems.

These models shed light on the processes at play in everyday decision making, and illustrate a novel approach to predicting real-world behavior.

*Host:* Katya Tentori

#### PREMESOR Seminar

*When:* Wednesday, 7th of June, 11.00AM - 12.00PM

*Where:* ACN lab - seminar room, II floor, Piazza della Manifattura 1 - Building n. 14 Borgo Sacco (Rovereto)

*Speaker:*

- Massimo Piattelli-Palmarini - Professor of Cognitive Science, Cognitive Science, Linguistics, & Psychology at the University of Arizona

*Title:* **Normal languages in abnormal brains**

*Abstract:* There is little doubt that, in the adult, specific brain lesions cause specific language deficits. Yet, brain localizations of linguistic functions are made problematic by several reported cases of normal language in spite of major brain anomalies, mostly, but not exclusively, occurring early in life. The signal cases are hydrocephaly, spina bifida and hemispherectomy. These cases are discussed and possible solutions are suggested: namely a vast redundancy of neurons and/or the role of microtubules as neuron-internal processors and key factors in signaling and guiding the growth and reconfiguration of the brain.

*Host:* Giorgio Vallortigara

#### CLIC Seminar

*When:* Thursday, 18th of May, 3.30PM - 5.00PM

*Where:* Meeting Room, second floor, CIMeC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- Ivan Donadello, FBK (Trento)

*Title:* **Logic Tensor Networks for Semantic Image Interpretation**

*Abstract:* Semantic Image Interpretation (SII) is the task of extracting structured semantic descriptions from images. It is widely agreed that the combined use of visual data and background knowledge is of great importance for SII. Recently, statistical relational learning (SRL) approaches have been developed to deal with reasoning and learning in the presence of rich data and knowledge under uncertainty. Logic Tensor Networks (LTNs) is an SRL framework which integrates neural networks with first-order (fuzzy) logic in an attempt to allow (i) efficient learning from noisy data in the presence of logical constraints and (ii) reasoning with logical formulas describing properties of the data. We develop and apply LTNs to two of the main tasks of SII, namely, classification of bounding boxes and the detection of part-of relations between bounding boxes. To the best of our knowledge, this is the first application of SRL to such SII tasks. The proposed approach is evaluated on a standard image processing dataset. Experiments show that the use of background knowledge in the form of logical axioms improves the performance of the state-of-the-art data-driven approaches in both tasks. Moreover, we show that the use of background logical knowledge adds robustness to the learning system in the presence of erroneous training data.

*Host:* Raffaella Bernardi

## CLIC Seminar

*When:* Wednesday, 10th of May, 3.30PM - 5.00PM

*Where:* Seminar Room, third floor, CIMeC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- Davide Crepaldi

*Title:* **The Reading Brain as a Statistical Learning Machine**

*Abstract:* Morphology's very heart lies in the bridging between form and meaning in the classical definition provided by theoretical linguistics. However, recent results have shown that, at least early during visual word identification, morphological phenomena may arise on the basis of form alone -- genuinely complex words (e.g., DEALER, which is someone who deals) and pseudo-morphological words (e.g., CORNER, which isn't someone who corns) are treated alike [1,2]. The reason behind these surprising set of data is still unclear. Bringing together data from animal research [3,4], positional constraints in morpheme identification in humans [5], and morphological effects in simple word recognition [6], I will illustrate one possible interpretation of these data, namely, that reading builds heavily on general learning mechanisms implemented into the ventral stream (and perhaps more widely in the brain), which capture regularities in letter co-occurrence whose primary origin is morphology itself.

## Transfer-Learning Seminar

*When:* Thursday, 20th of April, 4.00PM - 5.00PM

*Where:* Conference Room, CIMeC Via delle Regole 101, Mattarello

*Speaker:*

- Adam Zylbersztejn, Assistant Professor, University of Lyon 2 and GATE-LSE

*Title:* **Commitment with and without money: an experiment**

*Abstract:* We experimentally study commitment devices in the trust game with pre-play communication. We first replicate the well-known finding that bare communication does not improve cooperation. Then, we enrich this communication environment by introducing additional mechanisms: (i) monetary commitment for truth-telling achieved through a cost of lying (either "mild" or "deterrent"), and (ii) non-monetary commitment for truth-telling achieved via a truth-telling oath. The deterrent cost of lying induces the highest levels of cooperation, outperforming both the mild cost of lying and the truth-telling oath. The truth-telling oath has a positive effect on cooperation and performs as good as a mild cost of lying. However, combining monetary and non-monetary devices does not bring any improvement as compared to either of these mechanisms. Furthermore, maintaining cooperation over time through communication requires strong monetary incentives for honesty. Commitment devices also change the patterns of communication: there are fewer messages announcing cooperation and higher levels of cooperation conditional on such messages. The intensity of these effects varies across treatments and reaches its peak for the deterrent cost of lying. These data support the hypothesis that external commitment devices dissuade untrustworthy agents from making deceptive announcements.

*Host:* Giorgio Coricelli

## IIT Seminar

*When:* Wednesday, 19th of April, 2.00PM - 3.00PM

*Where:* Seminar Room, third floor, CIMeC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- Jennifer Whitesell, Scientist at the Allen Institute for Brain Science, Seattle, Washington, United States

*Title:* **An anatomical correlate of the mouse default mode network**

*Abstract:* The default mode network (DMN) has been described in humans and nonhuman primates using resting state functional MRI (fMRI), and recently a rodent correlate was observed using fMRI in anesthetized rats and mice. Altered DMN functional connectivity has been observed in a variety of pathological conditions including Alzheimer's and Parkinson's diseases. As a first step in understanding the mechanism of this pathological network degeneration, we are examining the structural connectivity underlying the functionally-defined rodent DMN using several viral-based mesoscale connectivity mapping approaches in mice. Using a DMN consensus map based on fMRI data registered to the Allen Institute Common Coordinate Framework, we identified brain regions belonging to the DMN, then performed paired stereotaxic injections of retrograde CAV2-Cre virus and anterograde rAAV expressing Cre-dependent fluorescent protein (eGFP) in pairs of regions inside and outside the DMN. One DMN region, the retrosplenial cortex, possesses at least two classes of target-defined cell types, one that projects preferentially to DMN regions and another that projects to regions outside the DMN, while other DMN regions seem to have only one projection pattern. I will present the results from our ongoing analysis of anatomical connectivity tracing in the context of a functionally-defined network.

*Host:* Alessandro Gozzi

## CIMeC PhD Seminar

*When:* Wednesday, 12th of April, 10.30PM - 12.00PM

*Where:* Seminar Room, third floor, CIMeC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- Femke T.A. Buisman-Pijlman

*Title:* **Addiction: impacting on pleasure, attention and decision making**

*Abstract:* Addiction is a common problem, but we are still increasing our knowledge of the underlying biological processes that maintain it. Although specific drugs target specific targets in the brain, addiction to a range of drugs results in similar adaptations. Chronic use changes the pleasure from use, attention to drugs cues over other information, decision making and other brain processes. In this lecture we will explore these changes and their underlying biological footprint as well as the research methods that can be used to investigate the different aspects of addiction.

*Host:* Massimiliano Zampini

## CIMeC Seminar

*When:* Tuesday, 11th of April, 3.00PM - 4.00PM

*Where:* Seminar Room, third floor, CIMeC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- Konstantinos Tsetsos

*Title:* **Selective integration: The mechanistic basis and normative justification of decision irrationality**

*Abstract:* Humans violate rational choice theory but why they do so remains unclear. I will present a new model, dubbed selective integration, according to which decision irrationality stems from an early processing bottleneck that dampens the gain of processing of weaker inputs. This bottleneck, besides from leading to violations of axiomatic decision theory (such as violations of the axioms of transitivity and regularity), can have a positive role by being able to nullify the influence of late noise arising beyond the sensory stage. I will present a series of experiments, in which the ameliorative role of selective integration is confirmed, suggesting that apparently irrational decisions are a side effect of a rational evidence accumulation process. I will close by alluding to the neurochemical basis of selective integration, showing that the pharmacological enhancement of cortical inhibition results in stronger decision irrationality patterns in healthy individuals.

*Host:* Katya Tentori

### MADVIS Seminar

*When:* Friday, 7th of April, 2.00 PM - 3.30PM

*Where:* Seminar Room, third floor, CIMeC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- Daniel Casasanto, Associate Professor of Psychology and Neuroscience, University of Chicago

*Title:* **Spatializing time and number: How culture shapes cognitive universals**

*Abstract:* People use space to conceptualize abstract domains like time and number. This tendency may be a cognitive universal, but the specifics of people's implicit space-time and space-number associations vary across cultures. How does culture shape our abstract concepts? In Western cultures, both time and numbers are arranged in people's minds along an imaginary horizontal line, from left to right, but in other cultures the directions of the mental timeline (MTL) and mental number line (MNL) are reversed. The directions of both the MTL and the MNL have long been assumed to depend on the direction in which people read and write text. In this talk I'll argue that this assumption is false, and show how different aspects of cultural experience determine the direction of the MTL and the MNL. The distinct experiential bases of the MTL and MNL were predicted on the basis of a general principle, which we call the CORElations in Experience (CORE) principle: People spatialize abstract domains in their minds according to the ways these domains are spatialized in the world.

*Host:* Olivier Collignon

### ACN Seminar

*When:* Thursday, 6th of April, 3.00PM - 4.00PM

*Where:* ACN lab II°Floor, P. Manifattura 1, Rovereto (TN)

*Speaker:*

- Gillian Forrester, PhD, Birkbeck, University of London

*Title:* **Hand dominance and the Evolution of Human Cognition: A Cross-Species Perspective**

*Abstract:* The investigation of human cognition benefits from a dual perspective approach, as the evolution and development of modern human abilities are inextricably linked. It is widely acknowledged that humans demonstrate population-level right-handedness, linked with dominant left hemisphere control of language processes. Additionally, it is recognized that a significant majority of mothers cradle their infants with their heads resting on the left arm, associated with a right hemisphere dominance for social-emotional processing. Yet, in both cases, species-unique, causal relationships are debated. The following presentation focuses on behavioural evidence from human and non-human animals supporting a theoretical supposition that evolutionarily old left and right hemisphere dominances for primitive survival behaviours provided a platform

for the evolution and development of sophisticated communication and social-emotional abilities in modern humans. Moreover, it is hypothesised that primitive cerebral dominances still play a critical role in the typical development of cognition in children.

*Host:* Giorgio Vallortigara

#### ACN Seminar

*When:* Wednesday, 5th of April, 10.00PM - 11.00PM

*Where:* ACN lab II<sup>o</sup>Floor, P. Manifattura 1, Rovereto (TN)

*Speaker:*

- Ivo D. Popivanov, PhD, Department of Cognitive Science and Psychology at the New Bulgarian University

***Title:* Neural representation of bodies in the primate inferotemporal cortex**

*Abstract:* Perception of bodies is an important process which animals (including non-human primates and humans) perform effortlessly every day. The information which is decoded from visual inspection of bodies can be instrumental for survival – e.g. distinguishing bodies of dangerous animals from conspecifics. Furthermore, analysis of body posture can provide various non-verbal signals useful for decoding the emotional state, intentions, attitude, etc. Despite the importance of body perception, the neural mechanisms underlying it are not fully understood yet. During this talk several studies performed in the Laboratory of Neuro- and Psychophysiology in Leuven, Belgium, will be presented aiming at shedding more light on how body perception is performed in the brain. Two distinct brain regions involved in representing bodies were localised by functional Magnetic Resonance Imaging (fMRI) in the inferotemporal cortex of four rhesus monkeys. Then, one of these regions was targeted with electrodes for recording single cell responses to 100 stimuli of different classes (bodies, faces, and artificial objects). The tolerance of the neurons to different image transformations preserving the stimulus identity was also studied. We found that the neurons in the more posterior body patch (midSTS) respond on average higher to bodies than to other stimuli (including artificial objects and faces), however individual neurons had heterogeneous responses, responding only to few body exemplars but never to all bodies (high within-class selectivity). Most of the neurons were tolerant to identity preserving transformations (such as scaling and change of the location within the receptive field). On the other hand, they were not tolerant to planar rotation of the stimuli.

*Host:* Giorgio Vallortigara

#### IIT Talk

*When:* Tuesday, 4th of April, 2.30PM - 3.30PM

*Where:* Seminar Room, third floor, CIMeC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- Alexander Thiele, Professor of Visual Neuroscience at the University of Newcastle

***Title:* Attentional modulation of information exchange between cortical layers and cortical areas**

*Abstract:* Attention improves perceptual abilities and is required for decision making. Many aspects of the effects of attention at the cellular level have been investigated, but how it affects information exchange between different cortical layers and different cortical areas remains poorly understood. We recorded from all cortical layers in macaque area V1 and V4 simultaneously while macaque monkeys performed a cued top-down spatial attention task. In the talk I will delineate how different aspects of feed-forward and feedback signals are routed between layers in V1 and in V4 as well as between different layers of V1 to different layers of V4 (and vice versa).

*Host:* Stefano Panzeri

## CIMeC Talk

*When:* Monday, 3rd of April, 3.30PM

*Where:* Sala Convegni 1°Floor, (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- M.Sc Alexandre Gauvin, SCIL - Université de Sherbrooke, Québec, Canada | GIN - Université de Bordeaux, France

*Title:* **Every (neural) fiber of your being?**

*Abstract:* Tractography is the only method enabling neuroscientists to virtually dissect white matter neural pathways in vivo. Unfortunately this method is highly dependent on the chosen models and parameters. Also, among algorithms available today, none can claim to accurately represent the underlying biology. In fact, there are many challenges to face along the processing pipeline, from data acquisition to tracts analysis. How do we assess the quality and reproducibility of tractograms?

*Host:* Jorge Jovicich

## CLIC Seminar

*When:* Thursday, 30th of March, 3.30PM - 5.00PM

*Where:* Seminar Room, third floor, CIMeC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- Francesca Franzon and Chiara Zanini, University of Padova

*Title:* **The conceiving of (un)countability and its encoding into language.**

*Abstract:* In our experience of the world, concrete entities, objects and substances, are visually perceived as having boundaries. Literature has highlighted the crucial role of boundaries in conceiving an entity and accordingly name it (Prasada et al., 2002; Chesney & Gelman, 2015). However, boundaries are not pertinent when denoting substances, thus references expressed by means of mass nouns and mass morpho-syntax (much butter) are more abstract than references expressed by means of count nouns and count morpho-syntax (a ring). The capability to recognize entities independently from their incidental shape is linked to non-linguistic logical operations such as abstraction, deduction, conservation (Vianello & Marin, 1997). Such abilities are not mature until the age of eight, whereas the acquisition of language is completed at five (Tomasello, 2003). Data from language acquisition (Zanini et al., 2016) will be compared with data collected on adult Italian native speakers. It will be argued that the nature of the differences between mass and count nouns reported in the literature is not totally lexical, and that it could be more economically explained in terms of frequency of occurrence and effects related to extra-linguistic abstraction abilities.

*Host:* Sandro Pezzelle

## Premesor Talk

*When:* Wednesday, 22nd of March, 11PM - 12PM

*Where:* ACN lab II°Floor, P. Manifattura 1, Rovereto (TN)

*Speaker:*

- Dr. Antone Martinho, Fellow by Examination | Magdalen College, Retained Lecturer | Pembroke College, Department of Zoology - University of Oxford

*Title:* **Concept Learning in Imprinting**

*Abstract:* Filial imprinting is the iconic ability of precocious birds to spontaneously learn to identify and follow their mother in the first days of life. While filial imprinting effects a limited portion of a birds' life history and is limited in the behaviours to which it pertains, recent evidence suggests a richer understanding of this form of learning, including the ability of juvenile birds to learn and represent abstract concepts through the imprinting mechanism. This talk will present some of the research that has evidenced this capability of abstraction and discuss why capacity for abstraction is necessary, even in this narrow learning modality.

*Hosts:* Giorgio Vallortigara

### CIMEC Talk

*When:* Thursday, 16th of March, 12PM

*Where:* Seminar Room, third floor, CIMEC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- Professor Bharat Biswal, Professor and Chair of Biomedical Engineering, New Jersey Institute of Technology, USA

*Title:* **Dynamic functional connectivity**

*Abstract:* Prof. Biswal is an internationally known researcher recognized for starting the field of mapping functional connectivity of the brain "at rest". In this talk he will present his most recent work characterizing dynamic aspects of functional connectivity.

*Hosts:* Nivedita Agarwal, Jorge Jovicich

### IIT Seminar

*When:* Tuesday, 7th of March 2017, 3:00PM – 4.00PM

*Where:* Seminar Room, third floor, CIMEC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- prof. Jason Lerch, Associate Professor, Department of Medical Biophysics, University of Toronto

*Title:* **Autism: the surprising role of the cerebellum**

*Abstract:* The cerebellum, as traditionally taught, serves to integrate motor outputs with sensorimotor inputs, and thus coordinates smooth and effective movements. Yet more and more evidence is emerging that the cerebellum plays a potentially critical role in autism, a disorder characterized by social deficits and repetitive behaviours. Here I will talk about a series of both mouse and human brain imaging studies that implicate cerebellar alterations in autism and related neurodevelopmental disorders, including its role in brain networks and sensitivity to environmental manipulation.

*Host:* Alessandro Gozzi

### CLIC Seminar

*When:* Thursday, 2nd of March 2017, 3:30PM – 4.30PM

*Where:* Seminar Room, third floor, CIMEC (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- Laura Rimell, University of Cambridge

*Title:* **Learning to Negate Adjectives with Bilinear Models**

*Abstract:* We learn a mapping that negates adjectives by predicting an adjective's antonym in an arbitrary word embedding model. We show that both linear models and neural networks improve on this task when they have access to a vector representing the semantic domain of the input word, e.g. a centroid of temperature words when predicting the antonym of 'cold'. We introduce a continuous class-conditional bilinear neural network which is able to negate adjectives with high precision.

*Host:* Aurelie Herbelot

### IIT Seminar

*When:* Thursday 23rd of February 2017, 11PM – 12PM

*Where:* Seminar Room, third floor CIMeC, (Palazzo Fedrigotti), Corso Bettini 31, Rovereto

*Speaker:*

- prof. Michela Fagiolini, Associate Professor at Children's Hospital of Harvard University

*Title:* **Circuit analysis and novel therapies in neurodevelopmental disorders**

*Abstract:* Our research has identified for the first time a visual phenotype in mouse models of Rett Syndrome and demonstrated its rescue by environmental and genetic manipulation (Durand et al, Neuron 2012). These results have paved the way to the identification of a specific role for Mecp2 in the experience-dependent refinement of cortical circuits by regulating the excitation of pivotal inhibitory neurons (Mierau et al., Biological Psychiatry 2015). The identification of a particular receptor pathway within a specific cortical circuit offers an accessible membrane target for drug intervention strategies that do not rely on the re-expression of Mecp2 itself. Dr. Fagiolini's laboratory has recently completed a pre-clinical trial of a low dose of ketamine, a FDA-approved NMDA antagonist, in a murine model of RTT (Patrizi et al., Biological Psychiatry 2016). Daily exposure to ketamine reverses deficits in cortical neuronal activity and connectivity in conjunction with significant improvements in general health and survival. Since human studies have also identified abnormalities in NMDA receptor subunits early on in RTT, it is possible that drugs modulating NMDA receptors may be able to prevent or delay the developmental regression that occurs in girls with RTT. The results found in the animal models strongly suggests that visual processing in RTT patients may also be altered and can be used as a robust biomarker of both cortical status and its response to therapy. To this end, Dr. Fagiolini has begun a fruitful collaboration with the Rett Clinic at BCH and the laboratory of Cognitive Neuroscience to assess the cortical function of the visual system in young girls with RTT using visual evoked potentials (VEP) as previously done in Mecp2 mutant mice. Remarkably, they found significant differences between typically developing children and RTT patients (Le Blanc et al., Annals of Neurology 2015) supporting the introduction of standardized VEP analysis in clinical and research settings to probe the neurobiological mechanism underlying functional impairment and to longitudinally monitor progression of the disorder and response to treatment.

*Host:* Alessandro Gozzi

### CIMeC PhD Talk

*When:* Monday 20th of February 2017, 10:30PM – 12:00PM

*Where:* Palazzo Istruzione, Aula 6, Aula Magna, Corso Bettini 84, Rovereto, Province of Trento, Italy

*Speaker:*

- Chris Chambers, Professor of Cognitive Neuroscience, School of Psychology, Cardiff University, UK

*Title:* **The Registered Reports project: A vaccine against research bias?**

*Abstract:* In 2013 the journal Cortex became the first outlet to offer Registered Reports, a format of pre-registered empirical publication in which peer review happens prior to data collection and analysis (see <https://cos.io/rr/>). The philosophy of Registered Reports is that in order to counteract publication bias and

various forms of researcher bias (such as p-hacking and hindsight bias), the publishability of a scientific study should be decided by the importance of the research question and rigour of the methodology, and never based on the results of hypothesis testing. In this talk I will provide an update on the progress of Registered Reports at Cortex and beyond, including uptake by more than 40 journals. I will focus in particular on some of the emerging challenges of the format as it has expanded, together with insights it has offered into forms of bias within both research and the peer review process. Together with allied initiatives, Registered Reports are helping to reshape the incentive structure of the life sciences to place transparency and reproducibility on par with conventional indicators of scientific quality.

*Host:* Francesco Pavani

#### CIMeC Talk

*When:* Wednesday 15th of February 2017, 1:00PM – 2:30PM

*Where:* CIMeC Corso Bettini, 31, Rovereto, Province of Trento, Italy 1st floor meeting room

*Speaker:*

- Aurelie Herbelot (University of Trento)

*Title:* **High-risk learning: acquiring concepts and things from tiny data**

*Abstract:* Humans are able to grasp the meaning of a new word extremely rapidly: often, a single sentence suffices for an educated guess. In a similar fashion, they can build a complex picture of a particular person or object from very reduced information. This extraordinary ability is still out of reach for state-of-the-art computational systems. Whilst the field of distributional semantics has made much progress in modelling the meaning of words and their composition, current systems still require exposure to huge corpora to simulate basic human semantic judgments. In this talk, I'll present a neural model of nonce word acquisition which, given some previously learnt semantic knowledge, can derive a reasonable representation of a new lexical item from tiny data. The strategy used is 'high-risk' in that the system has to trust the informativeness of the provided data, and accordingly update its parameters, in a way that would normally be seen as detrimental over a large corpus. Contrarily to previously proposed methods, this approach is an extension of a standard distributional semantics architecture, which is desirable from the point of view of creating a generic and incremental model of semantic knowledge acquisition. To illustrate this, I will sketch how, in principle, the model can be applied to learning representations of single instances, relating the acquisition of 'concepts' and 'things' in a single framework.

*Host:* Raffaella Bernardi

#### CIMeC Talk

*When:* Tuesday, 24th of January 2017, 10:30AM – 11:30AM

*Where:* Corso Bettini, 31, Rovereto, Province of Trento, Italy 1st floor Conference Room

*Speaker:*

- Dr. Gesa Hartwigsen, Department of Neuropsychology Max Planck Institute for Human Cognitive and Brain Sciences

*Title:* **Modulation of language networks: Insights from TMS and neuroimaging**

*Abstract:* Language is an elementary mental capability that humans use to communicate. In this talk, I will discuss how transcranial magnetic stimulation (TMS) and functional neuroimaging can be used to characterize interactions, adaptive plasticity and effective connectivity in the healthy language network. The first part of my talk focuses on the use of TMS during a language task to elucidate the contribution of the stimulated area to a specific language function. Here, I will address the role of different key regions for language comprehension on the word and sentence level. The second part of my talk is related to the combination of plasticity-inducing TMS before a task and subsequent functional neuroimaging to elucidate adaptive plasticity

during semantic processing. I will show that a TMS-induced perturbation might suppress task-related activity not only in the stimulated area, but in a large task-specific network for semantic processing. Moreover, TMS can also modulate the effective connectivity within this network. Finally, I will discuss how the upregulation of neighboring regions after a TMS-induced perturbation of a semantic key region can contribute to a better understanding of short-term reorganization and plasticity in the healthy language network. As an outlook, I will present novel TMS-fMRI data on the investigation of adaptive plasticity in the reorganized language network in patients with chronic post-stroke aphasia.

*Host:* Giorgio Vallortigara