

3rd Edition

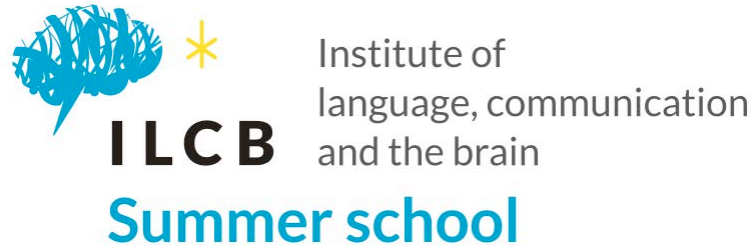
2020

**31st August
4th September**

CIRM

Centre International de Rencontres Mathématiques

Marseille, France



The 3d Edition of the ILCB Summer School offers Introductory, Intermediate and Advanced Classes in four core fields of Cognitive Science, reflecting the expertise of the Institute:

- Applied mathematics, statistics and networks;
- Neuroscience and behavior;
- Language and cognition;
- Computer science and machine learning.

Keynotes and social events complete this week of immersion.

KEYNOTE: Prof. Jonathan GRAINGER

Contact: contact@ilcb.fr

Registration until July 27th, 2020, at: <https://conferences.cirm-math.fr/2158.html>

Fees: - ILCB Members: Free (please, contact the administration for detail of accomodation)
- Non-ILCB Members: 105€ /day/per for Full Board (including accomodation, meals and participation to social events)

Basic Courses

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	
9h	Welcome					9h
	Language & the Brain	Speech for Dummies	Language & Cognition	Language & Cognition	Language & Cognition	
	Kristof Strijkers	Thierry Legou	Ph. Blache & J. German	James German	Philippe Blache	
10h						10h
	Break	Break	Break	Break	Break	
11h	Brain for Dummies	Behavior: From Aristotle to Cognitive Science	Behavior: From Aristotle to Cognitive Science	Behavior: From Aristotle to Cognitive Science	The Predictive Brain	11h
	Benjamin Morillon	A. Meguerditchian & M. Montant	A. Meguerditchian & M. Montant	A. Meguerditchian & M. Montant	Daniele Schön	
12h						12h
Lunch						
14h	Imaging for Dummies	Statistics	Statistics	Statistics	Statistics	14h
	Christian Bénar	Frédéric Richard	Frédéric Richard	Frédéric Richard	Frédéric Richard	
15h	Break	Break			Break	15h
16h	Machine Learning	Machine Learning	Break	Break	Machine Learning	16h
	H. Kadri & S. Takerkart	Hachem Kadri		Machine Learning	H. Kadri & S. Takerkart	
17h	Break		Hiking in the Calanques	H. Kadri & S. Takerkart		17h
				Break		
18h	Social Event			Keynote		18h
				Jonathan Grainger		

Intermediate Courses

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	
9h	Welcome					9h
	Language & Emotion	Language & Emotion	Language & Emotion	Language & Emotion	Language & Emotion	
	<i>Caterina Petrone</i>	<i>Catherine Pélachaud</i>	<i>Pascal Belin</i>	<i>Aileen McGonigal</i>	<i>Galina Iakimova</i>	
10h						10h
	Break	Break	Break	Break	Break	
11h	Early Development of Communication	Early Development of Communication	Early Development of Communication	Roles of neural oscillations in cognitive processes	Roles of neural oscillations in cognitive processes	11h
	<i>Clément François</i>	<i>Isabelle Dautriche</i>	<i>Marianne Jover</i>	<i>Benjamin Morillon</i>	<i>Benjamin Morillon</i>	
12h						12h
Lunch						
14h	Linear Regression	Mixed Models	Mixed Models	Mixed Models	Mixed Models	14h
	<i>Royce Anders</i>	<i>Royce Anders</i>	<i>Royce Anders</i>	<i>Royce Anders</i>	<i>Royce Anders</i>	
15h						15h
	Break	Break			Break	
16h	Engineering Technics	Engineering Technics	Break	Break	Engineering Technics	16h
	<i>Thierry Legou</i>	<i>Valérie Chanoine</i>		Engineering Technics	<i>Valérie Chanoine</i>	
17h	Break		Hiking in the Calanques	<i>Deirdre Bolger</i>		17h
				Break		
18h	Social Event			Keynote		18h
				<i>Jonathan Grainger</i>		

Advanced Courses

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	
9h	Welcome					9h
	Beyond Chomskynner	Beyond Chomskynner	Beyond Chomskynner	Beyond Chomskynner	Beyond Chomskynner	
	Arnaud Rey	Arnaud Rey	Arnaud Rey	Arnaud Rey	Arnaud Rey	
10h						10h
	Break	Break	Break	Break	Break	
	Signal processing : spectral analysis, time- frequency and sparsity	Signal processing : spectral analysis, time- frequency and sparsity	Signal processing : spectral analysis, time- frequency and sparsity	Functional Connectivity and Information Theory	Functional Connectivity and Information Theory	
11h				Andrea Brovelli	Andrea Brovelli	11h
	Bruno Torresani	Bruno Torresani	Bruno Torresani			
12h						12h
	Lunch					
14h	Bayesian Statistics	BCI & Predictive Coding	Bayesian Statistics	Bayesian Statistics	BCI (softwares & algorithms)	14h
	Pierre Pudlo	Jérémie Mattout	Pierre Pudlo	Pierre Pudlo	Theo Papadopoulo	
15h						15h
	Break	Break			Break	
16h	Machine Learning: Deep Learning / NLP	Machine Learning: Decoding	Break	Break	Machine Learning: Deep Learning / NLP	16h
	Benoit Favre & Frédéric Béchét	Sylvain Takerkart		Machine Learning: Deep Learning / NLP	Benoit Favre & Frédéric Béchét	
17h			Hiking in the Calanques	Benoit Favre & Frédéric Béchét		17h
	Break					
	Social Event			Break		
18h				Keynote Jonathan Grainger		18h

SYLLABUSES

BASIC COURSES

Language & the Brain: TBA

Speech for Dummies: TBA

Language & Cognition: TBA

Brain for Dummies, *B. Morillon*

This course will provide a general overview of the human brain, mainly through a historical, theoretical, and structural viewpoint.

Behavior: From Aristotle to Cognitive Science, *A. Meguerditchian & M. Montant*

This course proposes an introduction to human and non-human animal behavior in relation to language studies and the question of the phylogenetic origins of the language faculty. The course is organized in two parts. In the first part, Adrien Meguerditchian will make a brief historical overview of how behavior is assessed over times, from Aristotle to Darwin, then he will describe the concepts and methods proposed by the behaviorist paradigm, the biology of behavior and the contemporary cognitive ethology. During the second part, Marie Montant will address several questions raised by the comparison between human and non-human animals. Then she will describe the relationship between the complexity of behaviors and brain evolution, and how human behaviors are measured in cognitive paradigms.

The Predictive Brain, *D. Schön*

D. Schön will give a lecture about the predictive brain : How do we perceive the world surrounding us? What is the role of memory? How many real worlds exist? To what extent our knowledge limits how we study brain functions? I will try to address these and other questions by adopting a musical view of brain functions.

Imaging for Dummies: TBA

Statistics: TBA

Machine Learning, H. Kadri

This course aims to provide an overview of problem solving and data modeling from a machine learning perspective. The concepts of data representation, distribution, statistics as well as training, validation and testing will be reviewed, as well as the details of some learning algorithms. Practical work will be performed on a concrete problem with standard tools, which will allow to see the basic concepts of programming in Python.

INTERMEDIATE COURSES

Language & Emotion, P. Belin, G. Iakimova, A. McGonigal, C. Petrone, C. Pélachaud

- The lecture of P. Belin will be dedicated to investigating how the brain processes information in voice, including emotions.
- With C. Pélachaud class, we will present computational methods to model socio-emotional behaviors for virtual agent, focusing on communicative acts, emotions, and social attitudes. We will cover the relation between mental states and nonverbal behaviors as well as their realization in an embodied conversational agent.

Early Development of Communication, I. Dautriche, C. François, M. Jover

- Clément François se focalisera sur le développement neuroanatomique des réseaux de langage ainsi que sur les phénomènes de neuroplasticité sous-tendant le développement précoce de la perception de la parole avec un focus sur le raffinement phonologique. Pour se faire, il présentera les résultats d'études comportementales et de neuroimagerie menées chez le nourrisson et le tout petit.
- Isabelle Dautriche's lecture will concern word learning. Word learning is often considered the simplest and least controversial aspect of language development. Although theorists fiercely debate the ontogenetic and phylogenetic origins of grammar, everyone agrees that words must be learned by observing the contexts in which they are used. No other theory can explain how English-speaking children come to use 'shoe' to label footwear, whereas young French speakers use the same sequence of sounds to label cabbage. However, this self-evident truth masks a host of questions about how learning occurs and the knowledge that children bring to the problem. In this class, I will provide an overview of what we know about word learning in the very first years of life.
- From a developmental point of view, it is unlikely that intentional communication appears from scratch at the end of the first year (Ramenzoni & Liszkowski, 2016). Presenting her current researches, Marianne Jover will focus on the early development of communicative gesture and adults' understanding of the infants' movements (Jover & Scola, 2018, Jover et al., 2019).

Roles of neural oscillations in cognitive processes, B. Morillon

These two courses will introduce the main mechanistic functions for which neural oscillations are believed to play a role in information processing: synchronisation of local and large-scale neural ensembles, inter-areal communication-through-coherence, and segmentation of continuous sensory information into discrete computational units. We will review different cognitive functions for which these mechanisms apply, such as spatial and temporal attention, and most importantly speech, language and communication.

Linear Regression & Mixed Models, R. Anders

This course will provide both the theoretical background and skills to apply regression/mixed models in R/RStudio. Mixed models are some of the most popular analytical approaches in the human sciences, and the R programming language is widely used in academia. Topics include (but are not limited to) loading and assessing the integrity of your data set (missing values, outliers, etc.), distributional analysis and visualisation, mathematical understanding and requirements for an appropriate regression/mixed model, data transformations, model application, model checks and optimization, model selection, and if time permits, generalized linear mixed models such as with the logit family.

Engineering Technics: TBA

ADVANCED COURSES

Beyond Chomskynner, A. Rey

In 1957, the publication of Syntactic structures by N. Chomsky and Verbal Behavior by B. F. Skinner introduced two radically different approaches to the study of language. After a brief and critical presentation of these approaches, I will pave the way to current approaches based on language use and implicit statistical learning, showing that these approaches have slowly created a favorable climate for a paradigm shift in the study of language processes. I will also argue that the central notion of syntax should certainly be reconsidered or eventually, abandoned.

Signal processing : spectral analysis, time-frequency and sparsity, B. Torresani

- Lecture 1 : Spectral analysis and time-frequency

The focus in this first lecture will be on signal analysis. We will review reference methods for spectral analysis (Fourier transform, periodogram), and time-frequency analysis (short time Fourier transform and periodogram, Gabor transform,...). If possible we will also briefly discuss iterated filter banks (convolution networks and scattering transform)

- Lecture 2 : Time-frequency and wavelets, synthesis

In the second lecture we will revisit time-frequency methods from the point of view of synthesis rather than analysis. We will describe the basics of frame theory, discrete transforms and the construction of linear systems defined in the time-frequency domain.

- Lecture 3 : Sparse time-frequency representations

The last lecture will be devoted to the concept of sparsity, and will focus on standard algorithms for constructing sparse time-frequency and wavelet representations.

Functional Connectivity and Information Theory, A. Brovelli

I will present an overview of the mathematical and computational tools for the analysis of functional connectivity (FC) among neural signals. I will introduce notions such as non-directed versus directed (e.g., Granger causality) FC, time- versus frequency-domain FC measures. Finally, I will present recent advances in Information Theory that allow the characterisation of task-related neural interactions.


Bayesian Statistics: TBA

BCI & Predictive Coding: TBA

BCI (softwares & algorithms) : TBA

Machine Learning: Deep Learning / NLP: TBA

Machine Learning: Decoding: TBA



Organizing Committee

Christian-G. BÉNAR
Caroline CHAUX-MOULIN
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