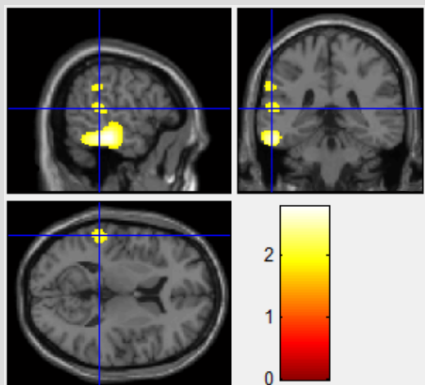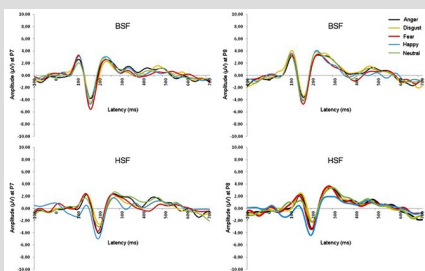# III CAN - 3rd Cognitive and Affective Neurophysiology Summer School: Acquisition, processing and analysis of EEG signal

Electroencephalography (EEG) and Event Related Potential (ERP) techniques applied to the study of cognitive and affective processes

Aims of the Summer School:

- Introduction to EEG and ERP applied to the study of cognitive and affective processes.
- Acquisition of electrophysiological data of brain activity.
- Signal processing (EEGLAB).
- Statistical analysis of the data.
- Fundamentals of source localization.

All the modules will have a hands-on component.

Scientific Coordination:

João Marques-Teixeira, MD, PhD
Fernando Barbosa, PhD
Fernando Ferreira-Santos, PhD
Pedro R. Almeida , PhD

Laboratory of Neuropsychophysiology

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E-mail: labnpf@fpce.up.pt

Intensive Summer School (40 hours).

Date: 8 to 13 of September 2014

Language: English

Basic knowledge of statistics required.

Venue: Faculty of Psychology and Educational Sciences, University of Porto.

Pre-registration: Until 18 of July 2014 (limit: 20 participants).

Registration form available at: http://www.fpce.up.pt/labpsi/summerschool/

Registration will be confirmed by 23 of July 2014

Course Fee: €300 (including all lunches)

Porto, 8-13 of September, 2014

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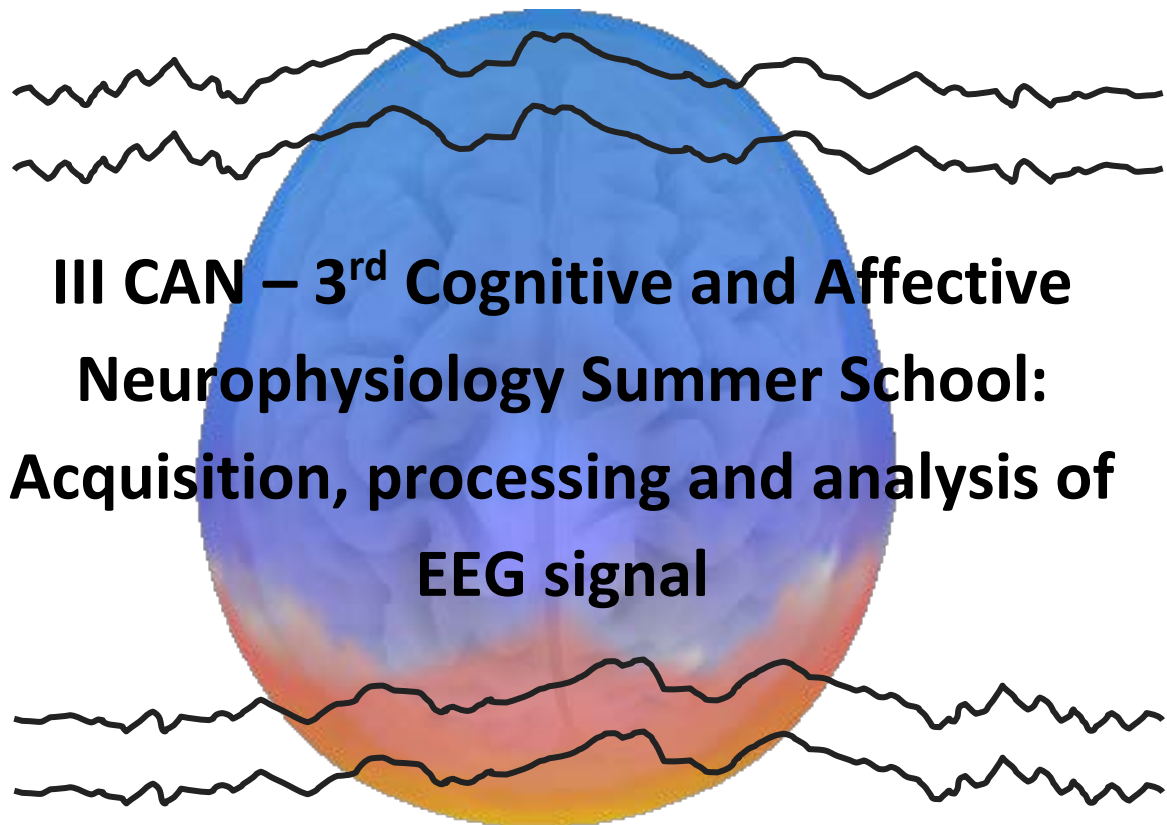
Preliminary information booklet

Laboratory of Neuropsychophysiology

U.PORTO
FACULDADE DE PSICOLOGIA
E DE CIÊNCIAS DA EDUCAÇÃO
UNIVERSIDADE DO PORTO

General information:

The Cognitive and Affective Neurophysiology Summer School is organized by the Laboratory of Neuropsychophysiology of the University of Porto. For information about our lab, please visit our website, http://www.fpce.up.pt/labpsi/.

Location:

The summer school will take place at the Faculty of Psychology and Education Sciences of the University of Porto (in Portuguese: *Faculdade de Psicologia e de Ciencias da Educacao da Universidade do Porto – FPCE-UP)*

Google Maps*:* http://goo.gl/maps/prtD8

How to get here?

By Air:

The closest airport is Porto Airport - Francisco Sá Carneiro:
http://www.ana.pt/en-US/Aeroportos/porto/Porto/Pages/Homepage-Porto.aspx

By Metro (Tram):

The D Line (yellow) connects 'Pólo Universitário' and 'Gaia', crossing the central station 'Trindade', where it has connection with Lines A (blue), B (red) and C (green). Leaving at the 'Pólo Universitário' station you are at FPCE-UP. For more information, see http://www.metrodoporto.pt/en/.

By Bus:

Bus lines (Route planner: http://www.itinerarium.net/wizard.aspx?ul=en-us):
Stop at: Igreja de Paranhos: 54 (AV.ALIADOS - PADRÃO MOREIRA)
Stop at: Rua Dr. Manuel Laranjeira: 38 (CAMPANHÃ - HOSP.S.JOÃO), 204 (HOSP.S.JOÃO - FOZ Mercado), 300 (CIRCULAR AV.ALIADOS - HOSP.S.JOÃO) e 301 (CIRCULAR SÁ DA BANDEIRA - HOSP.S.JOÃO)

By Car:

The best way to find FPCE-UP is to follow the signs to Paranhos / Hospital de São João.
Coming from the VCI: take the 'Paranhos / Hospital' exit off the freeway and stay to the right lane in the traffic lights at the 'Igreja de Paranhos' crossing. Turn right at the lights to the Rua do Dr. Manuel Pereira da Silva (street). A few yards further, turn on the first street to the left (where the Metro station of 'Polo Universitário' is located). You will find FPCE-UP to your l eft in that street.
Coming from Estrada da Circunvalação (EN12): go to 'Hospital de S. João' and, at the traffic lights, turn to the 'IPO - Instituto Português de Oncologia' (street: Rua António Bernardino Almeida). Go straight and turn left right before the streets becomes a two-way street. Then keep going until you find FPCE-UP on your right side.

Duration:

The course will take place between 8 (Monday) and 13 (Saturday) of September of 2014. The course duration will be 40 hours in total.

Faculty:

Professors João Marques-Teixeira (MD, PhD), Fernando Barbosa (PhD), Fernando Ferreira-Santos (PhD), and Pedro R. Almeida (PhD) are the scientific coordination team of the course.

Preliminary Schedule (may be subject to change – final version will be provided on site):

		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		9-Sep	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep
09:00	09:30	Opening and Introduction to EEG	Issues in EEG data collection	Signal processing (2)	Practicum: signal processing	Statistical analysis	
09:30	10:00						
10:00	10:30						
10:30	11:00						Fundamentals of source localization
11:00	11:30						
11:30	12:00		Signal processing (1)				
12:00	12:30						
12:30	13:00						
13:00	13:30	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
13:30	14:00						
14:00	14:30	Introduction to ERP	Practicum: EEG data collection	Practicum: signal processing	ERP analysis (time-domain)	Practicum: statistics	
14:30	15:00						
15:00	15:30						
15:30	16:00						
16:00	16:30						
16:30	17:00	Lab safety and hygiene			Practicum: ERP analysis		
17:00	17:30						

All lunches are included in the course (you will be provided with lunch coupons).

On Friday we will organise a social dinner and outing for those who are interested. This event is not included in the course fees. Details will be provided during the week.

Detailed Programme:

1. Introduction to the EEG/ERP techniques in Cognitive and Affective Neuroscience
    1.1. Electroencephalography (EEG)
        1.1.1. History
        1.1.2. Main discoveries and applications, EEG rhythms
    1.2. Principles of electricity
    1.3. Neurophysiological basis of the EEG signal
    1.4. Event-related potentials (ERP)
        1.4.1. History and technical definition
        1.4.2. ERP components: definition and overview
            1.4.2.1. Definition, classification, nomenclature, quantification
            1.4.2.2. Overview of the main components
    1.5. Technical basis of EEG/ERP
      1.5.1. Laboratory setting and recording equipment
      1.5.2. From the physical signal to the digital time-series
            1.5.2.1. Sensors, amplification, analog-to-digital conversion
            1.5.2.2. Sampling frequency, Nyquist-Shannon Theorem
2. Collecting EEG data
    2.1. Ethical guidelines and lab safety and hygiene
    2.2. Electrode positioning systems, montages, reference
    2.3. Software for recording and processing EEG/ERP data
3. Electrophysiological signal processing (using the freely available EEGLAB software)
    3.1. Introduction to time series analysis
    3.2. Digital filters
    3.3. Baseline correction
    3.4. Linear trend correction
    3.5. Event/response conditioning
    3.6. Removal/correction of artifacts
    3.7. Channel interpolation, downsampling
    3.8. Averaging and grand-averaging
    3.9. Quantification of ERPs in the time domain
    3.10. Advanced EEG/ERP analyses (short overview)
4. Statistical analysis of results
    4.1. Parametric statistical techniques (mean differences and analysis of variance)
        4.1.1. The sphericity problem
        4.1.2. The multiple comparisons problem
    4.2. Classical ERP component approach vs. mass-univariate approach/SPM
5. Fundamentals of source localization
    5.1. The forward and inverse problems in EEG source localization
    5.2. Equivalent current dipole modelling
    5.3. Distributed source solutions

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