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Department of Neurosciences
University of Medicine and Pharmacy "Iuliu Hatieganu"
Cluj-Napoca | Romania

EYE TRACKING IN NEUROSCIENCES

JUNE 2ND, 2016

"RoNeuro" Institute for Neurological Research and Diagnostic
37 Mircea Eliade Street, Cluj-Napoca, Romania

Welcome Address

It is a pleasure to welcome you to the 38th edition Seminars of the Neurosciences Department, "Eye Tracking In Neurosciences Seminar", June 2nd, 2016. The seminar is hosted by the Department of Neurosciences, Faculty of Medicine, "Iuliu Hatieganu" University of Medicine and Pharmacy ,Cluj-Napoca and "RoNeuro" Institute For Neurological Research and Diagnostic.

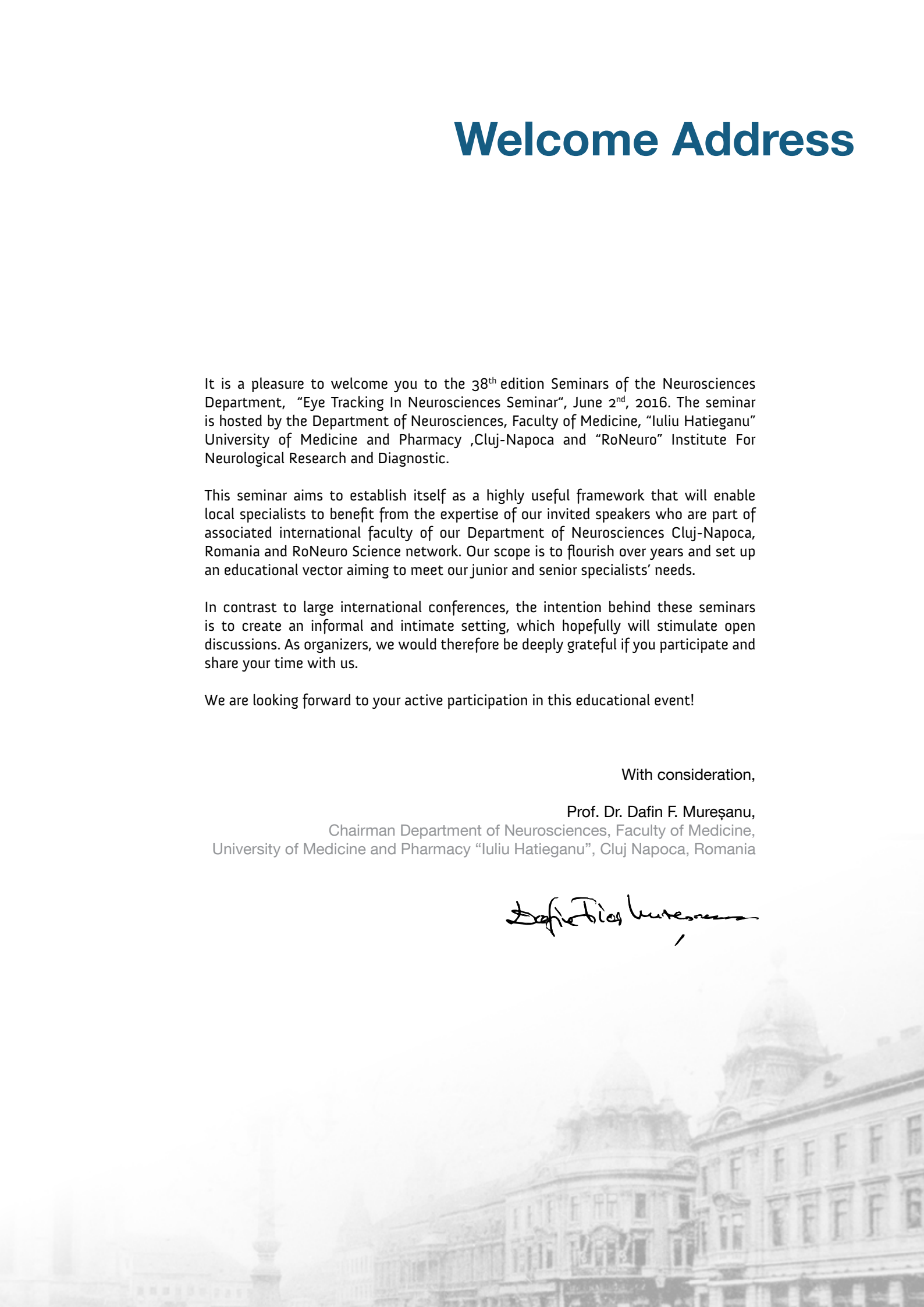
This seminar aims to establish itself as a highly useful framework that will enable local specialists to benefit from the expertise of our invited speakers who are part of associated international faculty of our Department of Neurosciences Cluj-Napoca, Romania and RoNeuro Science network. Our scope is to flourish over years and set up an educational vector aiming to meet our junior and senior specialists' needs.

In contrast to large international conferences, the intention behind these seminars is to create an informal and intimate setting, which hopefully will stimulate open discussions. As organizers, we would therefore be deeply grateful if you participate and share your time with us.

We are looking forward to your active participation in this educational event!

With consideration,

Prof. Dr. Dafin F. Mureșanu,
Chairman Department of Neurosciences, Faculty of Medicine,
University of Medicine and Pharmacy "Iuliu Hatieganu", Cluj Napoca, Romania



Organizers

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Speaker

Speaker

ALESSANDRA RUFA
/ITALY

Academic
Medical School:University of Siena, Italy,Summa cum laude (1989)
Master's degree Program I: Ophthalmology, Univ. of Siena, Italy,
Summa cum laude (1994).
Master's degree Program II: Neurology Univ. Siena, Italy Summa con laude (2005)
Fellowships: CNR (1995-97)- Univ. of Siena (1997-98)
Ph.D. program: Neurometabolic Disease, University of Florence,
Italy(1998-2000)
Fellowship John's Hopkins Hospital (lab eye movements. Prof. David Zee) 2000-2001-2003
Professorship NEI, NIH (2015)

Research interests
Neuro-ophthalmology Neurometabolic Diseases, Eye movements, Vision, Sensory Motor integration, Neurodegeneration

Scientific Collaborations:
June-July 2000 Visiting Scientist, Neuro-Ophthalmology service (Prof. J.G. Odel) Department of Ophthalmology and Electro-oculography (multifocal electroretinography-multifocal visual evoked potential) (Prof. D. Hood) Department of Psychology. Columbia University New-York.
April-June 2002 Visiting Scientist, Ocular Motor-Vestibular Testing and Research Laboratory (Prof. D.S. Zee), Neurology Department, Johns Hopkins Hospital, Baltimore, USA;
April-June 2005 Visiting Scientist, Ocular Motor-Vestibular Testing and Research Laboratory (Prof. D.S. Zee), Neurology Department, Johns Hopkins Hospital, Baltimore, USA
1995-up to date: Unit Neurometabolic Disease and Dep. Neurological and Behavioural Sciences (Prof. A. Federico), Medical School, University of Siena. Italy
2002: Centro Sistemi Complessi and Dep. of Information Engineering. University of Siena Italy
2008 up to date Collaboration with Prof J R Leigh Eye movement research lab Cleveland
2008 up to date Prof Alessandro Innocenti School of Echonomy University of Siena
2010 up to date Prof Stefano Ramat Ing Pavia
2010 up to date Prof Paolo Bartolomeo Sal Petrier Parigi
2010 up to date Prof Dorina Creanga institute of Phisics Isa Romania
2012-present : Lance M. Optican, PhD, biomedical engineer, Senior Scientist at NIH. Chief of the Section on Neural Modeling, Laboratory of Sensorimotor Research, National Eye Institute, NIH. In the frame of CERVISO project

2012-present : Dr Susana Martinez Conde MD PhD and her group at the Laboratory of Visual Neuroscience (Martinez-Conde Laboratory), Barrow Neurological Institute (USA) in the frame of the CERVISO project

Membership Society for Neurosciences (SfN), Italian Society of Neurosciences, Italian Society for Neurology, Italian Society for Ophthalmology, Italian Society of pediatric Ophthalmology, American Academy of Neurology (AAN).
She took part to Regional, National and European programs of research. She is the IP of a European program CORDIS FP7 PEOPLE

Scientific Program

Scientific Program

THURSDAY 2ND JUNE, 2016

9.00 – 10.30	Eye movement recording techniques, signal filtering and analysis
10.30 – 11.00	Coffee Break
11.00 – 13.00	Saccadic system and saccadic tasks in normal people and diseases
15.00 – 18.00	Practical sessions

FRIDAY 3RD JUNE, 2016

9.00 – 10.30	Analysis of gaze fixation distribution and 3D
10.30 – 11.00	Coffee Break
11.00 – 13.00	Cognitive tasks visual esploration, sequencing and decision making
15.00 – 18.00	Practical sessions

Abstract

RoNeuro Brain Days
6th European Teaching Course of Neurorehabilitation
Eye-tracking presentation

Alessandra Rufa MD & Valeria Serchi PhD
Dep Medicine Surgery & Neuroscience. Neurology and Neurometabolic Unit.
Eye tracking&Visual Application Lab. University of Siena. Italy

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1. Video eye-tracking technology and functioning principle
Understanding the functioning principle of the eye-tracking technology is important either to collect the data and to well interpret the outcome of a study involving this technology. Nowadays video based eye-trackers are popular thanks to a good accuracy of the estimation of the point of gaze (PoG) and to their user-friendly interface (Holmqvist, 2012). The functioning principle of the video based eye-trackers concerns the detection of specific features of the image of the eye. The most common video based eye-trackers detect the center of the pupil and the position of the first Purkinje image on the rear surface of the cornea. The distance between these two points is then translated in coordinates of the PoG trough an easy calibration procedure (Young & Sheena, 1970). General and critical aspects of the video based eye-trackers principle functioning are discussed in detail.

2. Eye-tracking signal
2.1. Noise, artifacts, blinks and filtering
The eye-tracking signal can be affected by events that are not strictly related to the eye movements, such as blinks, noise and artifacts. These events have a great influence on the accuracy and precision of the PoG measurements and therefore a pre-processing of the raw signal is necessary (Holmqvist, 2012). Commonly employed pre-processing techniques are described.
2.2. Saccadic analysis: dynamic and metric characteristics and how to get the relevant parameters
Saccades are voluntary redirection of the fovea on a visual target and are commonly studied to investigate specific neural functions though standardized tests. Saccades are assessed in terms of their dynamic (i.e. duration, peak and mean velocity, peak acceleration and deceleration) and of their metric properties (i.e. amplitude and accuracy) (Leigh & Zee, 2015). Saccades dynamic and metric characteristics are described along with examples of standardized saccade paradigms.
2.3. Main sequence
The relationship between saccade dynamic and metric parameters is summarized by mean of representations like the main sequence plot (saccade peak velocity or duration against saccade amplitude). The main sequence plot allows defining the ranges for normal and abnormal saccades (Leigh & Zee, 2015). The shape of the main sequence plot and the way to construct it are described.

3. Practical session
The steps necessary for a good eye-tracking experimental session are overviewed. In particular, the concepts of workspace, visual angles, stimulus depiction and subject setting up prior the data collection are discussed (Holmqvist, 2012). The presentation will then go through the calibration and validation procedures of commercial eye-tracker devices with examples and descriptions of operative cases (children and critical patients). The presentation will then discuss the quality of the measurements of video eye-trackers providing useful tricks for a successful data collection (Serchi, 2016).

4. General overview of saccadic system
Anatomical and physiological characteristics of saccadic system will be described. Saccadic tasks and their applications in clinical and research contexts will be discussed

5. Clinical applications
Changes in dynamic and metric parameters of saccades occur in movement disorders. Other abnormalities regarding more cognitive aspects of movement programming and executing characterize neurodegenerative diseases including dementia or psychiatric disorders.

6. Gaze analysis and visual search
The analysis of gaze during visual exploration is a more cognitive task depending upon individual cognitive and attentional resources. Beside the specific cognitive demand of a task and the individual attentional resources (Top-down control), the gaze behavior is influenced by image features (bottom-up control). Both top-down and bottom-up interactions influence the timing and distribution of fixations during visual exploration. Moreover central and peripheral vision cooperate during visual exploration for the optimization of sensory-motor integration.

7. Decision making
During decisional processes there is a general exploration of the scene, however, the gaze is progressively attracted towards the object of the future choice. Therefore the analysis of saccades and fixations over time may help to extrapolate computational models useful in understanding brain decisional process.

Notes

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