Report on activities of WG1 Theoretical Considerations *ENOC* 2005-2009

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Theoretical considerations in *ENOC* are important from the very beginning thanks to the Action Chair Professor Jordan Pop-Jordanov

WHY WE NEED THEORY?

Surgeon and his ‘happy patient’

While using contemporary computer-assisted diagnostics one needs to understand what exactly the computer shows and what the different reasons for the given finding might be.

Knowing only 'protocol of clicking' is not enough for deciding about the therapy, activation or inhibition of some brain processes.

Because of the shortage of time I am going to present only examples of WG1 Members' successes and activities.

So, please do not feel in any case forgotten or omitted - I am very sorry if your success is not to be mentioned during this 15 minutes; it certainly be in the final *ENOC* report

COUNTRIES THAT TOOK PART IN *ENOC* WG1 ACTIVITIES

Austria
Bulgaria
Estonia
Germany
Italy
Lithuania
Macedonia
Poland
Serbia
Turkey
UK

Global dimension

We had two great events devoted mainly to theoretical considerations, both organized by Italy - special thanks due to Walter Sannita and Riccardo Meucci

- **Conference "Neuroscience today: neuronal functional diversity and collective behaviors"**

  Firenze, March 2007

  <u>Dissemination:</u> ***Cognitive Processing, Vol. 10, 1 (2009)***

- **Advanced Training School "Consciousness and its Descriptors", Crotone, March 2009**

Participants from non-COST countries.

UNIVERSITY

Consciousness and its Descriptors

Crotone
Hotel Lido degli Scogli

27-28 march 2009

Advanced Workshop
in the framework of COST Action B27 "ENOC"

RAN
Research in Advanced Neurorehabilitation
Istituto S. Anna

Scientific committee:

Walter G. Sannita
Departement of Motor Science, University Genova Italy and Department of Psychiatry, SUNY, Stiny Brook USA

Organizing committee:

Riccardo Meucci
National Institute of Applied Optics (CNR-INOA), Firenze Italy

Invited speakers:

F. Tito Arecchi
Firenze, Italy

Fabio Babiloni
Roma, Italy

Gastone G. Celesia
Chicago, USA

Giuliano Dolce
Crotone, Italy

Jordan Pop-Jordanov
Skopje, Macedonia

W Klonowski
Warsaw, Poland

S Kouider
Paris, France

P Lanteri
Venezia Mestre, Italy

Steven Laureys
Liege, Belgium

Martin M. Monti
Cambridge, United Kingdom

Pietro Morasso
Genova, Italy

F Nijboer
Tübingen, Germany

F Riganello
Crotone, Italy

Walter G. Sannita
Genova/New York

Anil K. Seth
Brighton, United Kingdom

Juliana Yordanova
Sofia, Bulgaria

Highlight – COST Open Call 2006

Application for a new COST Action *BIOSIGNON* -
'Nonlinear Signal Analysis for Biomedical Applications'
- proposed and written by Wlodzimierz Klonowski, Poland

Participants in the application (in alphabetic order by Country; underlined researchers participating in *ENOC* WG1):

Milan Palus, Inst. Computer Science AS CS, CZECH REPUBLIC
Hiie Hinrikus, Tallinn Technical University, ESTONIA
Alpo Varri, Tampere University of Technology, FINLAND
Jiri Wackerman, Inst. Grenzg. Psychologie, Freiburg, GERMANY
Karl Karlsson, Reykjavik University, ICELAND
Luigi Fortuna, University of Catania, ITALY
Wlodzimierz Klonowski, IBBE PAS, Warsaw, POLAND
Aleksandar Kalauzi, University of Belgrade, SERBIA
Ernesto Pereda, Univ. of La Laguna, Tenerife, SPAIN

Highlight - good cooperation in WG1

An exchange of young researchers (through two Short Term Scientific Missions) has been carried out during the *ENOC* project. A. Buscarino, PhD student at the University of Catania (Italy) visited the laboratory of the University of Potsdam (Germany) and E. J. Ngamga, PhD student at the University of Potsdam visited the laboratory of Automation and Complex Systems at the University of Catania. The two researchers carried on a common topic of research on driven excitable systems. Such systems may model neuronal dynamics.

Results were published in a common paper:

E. J. Ngamga, A. Buscarino, M. Frasca, L. Fortuna, A. Prasad and J. Kurths, “Recurrence analysis of strange nonchaotic dynamics in driven excitable systems”, *Chaos*, vol. 18, no. 1, pp. 013128-1-8, 2008.

Highlight - cooperation Serbia-Poland

1. We get acquainted through *ENOC*.
2. We studied research of the other side.
3. A.Kalauzi was invited to join Editorial Board of *Nonlinear Biomedical Physics.*
4. M.Culic organized in 2007 2-day Serbian workshop but invited W.Klonowski to chair it, to give consultations to participants, and to present Polish group works.
5. Some works has already been continued into *NEUROMATH*.

Some computational aspects of the Brain Computer Interfaces based on Inner Music

Wlodzimierz Klonowski*, Wlodzisław Duch,**
Aleksandar Perovic*, Aleksandar Jovanovic*****

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***Department of Informatics, Nicolaus Copernicus University, Torun, Poland, duch@ieee.pl*
****Group for Intelligent Systems, School of Math. University of Belgrade, Serbia, pera@sf.bg.ac.yu*

Future challenges – proposing a new type of activity, SRSM

- Senior Researcher Short Mission

A group that is a part of COST Action invites a senior researcher from another country to chair a 1-2 day workshop where he/she consults the inviting group that presents its own works, its labs, its future plans, and the invited senior researcher presents his/her group works and also his/her own.

Needs new regulations, different from STSM.

Highlight - good cooperation in WG1

From University of Catania report:

Collaboration consolidated within the framework of *ENOC* between the University of Catania and the University of Firenze. Publications with an explicit acknowledgement to *ENOC*:

1. **L. Fortuna, M. Frasca, "An incomplete gallery: machines, cognition and nonlinearities", *Cognitive Processing*, vol. 10, pp. S111-S117, 2009.**
2. **E. J. Ngamga, A. Buscarino, M. Frasca, L. Fortuna, A. Prasad and J. Kurths, "Recurrence analysis of strange nonchaotic dynamics in driven excitable systems", *Chaos*, vol. 18, no. 1, pp. 013128-1-8, 2008.**
3. **F. T. Arecchi, L. Fortuna, M. Frasca, R. Meucci, G. Sciuto, "A programmable electronic circuit for modelling CO2 laser dynamics", *Chaos*, vol 15, no 4, 043104, 2005.**
4. **L. Fortuna, M. Frasca, C. Camerano, "Strange attractors, kinematic trajectories and synchronization", *International Journal of Bifurcations and Chaos*, vol. 18, no. 12, 2008, pp. 3703-3718.**
5. **L. Fortuna, M. Frasca, "Experimental synchronization of single-transistor-based chaotic circuits", *Chaos*, vol. 17, no. 4, pp. 043118-1-5, 2007.**
6. **M. Frasca, A. Buscarino, A.Rizzo, L. Fortuna, S. Boccaletti, "Dynamical network model of infective mobile agents", *Physical Review E*, vol. 74, no. 3, 036110, 2006.**
7. **P. Arena, A. Buscarino, L. Fortuna, M. Frasca, "Separation and synchronization of PWL chaotic systems", *Physical Review E*, 74, 026212, 2006.**
8. **M. Frasca, A. Buscarino, A.Rizzo, L. Fortuna, S. Boccaletti, "Dynamical network model of infective mobile agents", *Physical Review E*, vol. 74, no. 3, 036110, 2006.**
9. **M. Hulub, M. Frasca, L. Fortuna, P. Arena, "Implementation and synchronization of a 3x3 grid scroll attractor with analog programmable devices", *Chaos*, vol. 16, no. 1, 013121-1-5, 2006.**

New ideas initiated by *ENOC* discussion

From Estonian reports:

‘The most fruitful was idea about application of the nonlinear approach for detection of small hidden changes in the EEG signal. Multifractal method of scaling analysis of the EEG signal based on the length distribution of low variability periods (LDLVP) was developed and adopted for EEG analysis.’

Estonian cooperation with Macedonia and Poland

New ideas initiated by *ENOC* discussion

From Lithuanian reports:

Heart rate variability (HRV) and EEG during sleep

- analysis using fractal method and spectrum-weighted frequencies.

The results show that the easy-to-assess frequencies may yield a simple indicator of the sleep quality within the scope of comfortable patient monitoring.

Lithuanian cooperation with Macedonia and Poland

Challenge - success establishing a new *open access* journal

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www.nonlinearbiomedphys.com

That is all, folks…

Thank you for your patience!