

Domenica Bueti (Ph.D)

Personal Information

Family name, First name Bueti Domenica
 Date and place of birth 16/02/1974, Somma Lombardo (VA), Italy
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Academic Positions

From June 2015 Biomedical Imaging Research Center (CIBM), École Polytechnique Fedérale de Lausanne (EPFL), Lausanne, Switzerland. Senior research scientist.

2011- to present Department of Clinical Neurosciences (DNC), Lausanne University Hospital (CHUV), Lausanne, Switzerland. Senior research scientist and group leader.

2007-2010 Neuroimaging Lab, Santa Lucia Foundation, Rome, Italy. Post-doctoral research fellow working with Dr. Emiliano Macaluso on temporal attention and predictions, temporal learning and individual brain differences.

2004-2007 Visual Cognition Lab, Institute of Cognitive Neuroscience (ICN), University College London, UK. Post-doctoral research fellow working with Prof. Vincent Walsh on temporal processing in sensory and associative cortices.

2003-2004 Visual Cognition Lab, Institute of Cognitive Neuroscience (ICN), University College London, UK. Visiting PhD student working with Prof. Vincent Walsh on the interactions between spatial and temporal cognition.

Education

2001-2004 University of Rome ‘La Sapienza’, Italy. PhD in cognitive neuroscience under the supervision of Prof. Salvatore Maria Aglioti. My PhD work focused on cross-modal spatial and temporal attention and multisensory integration in healthy individuals and neurological patients.

1995-2000 Bachelor of Science (BSc) and Master of Science (MSc) in Psychology (i.e., ‘Laurea’), University of Padua, Italy. Master thesis on visuo-tactile spatial attentional disorders in right brain damaged patients (106/110).

Grants and Awards

2015 ERC consolidator grant on the project “How the Human Brain Masters Time (BiT)” *under evaluation* (1800000 €).

2015 Travel Award of the Japan Neuroscience Society (3000 €).

2014 Award of the Italian Scientific Qualification (“Abilitazione Scientifica Nazionale”) as Associate Professor in Psychobiology (<https://abilitazione.cineca.it/ministero.php/public/esitoAbilitati/settore/11%252FE1/fascia/2>).

2012-2015 PI on the project: “Preparatory, response-related, outcome-evaluation and predictive components of attentional orienting in right brain damage: clues for diagnosis and rehabilitation”. 274.000 € financed by the Italian Ministry of Health (RF-2010-2319059).

2003-2004 Marie Curie scholarship (FP6, RTN-training site student. 21000 €).

Publications Summary

- 24 publications (16 of them as first or last author) in international peer-reviewed journals including *Neuron*, *Journal of Neuroscience*, *Nature Neuroscience*, *Brain*, *Cortex*, *Neuroimage* (see the full list below).
- 1149 citations.
- h-index: 15 (*h* articles cited *h* times, source Scopus).

Teaching experience and supervised research projects

- 2014 -to present University Hospital of Lausanne. I am currently giving a methodological course on functional imaging and neuroscience methods for PhD students and postdocs.
- 2011-to present University Hospital of Lausanne. I am currently supervising two MSc students (Mr. Michel Bornet and Miss Tatiana Kénel-Pierre) on the project “The spatial representation of time in visual cortices”. At the University of Rome ‘La Sapienza’ I am co-supervising with Prof. Fabrizio Doricchi a PhD student (Mr. Alessio Dragone) on the project “predictive and motivational processing in brain damaged patients”.
- 2011-2014 University Hospital of Lausanne. I supervised two MSc students. Dr. Paolo Salvioni (MSc in medicine) on the project “Time processing in visual cortices: how the visual brain encodes and keeps track of time” and Miss Céline Gillioz (MSc in biology) on the project “Temporal processing in healthy ageing”.
- September 2013 University of Magdeburg, Germany. Lecturer at the international summer school “Imaging Time”.
- September 2011 University Hospital of Lausanne. Lecturer and project coordinator at the international school “FENS-IBRO Imaging Training Center”.
- 2010 Neuroimaging Lab, Santa Lucia Foundation, Rome, Italy. Lecturer and coordinator of a methodological course on functional imaging for PhD students and post-docs.
- 2008-2010 University of Rome ‘La Sapienza’. I co-supervised with Prof. Fabrizio Doricchi a PhD student (Mr. Nicola Binetti) on the project “Time in motion: effects of vestibular stimulation on the perception and production of time”.
- 2006-2007 ICN, London, UK. I supervised an MSc student (Mr. Eelco van Dongen) on the project “Temporal processing in human auditory cortex”.
- 2004-2006 Psychology Department of the University of Chieti, Italy. I was fixed-term lecturer in “Human Neurophysiology”. I gave a course on neuroanatomy and neurophysiology to first year undergraduate students.

Professional Responsibilities

Review activities

- Journals: I served as reviewer for a total of 26 biological and psychological journals including *Brain*, *Cerebral Cortex*, *Cortex*, *Current Biology*, *Human Brain Mapping*, *Journal of Cognitive Neuroscience*, *Journal of Experimental Psychology (HPP)*, *Journal of Neurophysiology*, *Journal of Neuroscience*, *Trends in Cognitive Sciences*.
- I served as reviewer for the following funding agencies: French National Funding Agency (ANR), Swiss National Funding Agency (SNF), Israel Science Foundation (ISF).

Editorial activities

- Consulting editor for “Timing and Time perception” (Brill Publisher).
- Associate editor for “Frontiers in Neuroscience”.
- Guest editor for “Neural Plasticity” in occasion of a special issue on “The Neurobiology of Time Processing”.

Professional Membership

I'm member of the *Society for Neuroscience (SfN)* and of the *Japan Neuroscience Society (JNS)*.

Invited talks

2016

- Chairing, together with Prof. Maria Concetta Morrone, the symposium "How the Brain Tells Time" at the Thirty-Forth European Workshop on Cognitive Neuropsychology, Bressanone, Italy.

2015

- Seminar at the Cognitive Neuroscience Department of the International School for Advanced Studies (SISSA), Trieste, Italy.
- Chairing, together with Dr. Masamichi Hayashi, the symposium "The Neural Mechanisms of Temporal Processing" at the Japan Neuroscience Society, Kobe, Japan.

2014 Keynote lecture, at the conference on "Timing and Time Perception", Ionian University, Corfù, Greece.

2013

- Seminar, Psychology Department, University of Bologna, Italy.
- Workshop "Temporal Prediction", University of Granada, Spain.
- Training summer school "Imaging Time", University of Magdeburg, Germany.

2012

- Seminar, Clinical Imaging Sciences Center (CISC), Brighton and Sussex Medical School, Falmer, UK.
- Nano-Symposium "Human Timing" at the Society for Neuroscience (SfN), New Orleans, USA.
- Interdisciplinary summer school "The names of time", Department of Physics and Astronomy, University of Padua, Italy.

2011 FENS-IBRO Imaging Training Center 2011, Lausanne, Switzerland.

2010 Seminar, Birkbeck College London, UK.

2009 Workshop "The Functions of the Parietal Lobes", Institute for Advanced Studies, Hebrew University of Jerusalem, Israel.

2008

- Workshop "The Nature of Time. From Physics to Psychology", Menéndez Pelayo International University of Barcelona (CUIMPB - Centre Ernest Lluch), Spain.
- Seminar, Cognitive Neuroscience Department of the International School for Advanced Studies (SISSA), Trieste, Italy.

2007

- Seminar, Neuroimaging centre (MARIARC), University of Liverpool, UK.
- Workshop "The anatomy of Time", UCL, London, UK.
- Magstim workshop "TMS in Cognition", UCL, London, UK.

2000-2001-2009 Italian Neuropsychological Society (SINP), Bologna, Italy.

Public engagement in science activities

2014

- Talk for TEDx Lausanne (<http://www.tedxlausanne.com/talk/looking-brain's-timekeeper>)
- Interview for BBC FUTURE (<http://www.bbc.com/future/story/20140624-the-man-who-saw-time-freeze>).

2012

- Interview for "RAI-Radio3-Scienza" (<http://www.radio3.rai.it/dl/radio3/programmi/puntata/ContentItem-65dc4d37-ab36-4fdb-ba57-72ad7cc22da6.html>).
- Interview for Radio Città Futura".
- Talk at "Infinitamente", Science and Art Festival, Verona, Italy

(<http://www.infinitamente.univr.it/programma.html>).

Current research collaborations

- Prof. Mara Cercignani (CISC, Brighton and Sussex Medical School): structural brain changes during time learning.
- Dr. Marzia De Lucia and Prof. Micah Murray (DNC, CHUV): scalp-recorded and intracranial Electroencephalography (EEG) to investigate temporal processing in auditory cortices.
- Prof. Fabrizio Doricchi (University of Rome, “La Sapienza”): attention, prediction, number cognition and the interactions with space and time.
- Prof. Bogdan Draganski (DNC, CHUV, Lausanne): grey and white matter changes associated with timing performance in ageing.
- Dr. Ryota Kanai and Dr. Masamichi Hayashi (School of Psychology, Sussex, University, UK): duration tuning and “chronotopic” representation.
- Dr. Ferath Kerif (DNC, CHUV, Lausanne): Dynamic Causal Modeling (DCM) of temporal networks.
- Dr. Roger Kalla (Department of Neurology, Munich University Hospital): time processing in patients with vestibular disorders.
- Dr. Wietske Van der Zwaag (CIBM, EPFL, Lausanne): duration tuning and “chronotopic” representation.

Project management and scientific leadership

I have managed multiple research projects at all stages of my career, many of which have been wholly investigated by me. Since I was a PhD student at the University ‘La Sapienza’ of Rome and later at the ICN of London and at the Santa Lucia Foundation of Rome, I have overseen numerous projects from their inception to completion, including data collection, data analysis and dissemination via publications and conference presentations. In 2011 I moved to the University Hospital of Lausanne to begin my independent research career and start my own research group. In addition to the supervision of a few master level projects, I’m currently co-supervising a PhD student. The work of my research group focuses on understanding the neural mechanisms and the functional architecture subserving the human ability to perceive, represent and manipulate information about time. This is a research interest I developed during the last 10 years of my career. My contribution in those years has been to develop new ideas and new behavioral paradigms, and to adapt these paradigms to the Transcranial Magnetic Stimulation (TMS) and functional Magnetic Resonance Imaging (fMRI) environments. I have been the lead scientist in this work; an area of study that was new to the labs where I worked and I have achieved important research goals (see Research Achievements) and developed expertise with several research methods (see Technical Skills). Overall, my research has established me as an independent researcher with an international reputation.

Research Achievements and Current Research Interests

My most important research achievement is to have highlighted the contribution of modality-specific cortices to time processing. In a series of TMS and fMRI studies (Bueti et al 2008, *J Cogn Neurosci*, Bueti et al., 2008 *PLoS ONE*, Bueti et al. 2010, *J Neurosci*, Bueti and Macaluso, 2010, *Neuroimage*, Bueti et al. 2012, *Neuron*, Salvioni et al. 2013, *J Neurosci*) I have challenged the idea of a single ‘centralized’ and ‘amodal’ clock, demonstrating the engagement of primary and secondary visual and auditory cortices in temporal computations. These results provide the first physiological evidence for a representation of the temporal properties of the visual and of the auditory environment in respectively primary visual and auditory cortices.

After demonstrating the involvement of visual and auditory cortices in temporal computations, my scientific priority is now to understand *how* temporal information is represented in these regions and what are the *functional links* and the *temporal hierarchies* between modality-specific and modality-independent nodes of temporal networks. By using

high-field fMRI (i.e. 7T), Dynamic Causal Modeling, Diffusion Tensor Imaging, EEG and the combination of TMS with EEG, my on-going projects aim to explore the functional properties and the temporal dynamics between different nodes of time networks (Kanai, Battistella, Van der Zwaag, Murray and Bueti under review, Kenel-Pierre, Murray and Bueti in preparation).

Recently I have been also interested in aspects of temporal cognition linked to the ‘subjective’ experience of time (i.e. distortions of time perception, Bueti and Macaluso, 2011, *Neuroimage*) and to the ability of learning time (i.e. individual brain differences and brain plasticity during time learning, Bueti et al. 2012, *Neuron*).

Technical skills

Technically I consider myself to be an expert in TMS and in both functional and structural magnetic resonance imaging (MRI). I have received an excellent training in both techniques at Institute of Cognitive Neuroscience and at the Wellcome Trust Centre for Neuroimaging of London, two world-leading institutions for neuroimaging and cognitive neuroscience. I have used MRI and TMS in a variety of experimental paradigms (e.g. single pulse, paired pulses, repetitive TMS, Stimulus phase-encoding for fMRI, fMRI adaptation) and I have a considerable experience of different methods of data analysis (e.g. univariate and multivariate methods for fMRI data, Voxel-Based Morphometry for structural MRI data). I'm familiar with the most used psychophysical procedures (e.g. thresholds estimation, fitting to psychometric functions, adaptive procedures) and because of the experience acquired during my PhD I am also familiar with neuropsychological testing of brain damaged patients.

Full list of peer-reviewed publications

1. **Bueti, D.**, Buonomano, D.V. Temporal Perceptual Learning (2014). *Timing and Time Perception*. 2, 261-89.
2. Salvioni, P., Murray, M.M., Kalmbach, L., **Bueti, D.** (2013). How the visual brain encodes and keeps track of time, *J Neurosci*. 33,12423-12429
3. Binetti, N., Siegler, I., **Bueti, D.***, Doricchi, F.* (2013). Adaptive tuning of perceptual timing to vestibular stimulation. *Neuropsychologia*, 51,197-210 - special issue on ‘Time processing’ *Equal contribution.
4. Spierer, L., Manuel, A., **Bueti, D.**, Murray, M.M. (2013). Contributions of pitch and bandwidth to sound-induced enhancement of visual cortex excitability in humans. *Cortex*, 49, 2727-33.
5. **Bueti, D.**, Lasaponara, S., Cercignani M., Macaluso, E. (2012). Learning about time: Plastic Changes and Individual Brain Differences. *Neuron*, 75, 725–737.
6. Aiello, M., Courtois, S.J., Merola, S., Ottaviani, T., Tomaiuolo, F., **Bueti, D.**, Rossetti, Y., Doricchi, F. (2012). No inherent left and right side in human “mental number line”: evidence from right brain damage. *Brain*. 135, 2492-2505.
7. **Bueti, D.** (2011). The sensory representation of time. *Front Integr Neurosci* 5, 34.
8. **Bueti, D.**, and Macaluso, E. (2011). Physiological correlates of subjective time: evidence for the temporal accumulator hypothesis. *Neuroimage* 57, 1251-1263.
9. Kanai, R., Lloyd, H., **Bueti, D.**, Walsh, V. (2011). Modality-independent role of the primary auditory cortex in time estimation. *Exp Brain Res* 209, 465-471.
10. Kalla, R., Muggleton, N., Spiegel, R., **Bueti, D.**, Claassen, J., Walsh, V., Bronstein, A. (2011). Adaptive motion processing in bilateral vestibular failure. *J Neurol Neurosurg Psychiatry* 82, 1212-1216.
11. Rusconi, E., **Bueti, D.**, Walsh, V., Butterworth, B. (2011). Contribution of frontal cortex to the spatial representation of number. *Cortex* 47, 2-13.
12. **Bueti, D.**, Bahrami, B., Walsh, V., Rees, G. (2010). Encoding of temporal probabilities in the human brain. *J Neurosci* 30, 4343-4352.
13. **Bueti, D.**, and Walsh, V. (2010). Memory for time distinguishes between perception and action. *Perception* 39, 81-90.
14. **Bueti, D.**, and Macaluso, E. (2010). Auditory temporal expectations modulate activity in visual cortex. *Neuroimage* 51, 1168-1183.

15. Binetti, N., Siegler, I.A., **Bueti, D.**, Doricchi, F. (2010). Time in motion: effects of whole-body rotatory accelerations on timekeeping processes. *Neuropsychologia* 48, 1842-1852.
16. **Bueti, D.**, and Walsh, V. (2009). The parietal cortex and the representation of time, space, number and other magnitudes. *Philos Trans R Soc Lond B Biol Sci* 364, 1831-1840.
17. **Bueti, D.**, van Dongen, E.V., Walsh, V. (2008). The role of superior temporal cortex in auditory timing. *PLoS ONE* 3, e2481.
18. **Bueti, D.**, Walsh, V., Frith, C., Rees, G. (2008). Different brain circuits underlie motor and perceptual representations of temporal intervals. *J Cogn Neurosci* 20, 204-214.
19. **Bueti, D.**, Bahrami, B., Walsh, V. (2008). Sensory and association cortex in time perception. *J Cogn Neurosci* 20, 1054-1062.
20. Doricchi, F., Guariglia, P., Figliozzi, F., Silveti, M., Gasparini, M., Merola, S., Macci, E., Binetti, N., Bruschini, M., **Bueti, D.** (2008). No reversal of the Oppel-Kundt illusion with short stimuli: confutation of the space anisometry interpretation of neglect and 'cross-over' in line bisection. *Brain* 131, e94; author reply e95.
21. Costantini, M., **Bueti, D.**, Pazzaglia, M., Aglioti, S.M. (2007). Temporal dynamics of visuo-tactile extinction within and between hemispaces. *Neuropsychology* 21, 242-250.
22. Avenanti, A., **Bueti, D.**, Galati, G., Aglioti, S.M. (2005). Transcranial magnetic stimulation highlights the sensorimotor side of empathy for pain. *Nat Neurosci* 8, 955-960.
23. **Bueti, D.**, Costantini, M., Forster, B., Aglioti, S.M. (2004). Uni- and cross-modal temporal modulation of tactile extinction in right brain damaged patients. *Neuropsychologia* 42, 1689-1696.
24. **Bueti, D.**, Moro, V., Aglioti, S.M. (2001). Aspetti spazio-temporali dell'estinzione unimodale e crossmodale tattile in pazienti cerebrolesi destri. *Giornale Italiano di Psicologia* 28, 865-874.

Papers under review

1. Kanai, R., van der Zwaag, W., Battistella, G., Murray, M.M., Doricchi F., **Bueti, D.** "Chronotopic" Maps in Human Premotor Cortex. Under review in *Nature Communications*.

References

1. Prof. Micah Murray (current employer), Department of Clinical Neurosciences, University Hospital of Lausanne. 46, Rue du Bugnon, 1011, Lausanne, Switzerland, (micah.murray@chuv.ch).
2. Prof. Vincent Walsh (previous employer), Institute of Cognitive Neuroscience, UCL, London. 17, Queen Square, WC1N3AR, London, UK, (v.walsh@ucl.ac.uk).
3. Dr. Emiliano Macaluso (previous employer), Neuroimaging Lab, Santa Lucia Foundation, via Ardeatina, 306, 00179, Rome, Italy (e.macaluso@hsantalucia.it).