

# GIOVANNI PIANTONI

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## RESEARCH STATEMENT

The overarching themes of my research career are the mechanisms and functions of brain rhythms, both during wakefulness and sleep. I obtained my M.Sc. in Cognitive Neuroscience *cum laude* with an internship on semantic ambiguity with MEG recordings with Dr. Snijders and Prof. Hagoort. I then received my Ph.D. degree at the Netherlands Institute for Neuroscience, under the supervision of Prof. Van Someren and Dr. Van Der Werf, on the topic of connectivity and sleep using a variety of techniques, such as EEG, MEG and DTI, resulting in multiple first-author and co-author publications. This effort allowed me to uncover novel brain mechanisms underlying structural and functional connectivity involved in all aspects of sleep research, such as memory consolidation and the effects of sleep deprivation.

I then received a two-year personal grant from the BIAL Foundation for a post-doc with Dr. Cash at Massachusetts General Hospital / Harvard Medical School, where I worked on sleep rhythms using intracranial recordings in patients with drug-resistant epilepsy. Based on ECoG recordings, I showed that most sleep spindles are limited to a very restricted cortical area, based on a theoretical hypothesis we developed. An exciting finding is the first description, in human intracranial recordings, of ultra-slow fluctuations in the range of hours, which are present both during wakefulness and sleep, and their effects on behavior.

I am currently working at the UMC Utrecht, with Prof. Ramsey and Dr. Petridou, on the link between brain activity measured with high-density ECoG grids in patients with epilepsy and the fMRI signal, in motor and visual tasks.

Throughout the years, I have obtained multiple travel awards, authored several oral and poster presentations at national and international conferences, and been trusted with responsibilities, such as Ph.D. representative and reviewer for several journals, such as *Neuroimage*, *Human Brain Mapping*, and *Sleep*.

During my Ph.D., I was strongly involved in the supervision of multiple M.Sc. students, especially in teaching them the use of Matlab and its toolboxes for the analysis of EEG/MEG and fMRI recordings. During my post-docs, I assisted research assistants and graduate students in the acquisition and analysis of intracranial recordings. I have been invited as guest lecturer to M.Sc. students at the Radboud University twice: one on the use of ECoG in research and another on sleep scoring and sleep oscillations.

On the technical side, I have gained extensive expertise in the acquisition and analysis of electrophysiological signals, such as EEG, MEG, and ECoG, and neuroimaging tools, such as DTI and fMRI. For these recordings, I have developed and applied advanced analytical and statistical techniques, such as the use of mixed-effects models in EEG/MEG and ECoG and a variety of source-reconstruction approaches.

I have contributed code to FieldTrip, the toolbox for the analysis of EEG/MEG signals developed at the Donders Institute, and developed a Python toolbox for the assessment of sleep rhythms, especially in ECoG.

## EDUCATION AND RESEARCH EXPERIENCE

- |                        |   |
|------------------------|---|
| Apr 2017 –             | <b>Postdoctoral Fellow</b><br>with Prof. N. Ramsey and Dr. N. Petridou, Dept. Neurology, University Medical Center Utrecht                              |
| Sep 2013 –<br>Apr 2017 | <b>Research Assistant / Postdoctoral Fellow</b><br>with Dr. S.S. Cash, Dept. Neurology, Massachusetts General Hospital / Harvard Medical School, Boston |
| Aug 2008 –<br>Jul 2013 | <b>Ph.D. Student</b><br>with Prof. E. van Someren and Dr. Y. van der Werf, Netherlands Institute for Neuroscience, Amsterdam (defense on 2 Dec 2014)    |
| Nov 2007 –<br>Aug 2008 | <b>Research Assistant</b><br>with Dr. D. Eagleman, Baylor College of Medicine, Houston  |
| Aug 2005 –<br>Sep 2007 | <b>M.Sc. Cognitive Neuroscience</b><br><i>cum laude</i> , Specialization Psycholinguistics at the Radboud University Nijmegen                           |
| Sep 2006 –<br>Aug 2007 | <b>Internship</b><br>with Dr. T. Snijders and Prof. P. Hagoort, Donders Centre for Cognitive Neuroimaging, Nijmegen                                     |
| Sep 2001 – Jul<br>2005 | <b>B.A. Philosophy</b><br>with Dr. R. Fabbrichesi Leo, Università degli Studi di Milano, Milan  |

## PUBLICATIONS

- Lewis LD, **Piantoni G**, Peterfreund RA, Eskandar EN, Harrell PG, Akeju O, Aglio LS, Cash SS, Brown EN, Mukamel EA, Purdon PL (2018) A transient cortical state with sleep-like sensory responses precedes emergence from general anesthesia in humans. *eLife*, 7:e33250
- Stolk A, Griffin SM, Van Der Meij R, Dewar C, Saez I, Lin JJ, **Piantoni G**, Schoffelen JM, Knight RT, Oostenveld R (2018) An integrated platform for human intracranial data analysis. *Nature Protocols* 13(7):1699–1723
- Naftulin JS, Ahmed OJ, **Piantoni G**, Eichenlaub JB, Martinet LE, Kramer MA, Cash SS (2018) Ictal and preictal power changes outside of the seizure focus correlate with seizure generalization. *Epilepsia* 59(7):1398-1409
- **Piantoni G**, Romeijn N, Van Der Werf YD, Van Someren EJW (2017) Alpha power predicts persistence of bistable perception. *Scientific Reports*, 7(1):5208
- **Piantoni G**, Halgren E, Cash SS (2016) Spatiotemporal characteristics of sleep spindles depend on cortical location. *Neuroimage*, 146:236–245
- Muller LE, **Piantoni G**, Koller D, Cash SS, Halgren E, Sejnowski TJ (2016) Rotating waves during human sleep spindles organize global patterns of activity that repeat precisely through the night. *eLife*, 5:e17267
- **Piantoni G**, Halgren E, Cash SS (2016) The contribution of thalamo-cortical core and matrix pathways to sleep spindles. *Neural Plasticity*, 2016:3024342

- Reijmer YD, Fotiadis P, **Piantoni G**, Boulouis G, Kelly KE, Gurol ME, Leemans A, O’Sullivan MJ, Greenberg SM, Viswanathan A (2016) Small vessel disease and cognitive impairment: The relevance of central network connections. *Human Brain Mapping* 37(7):2446–54
- **Piantoni G**, Van Der Werf YD, Jensen O, Van Someren EJW (2015) Memory traces of long-range coordinated oscillations in the sleeping human brain. *Human Brain Mapping* 36(1):67–84
- Astill RG, **Piantoni G**, Raymann RJ, Vis JC, Coppens JE, Walker MP, Stickgold R, Van Der Werf YD, Van Someren EJW (2014) Sleep spindle and slow wave frequency reflects motor skill performance in primary school-age children. *Frontiers in Human Neuroscience* 8:910
- Verweij IM, Romeijn N, Smit DJ, **Piantoni G**, Van Someren EJW, Van Der Werf YD (2014) Sleep deprivation leads to a loss of functional connectivity in frontal brain regions. *BMC Neuroscience* 15:88
- **Piantoni G**, Cheung BLP, Van Veen DB, Romeijn N, Riedner BA, Tononi G, Van Der Werf YD, Van Someren EJW (2013) Posterior-to-anterior effective connectivity along the cingulate cortex is reduced after sleep deprivation. *Neuroimage* 79:213–22
- **Piantoni G**, Poil SS, Linkenkaer-Hansen K, Verweij IM, Ramautar JR, Van Someren EJW, Van Der Werf YD (2013) Individual differences in white matter diffusion affect sleep oscillations. *Journal of Neuroscience* 33(1):227–33
- **Piantoni G**, Astill RG, Raymann RJ, Vis JC, Coppens JE, Van Someren EJW (2013) Modulation of gamma and spindle-range power by slow oscillations in scalp sleep EEG of children. *International Journal of Psychophysiology* 89(2):252–8
- Ramautar JR, Romeijn N, Gmez-Herrero G, **Piantoni G**, Van Someren EJW (2013) Coupling of infraslow fluctuations in autonomic and central vigilance markers: skin temperature, EEG beta power and ERP P300 latency. *International Journal of Psychophysiology* 89(2):158–64
- Koenis MM, Romeijn N, **Piantoni G**, Verweij IM, Van Der Werf YD, Van Someren EJW, C.J. Stam (2013) Does sleep restore the topology of functional brain networks? *Human Brain Mapping* 34(2):487–500
- **Piantoni G**, Kline KA, Eagleman DM (2010) Beta oscillations correlate with probability of perceiving rivalrous visual stimuli. *Journal of Vision* 10(13):18

#### UNDER REVIEW / UNDER PREPARATION

- **Piantoni G**, Hermes D, Ramsey NF, Petridou N (*under preparation*) Size of the spatial correlation between ECoG and fMRI activity
- **Piantoni G**, Rosenthal E, Halgren E, Cash SS (*under preparation*) 0.0002 Hz Fluctuations in Human Intracranial DC Recording.

#### PRESENTATIONS

##### INVITED TALKS

- *Human Electroencephalography Reveals Cortical Variability of Spindle Characteristics.* at the “World Sleep Conference” in Prague, Czech Republic, on October 11, 2017.

- *0.0002 Hz Fluctuations in Human Intracranial Recordings* at the “Sleep, Cognition and Consciousness” in Kaprun, Austria, on March 4, 2017.
- *Spatiotemporal Characteristics of the Sleep Spindle in Human Electroencephalography* at the 1st Conference on Sleep Spindles in Budapest, Hungary, on May 12, 2016.
- *Infra-Slow Fluctuations Correlate with the Sleep Cycle* at the Cognitive Rhythms Collaborative retreat in Boston, MA, on March 16, 2016.
- *Local Properties and Synchrony of Sleep Spindles in Human ECoG* at the SLEEP meeting, in Seattle, WA, on June 8, 2015.
- *Sleep Oscillations: Short-Term and Long-Term Factors* at the Neuropsychology and Functional Neuroimaging Research Unit in Brussels, Belgium, on February 25, 2013.

#### ORAL PRESENTATIONS

- *Human Electroencephalography Reveals Cortical Variability of Spindle Characteristics* at European Sleep Research Society, in Bologna, Italy, on September 15th, 2016 (with Travel Grant)
- *Alpha Power Encodes the Subjective Duration of Bistable Perception* at the Symposium “Sleep, Cognition and Consciousness”, in Salzburg, Austria on December 13, 2012.
- *Brainstem Activity and Slow Waves in Human Sleep EEG/fMRI* at SLEEP 2012, in Boston, MA on June 13, 2012.
- *White Matter Diffusion Correlates with Spindles and Slow Waves* at SLEEP 2012, in Boston, MA on June 13, 2012.
- *Sleep Deprivation Impairs Effective Connectivity during Resting State* at SLEEP 2011, in Minneapolis, MN on June 14, 2011.
- *Task-induced Neuronal Network Connectivity Reappears during Sleep in Humans* at European Sleep Research Society, in Lisbon, Portugal, on September 18, 2010; at ESRS-EU-Marie-Curie final symposium in Seon, Germany, on July 6, 2010.

#### POSTER PRESENTATIONS

- *0.0002 Hz fluctuations in human iEEG correlate with sleep cycles* at the International Conference for Cognitive Neuroscience (ICON), in Amsterdam, NL, on August 1, 2017
- *0.0002 Hz Fluctuations in Human Intracranial DC Recordings* at the Society for Neuroscience meeting, in San Diego, CA, on November 14, 2016.
- *Spatiotemporal Evolution of the Sleep Spindle in Human Neocortex* at the Society for Neuroscience meeting, in Chicago, IL, on October 21, 2015.
- *Insights into Local Properties and Synchrony of Sleep Spindles from ECoG in Humans* at the Society for Neuroscience meeting, in Washington, D.C., on November 16, 2014.
- *The Duration of Bistable Perception Is Predicted by EEG Alpha Power* at Association for the Scientific Study of Consciousness, in Brighton, UK, on July 2-6, 2012.
- *Sleep Deprivation Impairs Effective Connectivity During Resting State* at Human Brain Mapping, in Quebec City, Canada on June 27-28, 2011.
- *Task-Induced Neuronal Network Connectivity Is Reactivated During Sleep: An MEG Study.* at Human Brain Mapping, in Barcelona, Spain, on June 6-10, 2010.

## INVITED REVIEWER FOR

- Brain Topography
- Cerebral Cortex
- European Journal of Neuroscience
- Frontiers in Human Neuroscience
- Human Brain Mapping
- Journal of Clinical Sleep Medicine
- Neuroimage
- Psychophysiology
- Scientific Reports
- Sleep

## SCHOLARSHIPS, GRANTS AND PRIZES

Sep 2016	Travel grant to European Sleep Research Society 2016, in Bologna, IT	€500
May 2015	Best poster prize at Research Fellows Poster Celebration at Massachusetts General Hospital	\$450
2013 – 2015	P.I. on two-year personal grant 220/2012, BIAL Foundation	€46,500
Dec 2012	Travel grant to the symposium on Sleep, Cognition and Consciousness in Salzburg, AT	€200
Jun 2012	Travel grant to SLEEP meeting 2012 in Boston, MA	\$350
Jun 2011	Travel grant to SLEEP meeting 2011 in Minneapolis, MN	\$400
Sep 2010	Travel grant to European Sleep Research Society 2010, in Lisbon, PT	€500
Sep 2006	HSP Huygens Scholarship during M.Sc.	€12,000

## INSTITUTIONAL POSITIONS

Feb 2017	Guest lecturer for two lectures on electrophysiology of sleep to M.Sc. students in Biomedical Sciences
Oct 2016	Guest lecturer for Neuroimage I to M.Sc. students in Cognitive Neuroscience
2011 – 2013	Representative for Ph.D. students at the Netherlands Institute for Neuroscience
2005 – 2007	Editor Psycholinguistics, <i>Nijmegen CNS Master's Thesis Journal</i>

## INTERNATIONAL VISITS

Apr 2016 – Sep 2016	Four-month visit to Prof. O. Jensen on temporal properties of alpha oscillations, at Donders Institute for Cognitive Neuroimaging, Nijmegen
Feb 2015	One-week visit to Prof. E. Halgren investigating spindle characteristics in ECoG, at Multimodal Imaging Lab, UCSD, San Diego, CA
Nov 2010	One-week visit to Prof. P. Maquet on sleep recordings with EEG/fMRI, at University of Liege, BE

## TECHNIQUES

EEG	Analysis of high-density EEG for waking and sleep brain rhythms at the scalp and source level
MEG	Data acquisition during M.Sc. internship at the Donders Institute; analysis of reactivation of inter-regional connectivity during wakefulness and sleep
ECoG	Acquisition and analysis of intracranial electrocorticographic recordings in patients with drug-resistant epilepsy
DTI	Correlation between connectivity properties of white-matter tracts and sleep parameters, such as slow waves and spindles
fMRI	Analysis of combined EEG/fMRI during sleep in relation to brain stem activity associated with slow waves
Python	phypno (main developer of toolbox for ECoG and sleep analysis), mne-python
Matlab	FieldTrip (contributor), EEGLab
R	lme4 (linear mixed-effects models), ggplot2 (plotting functions)
Neuroimaging	SPM8 (fMRI analysis), FSL (DTI tractography), ExploreDTI (DTI deterministic tractography)

## REFERENCES

**Dr. Sydney S. Cash**

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