

## Personal details

### Dr. B.C.M. (Bernadette) van Wijk

Post-Doctoral Research Associate

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## Research statement

How does the coordinated activity of millions of neurons lead to human cognition and behaviour? My work tries to answer this question by looking at the motor system in healthy human subjects and patients with movement disorders. I use techniques such as magneto-encephalography (MEG), electro-encephalography (EEG), electro-myography (EMG), and local field potentials (LFPs) recorded from deep brain stimulation electrodes to study how synchronized neural activity leads to movement in healthy subjects and abnormal movement in Parkinson's disease.

In addition to this experimental work, I have a strong methodological interest. I revealed important caveats in the application of graph theory to describe the structure of complex networks (*van Wijk et al. 2010*), and contributed a novel method for the estimation of cross-frequency coupling (*van Wijk et al. 2015*). Furthermore, I am involved in the development of dynamic causal modelling (DCM), which is a Bayesian computational modelling technique to infer (synaptic) connectivity underlying neuroimaging data features as observed in experimental recordings. On this topic I teach within the annual SPM course at University College London and contribute Matlab code to the open source SPM toolbox.

## Key words

- Brain oscillations
- MEG / EEG / LFPs / EMG
- Functional connectivity
- Human motor control
- Parkinson's disease
- Cross-frequency coupling
- Dynamic causal modelling
- Computational neuroscience
- Cognitive neuroscience
- Graph theory

## Experience

### Post-doctoral

#### Current

*Research Associate* 01/05/2016 - 31/03/2018  
Movement Disorder and Neuromodulation Unit, Department of Neurology, Charité-University Medicine Berlin, Germany. Collaborator: Prof. AA Kühn

*Honorary Research Affiliate* 01/04/2016 - ...  
Wellcome Trust Centre for Neuroimaging, University College London, UK.

*Visiting Researcher* 01/10/2017 - 31/03/2018  
Integrative Model-based Cognitive Neuroscience Research Unit, Department of Psychology, University of Amsterdam, the Netherlands. Collaborator: Prof. BU Forstmann

#### Previous

*Research Associate* 01/06/2013 - 31/03/2016  
Wellcome Trust Centre for Neuroimaging, University College London, UK.  
Collaborators: Dr. V Litvak, Prof. KJ Friston

*Research Officer* 16/01/2013 - 31/03/2013  
Queensland Institute of Medical Research, Brisbane, Australia. Collaborator: Prof. MJ Breakspear

### During PhD

*International working visit* 01/03/2010 - 30/06/2010  
Wellcome Trust Centre for Neuroimaging, University College London, UK. Group Prof. KJ Friston

*PhD student* 01/06/2008 - 31/08/2012  
Faculty of Human Movement Science, VU University Amsterdam, NL.  
Supervisors: Prof. A Daffertshofer, Prof. PJ Beek

## Before PhD

Teaching and Research Assistant 01/09/2005 - 30/06/2006

Research Assistant 01/02/2008 - 31/05/2008

Faculty of Human Movement Science, VU University Amsterdam, NL.

International working visit 01/02/2007 - 14/07/2007

Master's Research internship at the School of Psychology, University of Birmingham, UK.

Supervisor: Dr. P Praamstra

## Education

<b>Doctoral degree</b>	Human Movement Sciences VU University Amsterdam, The Netherlands	2008-2012 cum laude (top 5%)
<b>Master's degree</b>	Human Movement Sciences VU University Amsterdam, The Netherlands	2006-2007 cum laude (top 5%)
<b>Bachelor's degree</b>	Human Movement Sciences VU University Amsterdam, The Netherlands	2003-2006 cum laude (top 5%)

## PhD thesis

### Neural synchronization within and between regions of the motor system

Defended on 26/11/2012.

## Publications

Total = 20  
First Author =  
12

H-index = 11  
(Google  
Scholar)

**van Wijk BCM**, Cagnan H, Litvak V, Kühn AA, Friston KJ (submitted). Generic dynamic causal modelling: an illustrative application to Parkinson's disease.

Lofredi R, **van Wijk BCM**, Neumann W-J, Schneider G-H, Sander TH, Kühn AA (in production). Movement-related changes in cortico-pallidal coupling revealed by simultaneous intracranial and magnetoencephalography recordings in dystonia patients. *Journal of Visualized Experiments*.

**van Wijk BCM** (2017). Is broadband gamma activity pathologically synchronized to the beta rhythm in Parkinson's disease? *The Journal of Neuroscience* 37:9347-9349.

**van Wijk BCM**, Neumann W-J, Schneider G-H, Sander TH, Litvak V, Kühn AA (2017). Low-beta cortico-pallidal coherence decreases during movement and correlates with overall reaction time. *Neuroimage* 159:1-8.

**van Wijk BCM**, Pogosyan A, Hariz MI, Akram H, Foltynie T, Limousin P, Horn A, Ewert S, Brown P, Litvak V (2017). Localization of beta and high-frequency oscillations within the subthalamic nucleus region. *Neuroimage: Clinical* 16:175-183.

Espenhahn SE, de Berker AO, **van Wijk BCM**, Rossiter HE, Ward NS. Movement-related beta oscillations show high intra-individual reliability (2017). *Neuroimage* 147:175-185.

**van Wijk BCM**, Beudel M, Jha A, Oswal A, Foltynie T, Hariz MI, Limousin P, Zrinzo L, Aziz TZ, Green AL, Brown P, Litvak V (2016). Subthalamic nucleus phase-amplitude coupling correlates with motor impairment in Parkinson's disease. *Clinical Neurophysiology* 127:2010-2019.

Friston KJ, Litvak V, Oswal A, Razi A, Stephan KE, **van Wijk BCM**, Ziegler G, Zeidman P (2015). Bayesian model reduction and empirical Bayes for group (DCM) studies. *Neuroimage* 128:413-431.

**van Wijk BCM**, Jha A, Penny W, Litvak V (2015). Parametric estimation of cross-frequency coupling. *Journal of Neuroscience Methods*: 243:94-102. *This paper describes a new statistical method to estimate significant cross-frequency coupling from electrophysiological recordings.*

Friston KJ, Bastos AM, Oswal A, **van Wijk B**, Richter C, Litvak V (2014). Granger causality revisited. *Neuroimage* 101:796-808.

**van Wijk BCM**, FitzGerald THB (2014). Thalamo-cortical cross-frequency coupling detected with MEG. *Frontiers in Human Neuroscience* 8:187.

Boersma M, de Bie HMA, Oostrom KJ, van Dijk BW, Hillebrand A, **van Wijk BCM**, Delemarre-van de Waal HA, Stam CJ (2013). Resting-state oscillatory activity in children born small for gestational age: an MEG study. *Frontiers in Human Neuroscience* 7:600.

**van Wijk BCM**, Litvak V, Friston KJ, Daffertshofer A (2013). Nonlinear coupling between occipital and motor cortex during motor imagery: a dynamic causal modeling study. *Neuroimage* 71:104-113. *In this paper we apply DCM for time-frequency responses as a phenomenological generative model.*

**van Wijk BCM**, Beek PJ, Daffertshofer A (2012). Neural synchrony within the motor system: what have we learned so far? *Frontiers in Human Neuroscience* 6:252.

**van Wijk BCM**, Willemsse RB, Vandertop WP, Daffertshofer A (2012). Slowing of M1 oscillations in brain tumor patients in resting state and during movement. *Clinical Neurophysiology* 123:2212-2219.

**van Wijk BCM**, Beek PJ, Daffertshofer A (2012). Differential modulations of ipsilateral and contralateral beta (de)synchronization during unimanual force production. *European Journal of Neuroscience* 36:2088-2097.

Daffertshofer A, **van Wijk BCM** (2011). On the influence of amplitude on the connectivity between phases. *Frontiers in Neuroinformatics* 5(6).

**van Wijk BCM**, Stam CJ, Daffertshofer A (2010). Comparing brain networks of different size and connectivity density using graph theory. *PLoS ONE* 5:e13701. ***This paper reveals important methodological caveats of popular graph theory analysis. These are relevant for a wide range of structural and functional brain connectivity studies. To date the paper has received >480 citations (Google Scholar).***

Antiqueira L, Rodrigues FA, **van Wijk BCM**, Costa L da F, Daffertshofer A (2010). Estimating complex cortical networks via surface recordings – a critical note. *Neuroimage* 53:439-449.

Boonstra TW, **van Wijk BCM**, Praamstra P, Daffertshofer A (2009). Corticomuscular and bilateral EMG coherence reflect distinct aspects of neural synchronization. *Neuroscience Letters* 29:17-21.

**van Wijk BCM**, Daffertshofer A, Roach N, Praamstra P (2009). A role of beta oscillatory synchrony in biasing response competition? *Cerebral Cortex* 19:1294-1302.

## Research grants and prizes

- MEG UK 2015 - Best presentation award
- Data analysis competition Biomag 2014 – third prize
- Data analysis competition Biomag 2010 – first prize (500 EURO)
  
- GSK Stiftung Travel Grant. 2017 (800 EURO)
- Guarantors of Brain Travel Grant 2016 (800 GPB)
- **NWO Toptalent 2008**  
The Netherlands Organisation for Scientific Research  
Personal grant for financing the salary of a 4-year PhD project. **180.000 EURO**  
Competitive national grant scheme with several selection rounds aiming at excellent Master students from all scientific disciplines for financing their own PhD at a university in The Netherlands.
- *Hersenstichting Nederland* (Dutch Organization for Brain Research)  
Grant for students to support an international research internship related to brain research. 2007 (500 EURO)

## Invited talks

- Colloquium at Institute of Brain and Behaviour, VU University Amsterdam, NL. 12/04/2018
- 14<sup>th</sup> Karniel Computational Motor Control Workshop, Ben-Gurion University of the Negev, Beer-Sheva, Israel. 13-15/03/2018
- Seminar at the Max Planck Institute for Human and Cognitive Brain Sciences, Leipzig, Germany. 19/02/2018
- BCN Symposium on Invasive and Non-Invasive Neuromodulation, University of Groningen, NL. 12/10/2017
- Seminar at Institute of Psychiatry, King's College London, UK. 29/01/2016
- Lab meeting Centre for Neuropsychopharmacology group, Imperial College London, UK. 19/01/2016
- Seminar at the Movement Disorders Unit, Charité Universitätsmedizin Berlin, Germany. 03/12/2015
- Workshop on synchrony and connectivity, King's College London, UK. 16/09/2015
- Brain meeting lecture at Wellcome Trust Centre for Neuroimaging, University College London, UK. 03/07/2015
- Lecture at British Neuroscience Association meeting 2015, Edinburgh, UK. 13/04/2015

- Seminar at Sir Peter Mansfield Magnetic Resonance Centre, University of Nottingham. 06/11/2014
- Lab meeting experimental Neurology group, University of Oxford, UK. 30/04/2014
- Seminar at Centre for Complexity Sciences, University of Bristol, UK. 25/03/2014
- Lab meeting SyMoN group, School of Psychology, University of Birmingham, UK. 06/03/2014
- Workshop on functional connectivity, Donders Institute, Nijmegen, NL. 17/06/2011
- Lecture at annual SPM course on M/EEG, Institute of Neurology, University College London, UK. 2011-...

## Organization

Organizer of weekly scientific lab meetings. Movement Disorder and Neuromodulation Unit, Charité - University Medicine Berlin. 2017

Co-organizer of the SPM course for MEG/EEG in May 2014, May 2015, and May 2016, London. The course consists of two days lectures and demonstrations, and a one day computer seminar. Organization involves constructing the course program and inviting local and external speakers.

Co-organizer of a one-day workshop on Fieldtrip and SPM toolboxes at MEG UK 2015, January 7, Birmingham, UK. The workshop consists of short lectures and hands-on computer sessions.

Co-organizer of the weekly 'brain meeting' seminars at the Wellcome Trust Centre for Neuroimaging for the year 2013-2014. Organization involves inviting and hosting national and international speakers working on various neuroscientific topics.

Co-organizer of a symposium on 'Cross-frequency coupling – methodological challenges' at Biomag 2014, Halifax Canada.

## Teaching experience

### Student supervision

Supervision of 7 'Miniscriptie' short literature theses, Bachelor's 'Psychobiologie', University of Amsterdam. 2017-2018

Supervision of research projects at Charité: 1 Research Master student (3 months), 1 Bachelor student (3 months). 2016-2017

Supervision of research projects at UCL: 1 Research Master's student (6-months). 2015

Supervision of research projects at VU: 8 Bachelor's Human Movement Sciences students (4 projects of 4 months each). 2008-2012

Supervision of 1 literature thesis, Bachelor's Human Movement Sciences, VU University Amsterdam. 2011

### Seminars

Supervision during a one day computer seminar of the annual SPM course hosted by the Institute of Neurology, UCL. The students in this course are primarily PhD students and post docs from universities across Europe. 2010-2016

Teaching assistant for dissection classes of the Neuroanatomy course in the Bachelor's curriculum of Human Movement Sciences, VU University Amsterdam. 2009-2011

Teaching assistant for various Matlab-based computer seminars for courses in the Bachelor's curriculum of Human Movement Sciences, VU University Amsterdam: *Introduction to Matlab*, *Introduction to research methods*, *Simulation models of neuromuscular systems*. 2005-2007

### Lectures

Lecture on dynamic causal modelling in the annual SPM course hosted by the Institute of Neurology, UCL. 2011-2017

Lecture on Electrophysiology of the motor system. Clinical Neuroscience, Charité. March 2017

Lecture on Neuronal models of cortico-basal ganglia loops. Medical Neuroscience, Charité. Nov 2016

Lecture on Dynamic causal modelling. MEG UK, Birmingham. 2015

Lecture on Dynamic causal modelling. BNA, Edinburgh. 2015

**PhD  
Committee  
Member**

Maarten van den Heuvel (VU University Amsterdam, December 2017)  
Loek Brinkman (Radboud University Nijmegen, June 2016)

**Reviewer  
activities**

Review editor for:

- Frontiers in Human Neuroscience
- Brain Topography

Ad-hoc peer reviewer for:

- The Journal of Neuroscience
- PLoS One
- Neuroimage
- Journal of Neuroscience Methods
- Schizophrenia Bulletin
- Movement Disorders
- European Journal of Applied Physiology
- Journal of Neurophysiology
- Chaos
- Neuroscience Letters
- Human Movement Science
- Clinical Neurophysiology

**Skills**

Matlab programming	●●●●●●●●●●
SPM	●●●●●●●●●○
Fieldtrip	●●●●●●●●○○
Signal processing	●●●●●●●●●○
MEG acquisition	●●●●●●●●●○
EEG acquisition	●●●●●●●●○○
Experimental design	●●●●●●●●●○

Experienced with data acquisition and signal processing of: MEG (CTF system), EEG (Biosemi), EMG (surface bipolar and high-density grids), force sensors, accelerometers, and motion capturing (Optotrak).

Experienced with various signal processing methods: e.g., spectral analysis, event-related potentials, coherence, phase synchronization, source localization, principal component analysis, graph theory, dynamic causal modeling, cross-frequency coupling.

Contributor of SPM Matlab functions for analysis of cross-frequency coupling and dynamic causal modeling.

Experienced with Windows and Linux operating systems, as well as grid computing.

**Extra-  
curricular  
courses**

- Linear Algebra (first year Bachelor's Mathematics, VU University Amsterdam)
- Non-linear dynamics (second year Bachelor's Mathematics, VU University Amsterdam)
- Probabilistic and Unsupervised Learning, Approximate Inference and Learning in Probabilistic Models (Gatsby Unit for Computational Neuroscience, University College London)
- Model-based neuroscience summer school 2017 (University of Amsterdam)

**Other  
presenta-  
tions**

**Oral presentations**

- MEG UK 2017, Oxford, UK
- Biomag 2016, Seoul, South Korea
- Biomag 2014, Halifax, Canada
- MEG UK 2014, Nottingham, UK
- Brainmodes 2012, Brisbane, Australia
- Brainmodes 2010, Copenhagen, Denmark
- 7th NFSI & ICBEM 2009, Rome, Italy

**Poster presentations**

- IBAGS 2017, Mérida, Mexico
- MEG UK 2017, Oxford, UK

International DBS Symposium KFO 247, 2016, Berlin, Germany  
 Bernstein Conference 2016, Berlin, Germany  
 20th International Congress of Parkinson's Disease and Movement Disorders 2016, Berlin, Germany  
 Society for Neuroscience 2015, Chicago, USA  
 CuttingEEG 2015, Berlin, Germany  
 UCL Neuroscience Symposium, 19 June 2015, London, UK  
 MEG UK 2015, Birmingham, UK  
 Brainmodes 2014, London, UK  
 UCL Neuroscience Symposium, 13 June 2014, London, UK  
 HBM 2014, Hamburg, Germany  
 MEG UK 2014, Nottingham, UK  
 Brainmodes 2013, Amsterdam  
 7th FENS forum of European Neuroscience, 2010, Amsterdam, NL  
 7th edition of Progress in Motor Control, 2009, Marseille, France  
 Biomag 2008, Sapporo, Japan

**Other international conferences**

Attendance of international conferences (>1 day) without presenting own work: *Brain informatics and Health* (London 2015), *Brainmodes* (Amsterdam 2008 & Marseille 2011), *Brain Connectivity Workshop* (Maastricht 2009 & Berlin 2010), *FENS Satellite Symposium on Motor Control* (Nijmegen 2010).

**Public engagement**

UCL Hospitals Research Open Day, 10 July 2014. Helping out at information stall on deep brain stimulation in Parkinson's disease. Explaining ongoing research to members of the public.

**Languages**

