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Nicole Voges  
Institute of Language, Communication and the Brain  
& Institut de Neurosciences de la Timone UMR7289  
Aix-Marseille University  
27 Boulevard Jean Moulin  
F – 13385 Marseille Cedex 05  
mailto: nicole.voges@univ-amu.fr

home:  
142 Corniche Kennedy  
F – 13007 Marseille  
mailto: nicole.voges@gmx.com

## Curriculum Vitae

Name: Nicole Voges  
Date of birth: March 17th, 1971  
Place of birth: Hannover/Langenhagen, Germany

### Work/Research experience:

- since 04/2020 **Post-doctoral ILCB grant**, Brainets Group, INT & INS Marseille (PIs A. Brovelli & D. Battaglia). By means of computational modeling we develop and test a set of tools that are able to detect and track cognitive processing in the dynamics of neural circuits. These tools are elementary computations to be performed on information.
- 12/2015 – 03/2020 **Post-doctoral position**, Statistical Neuroscience Group, INM-6, FZJ, Germany (PI S. Grün). Analysis of electrophysiological data: I was working on the evaluation of spike sorting methods applied to extracellular STN recordings in Parkinson patients (DFG grant KFO219), as well as on the characterization of resting state dynamics (LFP & single neuron spiking) in multi-electrode recordings from monkey motor cortex (in comparison to network simulations as part of the HBP).
- 07/2014 – 11/2015 **Post-doctoral position**, Sensory Systems and Behaviour, CRG Barcelona (PI M. Louis, EU project MINIMAL). Using optogenetics, we investigated the neuronal mechanisms of decision making in *Drosophila* larvae. My work included operant learning experiments using and complementing a closed-loop tracker, the extension of an agent model to simulate larvae behaviour, as well as writing reports and student supervision.
- 05/2014 – 06/2014 **Post-doctoral position**, UMR 7503, LORIA – INRIA Nancy, France (PI A. Hutt, ERC grant MATHANA). Analysis of up- and down states in intracellular recordings from the rat's cortex.

- 04/2012 – 04/2014 **Researcher (fixed term)**, UMR 7503, LORIA – CNRS Nancy, France (PI D. Martinez, ANR grant Pherotaxis). Study of moth's olfactory mating search. We combined neuronal modeling, the analysis of neurobiological data, robotics, and information theory applied to search strategies. My job included cyborg experiments, the implementation of reactive and cognitive search strategies, data analysis, and modeling.
- 10/2010 – 03/2012 **Post-doctoral position**, University Eye Hospital, Section Visual Function, Freiburg, Germany (PIs M. Bach & G. Kommerell, DFG grant KO761/2-2). Continuation of a clinical study on the advantage of binocularity in the presence of external noise. The project involved programming visual stimuli in a 3D virtual reality environment, its functional coupling to shutter glasses, experiments with human subjects, as well as the statistical analysis of hit rates and reaction times.
- 06/2009 – 05/2010 **Post-doctoral position**, in collaboration between INRIA Sophia Antipolis (supervisor M. Clerc) and INSERM U751, Marseille, France (supervisor C. Bénar). The work was part of initiating the ANR grant Multimodel on the investigation of the neurovascular coupling in epilepsy. Inspired by simultaneous EEG-fMRI recordings we coupled a neural mass to a metabolic-hemodynamic model and focused on the analysis of non-linearities and negative BOLD signals.
- 11/2007 – 04/2009 **Post-doctoral position**, INCM, UMR6193 CNRS – Université de la Méditerranée, Marseille, France (supervisors L. Perrinet & G. Masson, EU project FACETS). We analyzed differences in the spiking dynamics of various cortical network architectures (connectivities in 2D) based on realistic parameters. My job included the development of neuronal networks, computer simulations using NEST/PyNN, as well as data analysis.
- 2001–2002 **Employee** in Testing and QA in the R&D Dept. of SER Technology Deutschland GmbH. My duties were mainly data preparation/preprocessing and analysis, as well as core algorithm testing.

## Education:

- 2003–2007 **PhD studies** “Statistical analysis of cortical networks based on neuroanatomical data”, Dept. of Neurobiology and Biophysics, University of Freiburg (supervisors A. Aertsen, S. Rotter). I transformed neuroanatomical data into spatially embedded cortical network models. The idea was to improve cortical networks by including single cell morphology and to statistically analyze the emerging differences, e.g., using graph theory.
- 2007 Completion of PhD studies at the Bernstein Center for Computational Neuroscience, Freiburg. PhD in July 2007.
- 2004–2006 Stipend of the Institute for Frontier Areas of Psychology and Mental Health, Dept. of Theory and Data Analysis
- 1990–2001 **Studies in physics (Dpl)**, Carl von Ossietzky University Oldenburg

2000/01	Diploma thesis on “Classification of spike trains of retinal ganglion cells” (Dept. of statistical physics). The thesis was part of the SFB project 517 <i>Neurocognition</i> . I used statistical physics (machine learning) to perform a stimulus-based classification of extracellular ganglion cell recordings of a turtle’s retina, looking for the most appropriate preprocessing method.
1998/99	Pre-master thesis “Statistical analysis of the energy dissipation rate in a turbulent free jet”
1996	Internship “Physical measurement and digital signal processing”
1990	<b>Abitur</b> at Matthias-Claudius-Gymnasium Gehrden, Hannover

## Publications

in preparation	Voges N, Hausmann J, Brovelli A, Battaglia D. Low-level algorithmic decomposition of neural circuit function.
in preparation	Johanna Senk J, Kriener B, Plesser HE, Gewaltig M-O, Diesmann M, Djurfelt M, Voges N, van Albada SJ. Connectivity Concepts in Neuronal Network Modeling. <i>To be uploaded to arxiv.org</i>
under revision	Dabrowska PA*, Voges N*, von Papen M, Ito J, Dahmen D, Riehle A, Brochier T, Grün S. Characterisation of spiking resting state dynamics in Macaque monkey motor cortex. <i>Uploaded to BioRxiv: <a href="https://doi.org/10.1101/2020.05.28.121095">https://doi.org/10.1101/2020.05.28.121095</a></i>
under revision	Dahmen D, Layer M, Deutz L, Dabrowska PA, Voges N, von Papen M, Brochier T, Riehle A, Diesmann M, Grün S, Helias M. Long-range coordination patterns in cortex change with behavioral context. <i>Uploaded to BioRxiv: <a href="https://doi.org/10.1101/2020.07.15.205013">https://doi.org/10.1101/2020.07.15.205013</a></i>
2019	Sukiban J*, Voges N*, Weber I, Dembek T, Pauli R, Visser-Vandewalle V, Denker M, Timmermann L, Grün S. Evaluation of spike sorting algorithms: Simulations and application to human Subthalamic Nucleus recordings. <i>Neuroscience 14</i> , pp 168-185
2014	Voges N, Chaffiol A, Lucas P, Martinez D. Reactive Searching and Infotaxis in Odor Source Localization. <i>PLoS Comput Biol 10(11): e1004019. doi: 10.1371/journal.pcbi.1004019</i>
2013	Martinez D, Chaffiol A, Voges N, Gu Y, Anton S, Rospars J-P, Lucas P. On/Off pheromone signaling in moths as neural correlates of a search strategy. <i>PLoS ONE 8(4): e61220. doi:10.1371/journal.pone.0061220</i>
2012	Voges N, Perrinet L. Recurrent cortical networks with realistic horizontal connectivities show complex dynamics. <i>Frontiers Computational Neuroscience DOI: 10.3389/fncom.2012.00041</i>
2012	Voges N, Bach M, Kommerell G. Parallax movement beats binocularity in the presence of external visual noise. <i>Ophthalmic &amp; Physiological Optics 32</i> , pp 308–316

- 2012 Voges N, Aertsen A, Rotter S. Structural models of cortical networks with long-range connectivity. *Mathematical Problems in Engineering*, Article ID 484812, 17 pages. DOI: 10.1155/2012/484812
- 2012 Voges N, Blanchard S, Wendling F, Benali H, David O, Papadopoulo T, Clerc M, Bénar C. Modeling of the neurovascular coupling in epileptic discharges. *Brain Topography* 25(2), pp 136–156
- 2011 Blanchard S, Papadopoulo T, Bénar C, Voges N, Clerc M, Benali H, Warnking J, David O, Wendling F. Relationship between flow and metabolism in BOLD signals: insights from biophysical models. *Brain Topography* 24(1), pp 40–53
- 2010 Voges N, Schüz A, Aertsen A, Rotter S. A modeler's view on the spatial structure of horizontal neuronal connectivity in the neocortex. *Progress in Neurobiology* 92, pp 277–292
- 2010 Voges N, Guijarro C, Aertsen A, Rotter S. Models of cortical networks with long-range patchy projections. *Journal of Computational Neuroscience* 28(1), pp 137–154
- 2010 Voges N, Perrinet L. Phase space analysis of networks based on biologically realistic parameters. *Journal of Physiology – Paris* (104), pp 51–60
- 2007 Voges N, Aertsen A, Rotter S. Statistical analysis of spatially embedded networks: From grid to random node positions. *Neurocomputing* 70(10–12), pp 1833–1837

## Conference proceedings

- 2012 Kommerell G, Voges N, Bach M. Zwei Augen besser als ein Auge? *Zeitschrift für Praktische Augenheilkunde* 33, pp 453–456
- 2010 Voges N, Blanchard S, Wendling F, Benali H, David O, Papadopoulo T, Clerc M, Bénar C. Application of a hemodynamic model to epileptic spikes. *Proceedings NeuroComp 2010*, pp 232–236
- 2008 Voges N, Perrinet L. Analyzing cortical network dynamics with respect to different connectivity assumptions. *Proceedings NeuroComp 2008*, pp 299–301
- 2000 Ammermüller J, Greschner M, Voges N, Bongard M. Stimulus feature extraction from the ensemble activity of retinal ganglion cells: Experiments using periodic stimuli with and without external information, and stimuli simulating microscopic eye movements. *Baratoff G., Neuman, H. (eds). Dynamic perception. Proceedings in artificial intelligence vol. 9. Akad. Verlag, Berlin*, pp 159–162

## Theses

- 2007 Voges N (2007). Statistical analysis of cortical networks based on neuroanatomical data. *PhD thesis, University of Freiburg*
- 2000 Voges N (2000). Klassifikation von spike trains retinaler Ganglienzellen. *Diplomarbeit (master thesis), Carl von Ossietzky Universität Oldenburg*
- 1999 Voges N (1999). Statistische Untersuchung der Energiedissipationsraten im turbulenten Freistrah. *Studienarbeit (student project), Carl von Ossietzky Universität Oldenburg*

## Teaching & Reviewing

- since 2016 Supervision of PhD student P. Dabrovska
- 2016–2019 Supervision of PhD student J. Sukiban
- 2016–2018 Lecturer and tutor for “Introduction to Computational Neuroscience” & regular supervision of student seminar “Cortical Structure and Function”, RWTH Aachen
- since 2008 Reviewer for Cerebral Cortex, Biological Cybernetics, Physica A
- 2002–2007 Regular supervision of student seminar “Brain & Cognition” at the University of Freiburg
- 2006/2007 Co-supervision of diploma student C. Guijarro
- 10/2006 Tutor for exercises in “Neurophysiology I: Measurement and Analysis of Neuronal Activity”, Dept. of Neurobiology & Biophysics, Biology III, University of Freiburg
- 10/2006 Tutor for exercises in “Analysis and Models in Neurophysiology”, NWG-Course, University of Freiburg
- 2004–2005 Tutor for exercises in “Introduction to Neurobiology and Biophysics III: Measurement and Model”, Dept. of Neurobiology & Biophysics, Biology III, University of Freiburg

## Languages & programming skills

- Languages German (native), English (fluent), French (almost fluent)
- Software experiences C/C++, Objective C, Matlab, Python, NEST/PyNN, Tcl/Tk, OpenGL, R, Mathematica, Java, Git

## Invited talks

- 12/2013 “Reactive and cognitive mating search strategies” at University Eye Hospital, Freiburg (invited by S. Heinrich and M. Bach)
- 07/2013 “From perception to action in searching” at INRIA, Paris
- 10/2011 “Two modeling approaches: spiking cortical networks and population models in epilepsy – space matters!” at Loria, Nancy (invited by D. Martinez)
- 04/2011 “From neuroanatomy combined with graph theory via network dynamics of the visual cortex to retinotopic map formation” at the Centre for Mathematical Sciences, DAMTP, Cambridge (invited by S. Eglén)
- 06/2010 “Explorative investigation of the neurovascular coupling in epilepsy” at the Norwegian University of Life Sciences (UMB, invited by H.E. Plesser and G.T. Einevoll)
- 01/2009 “Statistical analysis & dynamics of cortical networks based on neuroanatomical data” at INRIA Sophia Antipolis (invited by M. Clerc)
- 07/2007 “Statistical analysis of cortical networks with long-range patchy connections” at Newcastle University (invited by M. Kaiser and T. Binzegger)
- 04/2007 “Statistical analysis of cortical networks with long-range patchy connections” at the Institute of Neuroinformatics, University/ETH Zürich (invited by R. Douglas)
- 03/2007 “Statistical analysis of cortical networks with long-range patchy connections” at INCM – CNRS, Marseille (invited by L. Perrinet and G. Masson)
- 11/2004 “How to model cortical long-range patchy connections?” at Max-Planck-Institut für biologische Kybernetik, Tübingen (invited by A. Schüz)

## Selected conference contributions

- 2020 Voges N, Brovelli A, Battaglia D. Information dynamic metrics track the emergence of cognitive information processing from neural circuits. *AREADNE, Bernstein Conference, Brain Criticality, online*
- 2019 Dahmen D, Layer M, Deutz L, Dabrowska PA, Voges N, von Papen M, Brochier T, Riehle A, Diesmann M, Grün S, Helias M. Coordination between individual neurons across mesoscopic distances *CNS 2019, Barcelona*
- 2017 Voges N, Dabrowska P, Senk J, Hagen E, Riehle A, Brochier T, Grün S. Characterization of resting state dynamics in monkey motor cortex. *26th Annual Computational Neuroscience Meeting, Antwerp*
- 2016 Voges N, Sukiban J, Pauli R, Denker M, Timmermann L, Grün S. Evaluation of spike sorting results. *Bernstein Conference for Computational Neuroscience, Berlin*

- 2015 Voges N, Davies A, Schulze A, Webb B, Louis M. First steps in encoding the link between sensory neural firing and behaviour in *Drosophila* larvae, *NETT International Conference on System Level Approaches to Neural Engineering, Barcelona*
- 2013 Voges N, Montagnini A, Martinez D. Comparison of reactive and cognitive search strategies, *36th European Conference on Visual Perception, Bremen*
- 2012 Voges N, Chaffiol A, Buhry L, Lucas P, Martinez D. Post-stimulus firing and the corresponding olfactory search strategy. *42nd annual meeting of the Society for Neuroscience, New Orleans*
- 2012 Voges N, Bach M, Kommerell G. Parallax movement beats binocularity in the presence of external visual noise. *35th European Conference on Visual Perception, Alghero*
- 2011 Voges N, Bach M, Kommerell G. The advantage of binocularity in the presence of stationary or moving external visual noise. *34th European Conference on Visual Perception, Toulouse*
- 2011 Voges N, Perrinet L. The relationship between cortical network structure and the corresponding state space dynamics. *20th Computational Neuroscience Meeting, Stockholm*
- 2010 Voges N, Blanchard S, Wendling F, Benali H, David O, Papadopoulou T, Clerc M, Bénar C. Investigation of BOLD responses to epileptic spikes: a combined modeling & data analysis approach. *16th Annual Meeting of the Organization for Human Brain Mapping, Barcelona*
- 2009 Voges N, Perrinet L. Recurrent cortical networks with realistic horizontal connectivities show complex dynamics. *18th Computational Neuroscience Meeting, Berlin*
- 2009 Voges N, Perrinet L. Dynamical state spaces of cortical networks representing various horizontal connectivities. *Computational and Systems Neuroscience 2009, Salt Lake City*
- 2008 Voges N, Kremkow J, Perrinet L. Analyzing cortical network dynamics with respect to spatially realistic connectivities. *Federation of European Neuroscience Societies Forum, Genève*
- 2006 Voges N, Aertsen A, Rotter S. Anatomy-based network models of cortex and their statistical analysis. *15th Computational Neuroscience Meeting, Edinburgh*
- 2005 Voges N, Aertsen A, Rotter S. Statistical analysis and modeling of cortical network architecture based on neuroanatomical data. *30th Göttingen Neurobiology Conference*
- 2000 Greschner M, Voges N, Ammermüller J. Stimulus feature extraction from the ensemble activity of retinal ganglion cells: Experiments simulating microscopic eye movements. *28th Göttingen Neurobiology Conference*

- 2000 Ammermüller J, Bongard M, Rujan P, Voges N. Decoding of visual stimulus features from the intrinsic activity of retinal ganglion cell populations. *23rd European Conference on Visual Perception, Groningen*
- 1999 Voges N, Reisner B, Renner C, Peinke J. On Markov properties of the energy dissipation rate in turbulence. *Spring conference of the German Physical Society, Münster*