Renato Carlos F. **Duarte**

Postdoctoral Researcher in Cognitive Computational Neuroscience

Institute of Neuroscience and Medicine (INM-6), Institute for Advanced Simulation (IAS-6)
and JARA Institute Brain Structure-Function Relationships (JBI-1 / INM-10),
Jülich Research Centre, Jülich, Germany

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Education

Albert-Ludwigs-Universität, Faculty of Biology (host)   *Freiburg, Germany*

European Study Program in Neuroinformatics and Computational Neuroscience (EuroSPIN) - Joint PhD degree   *Sep. 2011 - May 2018*

- Dissertation: *State-dependent processing in spiking neural networks*
- Advisor: Prof. Dr. Abigail Morrison
- Honours: *Summa cum laude*
- Relevant Coursework: Computational Neuroscience, Simulating Biological Neural Networks, Introduction to Scientific Programming in Python

University of Edinburgh, School of Informatics (partner)   *Edinburgh, United Kingdom*

European Study Program in Neuroinformatics and Computational Neuroscience (EuroSPIN) - Joint PhD degree   *Jun. 2012 - Jan. 2013*

- Advisor: Prof. Dr. Peggy Seriès
- Relevant Coursework: Probabilistic Modelling and Reasoning, Information Theory, Advanced Natural Language Processing

University of Algarve, Faculty of Human and Social Sciences   *Faro, Portugal*

M.Sc. in Cognitive Neuroscience and Neuropsychology   *Sep. 2009 - Aug. 2011*

- Dissertation: *Self-organized sequence processing in recurrent neural networks with multiple interacting plasticity mechanisms*
- Advisor: Prof. Dr. Karl Magnus Petersson
- Honours: *Distinction* (17/20)
- Relevant Coursework: Cognitive Neuroscience, Neuroimaging Methods, Neuropsychiatry and Neuropharmacology, Developmental Cognitive Neuroscience and Neuroplasticity, Nervous System Pathologies, Cognitive Psychology

University of Coimbra, Faculty of Pharmacy   *Coimbra, Portugal*

B.Sc. in Pharmaceutical Science   *Oct. 2002 - Jun. 2009*

- Relevant Coursework: Biochemistry, Pharmacology, Molecular Cell Biology, Anatomophysiology, Embryology, Histology

Positions

Max Planck Institute for Psycholinguistics   *Nijmegen, Netherlands*

Guest Researcher   *Jan. 2019 - Present*

- Collaborator in the *Neurobiology of Language* department

Forchungszentrum Jülich (FZJ)   *Jülich, Germany*

Postdoctoral Researcher   *Jun. 2018 - Present*

- *Computation in Neural Circuits (CiNC)*, Institute of Neuroscience and Medicine (INM-6), Institute for Advanced Simulation (IAS-6) and JARA-Institute Brain Structure Function Relationship (JBI 1 / INM-10)

Forchungszentrum Jülich (FZJ)   *Jülich, Germany*

Doctoral researcher   *Jul. 2014 - May 2018*

- *Computation in Neural Circuits (CiNC)*, Institute of Neuroscience and Medicine (INM-6), Institute for Advanced Simulation (IAS-6) and JARA-Institute Brain Structure Function Relationship (JBI 1 / INM-10)

Ruhr-Universität Bochum   *Bochum, Germany*

Doctoral researcher   *Jan. 2013 - Jun. 2014*

- *Institute of Cognitive Neuroscience (IKN)*, Department of Psychology

University of Edinburgh   *Edinburgh, UK*

Doctoral Researcher   *Aug. 2012 - Jan. 2013*

- *Institute for Adaptive and Neural Computation*, School of Informatics
- Mobility period at the partner institution within the EuroSPIN PhD Program

Albert-Ludwigs-Universität   *Freiburg, Germany*

Doctoral Researcher   *Oct. 2011 - Jul. 2012*

- *Bernstein Center Freiburg (BCF)* and *Institute for Microsystems Technology (IMTEK)*, Faculty of Biology
- Host institution within the EuroSPIN PhD Program

University of Algarve · *Faro, Portugal*

Research Assistant · *Oct. 2010 - Sep. 2011*

- *Cognitive Neuroscience Research Group*, Faculty of Human and Social Sciences, Department of Psychology

Publications

Journal Articles

- Hartmut Fitz, Marvin Uhlmann, Dick van den Broek, **Renato Duarte**, Peter Hagoort, and Karl Magnus Petersson. Neuronal theory of working memory. *PNAS* (In Review). BioRxiv doi:10.1101/546325.

- Claudia Bachmann, Tom Tetzlaff, **Renato Duarte**, and Abigail Morrison. Firing rate homeostasis counteracts changes in stability of recurrent neural networks caused by synapse loss in Alzheimer's disease. *PLoS Computational Biology* (In Review). arXiv doi:1909.01012.

- Barna Zajzon, Sepehr Mahmoudian, Abigail Morrison, and **Renato Duarte**. Passing the Message: Representation Transfer in Modular Balanced Networks. *Frontiers in Computational Neuroscience*, 13:79, 2019.

- **Renato Duarte** and Abigail Morrison. Leveraging heterogeneity for neural computation with fading memory in layer 2/3 cortical microcircuits. *PLoS Computational Biology*, 15(4):1–42, 2019.

- **Renato Duarte**, Alexander Seeholzer, Karl Zilles, and Abigail Morrison. Synaptic patterning and the timescales of cortical dynamics. *Current Opinion in Neurobiology*, 43:156–165, 2017.

- Philipp Weidel, Mikael Djurfeldt, **Renato Duarte**, and Abigail Morrison. Closed loop interactions between spiking neural network and robotic simulators based on MUSIC and ROS. *Frontiers in Neuroinformatics*, 10(31):1–19, 2016.

- **Renato Duarte**. Expansion and State-Dependent Variability along Sensory Processing Streams. *The Journal of Neuroscience*, 35(19):7315–7316, 2015.

- Carlos Toledo-Suárez, **Renato Duarte**, and Abigail Morrison. Liquid computing on and off the edge of chaos with a striatal microcircuit. *Frontiers in Computational Neuroscience*, 8(November):130, 2014.

- **Renato Duarte** and Abigail Morrison. Dynamic stability of sequential stimulus representations in adapting neuronal networks. *Frontiers in Computational Neuroscience*, 8(124):124, 2014.

Conference Proceedings

- **Renato Duarte**, Marvin Uhlmann, Dick Den Van Broek, Hartmut Fitz, Karl Magnus Petersson, and Abigail Morrison. Encoding symbolic sequences with spiking neural reservoirs. In *Proceedings of the International Joint Conference on Neural Networks*, pages 1–8. IEEE, 2018.

- Barna Zajzon, **Renato Duarte**, and Abigail Morrison. Transferring State Representations in Hierarchical Spiking Neural Networks. In *Proceedings of the International Joint Conference on Neural Networks*, pages 1–9. IEEE, 2018.

- Dick van den Broek, Marvin Uhlmann, Hartmut Fitz, **Renato Duarte**, Peter Hagoort, and Karl Magnus Petersson. The best spike filter kernel is a neuron, Extended abstract presented at Computational Cognitive Neuroscience (CCN), 2017.

- **Renato Duarte**, Peggy Seriès, and Abigail Morrison. Self-Organized Artificial Grammar Learning in Spiking Neural Networks. In *Proceedings of the 36th Annual Conference of the Cognitive Science Society*, pages 427–432, 2014.

Theses

- **Renato Duarte**. *State-dependent processing in Spiking Neural Networks*. PhD Thesis, Albert-Ludwigs-Universität Freiburg and University of Edinburgh. 2017.

- **Renato Duarte**. *Self-organized sequence processing in recurrent neural networks with multiple interacting plasticity mechanisms*. MSc thesis, University of Algarve, 2011.

Presentations

Oral

NII Shonan Symposium no. 141: *Language as Goal-Directed Sequential Behavior: Computational Theories, Brain Mechanisms, Evolutionary Roots* · *Kanagawa, Japan*

State-dependent processing in Spiking Neural Networks · *May 2019*

Center for Biomedical Research (CBMR) Distinguished Seminars · *Faro, Portugal*

State-dependent processing in Spiking Neural Networks · *May 2018*

Institute for Advanced Simulation (IAS) Retreat — *Jülich, Germany*
LEVERAGING HETEROGENEITY FOR NEURAL COMPUTATION WITH FADING MEMORY — *Dec. 2016*

Institute for Neuroscience and Medicine (INM) Retreat — *Jülich, Germany*
DECISION-SPECIFIC SEQUENCES OF NEURAL ACTIVITY IN BALANCED RANDOM NETWORKS DRIVEN BY STRUCTURED SENSORY INPUT — *Jul. 2016*

5th EuroSPIN Workshop — *Stockholm, Sweden*
SYNAPTIC ADAPTATION STABILIZES SEQUENTIAL STIMULUS REPRESENTATIONS — *May 2015*

7th International Workshop on *Guided Self-Organization* — *Freiburg, Germany*
SYNAPTIC ADAPTATION STABILIZES SEQUENTIAL STIMULUS REPRESENTATIONS — *Dec. 2014*

36th Annual Conference of the Cognitive Science Society — *Quebéc, Canada*
SELF-ORGANIZED ARTIFICIAL GRAMMAR LEARNING IN SPIKING NEURAL NETWORKS — *Jul. 2014*

Osnabrück Computational Cognition Alliance Meeting on *The Brain as a Self-Organized Dynamical System* — *Osnabrück, Germany*
SYNTAX PROCESSING PROPERTIES OF GENERIC CORTICAL CIRUCUITS — *May 2013*

EuroSPIN/NeuroTime Workshop — *Beuggen, Germany*
PROCESSING STRUCTURED SYMBOLIC SEQUENCES WITH RECURRENT NEURAL NETWORKS — *Jan. 2013*

POSTER

International Joint Conference on Neural Networks (IJCNN) — *Rio de Janeiro, Brazil*
ENCODING SYMBOLIC SEQUENCES WITH SPIKING NEURAL RESERVOIRS — *Jul. 2018*

Neural Coding, Computation and Dynamics (NCCD) — *Capbreton, France*
LEVERAGING HETEROGENEITY FOR NEURAL COMPUTATION WITH FADING MEMORY IN LAYER 2/3 CORTICAL MICROCIRCUITS — *Sep. 2017*

Integrated Systems Neuroscience (ISN) — *Manchester, UK*
LEVERAGING HETEROGENEITY FOR NEURAL COMPUTATION WITH FADING MEMORY IN LAYER 2/3 CORTICAL MICROCIRCUITS — *Sep. 2017*

Institute for Neuroscience and Medicine (INM) and Institute for Complex Systems (ICS) Retreat — *Jülich, Germany*
LEVERAGING COMPLEXITY AND HETEROGENEITY FOR NEURAL COMPUTATION WITH FADING MEMORY — *Jul. 2017*

24th Annual Computational Neuroscience Meeting (CNS 2015) — *Prague, Czech Republic*
ROS-MUSIC TOOLCHAIN FOR SPIKING NEURAL NETWORK SIMULATIONS IN A ROBOTIC ENVIRONMENT — *Jul. 2015*

Human Brain Project Workshop: *Stochastic Neural Computation* — *Paris, France*
DYNAMIC STIMULUS REPRESENTATIONS IN ADAPTING NEURONAL NETWORKS — *Nov. 2014*

Donders Discussions — *Nijmegen, Netherlands*
TEMPORAL SEQUENCE LEARNING VIA ADAPTATION IN BIOLOGICALLY PLAUSIBLE SPIKING NEURAL NETWORKS — *Nov. 2014*

Bernstein Conference 2014 — *Göttingen, Germany*
TEMPORAL SEQUENCE LEARNING VIA ADAPTATION IN BIOLOGICALLY PLAUSIBLE SPIKING NEURAL NETWORKS — *Sep. 2014*

23rd Annual Computational Neuroscience Meeting (CNS 2014) — *Quebéc, Canada*
TEMPORAL SEQUENCE LEARNING VIA ADAPTATION IN BIOLOGICALLY PLAUSIBLE SPIKING NEURAL NETWORKS — *Aug. 2014*

BCCN Freiburg conference: *Dynamics of neuronal systems* — *Freiburg, Germany*
SYNTAX PROCESSING PROPERTIES OF GENERIC CORTICAL CIRUCUITS — *Mar. 2013*

22nd Annual Computational Neuroscience Meeting (CNS 2014) — *Paris, France*
SYNTAX PROCESSING PROPERTIES OF GENERIC CORTICAL CIRUCUITS — *Jun. 2013*

Workshops & Courses

2019	**Cognomics 2019: *Bridging gaps: From genes to cognition***, Max-Planck Institute for Psycholinguistics	*Nijmegen, Netherlands*
2019	**Neuro-anatomical foundations of cortical computation**, Max-Planck Institute for Psycholinguistics	*Nijmegen, Netherlands*
2018	**Champalimaud Research Symposium: *Quantitative approaches to behavior and neural systems***, Champalimaud Center for the Unknown	*Lisbon, Portugal*
2018	**Advances in Reservoir Computing**, International Joint Conference on Neural Networks (IJCNN)	*Rio de Janeiro, Brazil*
2018	**Cognitive Computation Symposium (CoCoSym): *Thinking beyond Deep Learning***, City University of London	*London, UK*
2017	**Neural Coding, Computation and Dynamics (NCCD 2017) Workshop**, Capbreton Casino	*Capbreton, France*
2017	**Integrated Systems Neuroscience (ISN 2017) Workshop**, The University of Manchester	*Manchester, UK*

2017	**Computational Psychiatry**, Translational Neuromodeling Unit (TNU), ETH Zürich	*Zürich, Switzerland*
2016	**Hierarchical Processing Advanced Course**, Champalimaud Center for the Unknown	*Lisbon, Portugal*
2015	**NESTML Community Workshop**, RWTH Aachen University	*Aachen, Germany*
2015	**Neural Coding, Computation and Dynamics (NCCD 2015) Workshop**, URH Palacio de Oriol Hotel	*Bilbao, Spain*
2015	**5th EuroSPIN Workshop**, KTH Royal Institute of Technology	*Stockholm, Sweden*
2014	**7th International Workshop on *Guided Self-Organization***, Machine Learning Lab, Albert-Ludvigs-Universität	*Freiburg, Germany*
2014	**Human Brain Project (HBP) Workshop: *Stochastic Neural Computation***, European Institute for Theoretical Neuroscience	*Paris, France*
2014	**Data Analysis and Data Mining with Python**, Jülich Supercomputing Center	*Jülich, Germany*
2014	**Practical Brain Network Modelling with The Virtual Brain**, University Medical Center Hamburg-Eppendorf	*Hamburg, Germany*
2013	**Advanced Statistics and Data Mining Summer School**, Universidad Politècnica de Madrid	*Madrid, Spain*
2013	**Advanced Seminar: *Alzheimer's Disease***, Bernstein Center Freiburg	*Freiburg, Germany*
2013	**EuroSPIN/NeuroTime Workshop**, Bernstein Center Freiburg	*Beuggen, Germany*
2012	**Advanced Seminar: *Language and the Brain***, Bernstein Center Freiburg	*Freiburg, Germany*
2012	**Advanced Seminar: *Brain and Cognition - Exploring the relations between structure, dynamics and function of biological neural networks***, Bernstein Center Freiburg	*Freiburg, Germany*
2012	**Advanced Seminar: *Ethical Aspects of Neurotechnology***, Bernstein Center Freiburg	*Freiburg, Germany*
2011	**2nd EuroSPIN Workshop**, National Center for Biological Sciences (NCBS)	*Bangalore, India*
2011	**Analysis and Models in Neurophysiology**, Bernstein Center Freiburg	*Freiburg, Germany*
2010	**Fundamentals in Neuroscience**, Life and Health Sciences Institute	*Braga, Portugal*

Teaching & Mentorship

LECTURER / TUTOR

2019-2020	**Spring School in Computational Neuroscience**, European Institute for Theoretical Neuroscience (EITN)	*Paris, France*
2013-2015	**Introduction to Scientific Programming in Python**, Department of Psychology, Ruhr-Universität Bochum	*Bochum, Germany*
2014-2015	**Biological Neural Network Simulation**, Bernstein Center Freiburg	*Freiburg, Germany*
2012-2013	**Cognitive Psychology Seminars**, Bernstein Center Freiburg	*Freiburg, Germany*

ACADEMIC SUPERVISION

2015-	**PhD Student**, Philipp Weidel
2018-	**PhD Student**, Barna Zajzon
2018-	**PhD Student**, Tobias Shulte to Brinke
2019	**Internship**, Minseok Kang
2017-2018	**MSc Student**, Barna Zajzon
2015-2016	**Internship**, Sepehr Mahmoudian

Grants & Awards

2019-	**Principal Investigator in Computing Time Grant 15833**, *Functional neural architectures*, Jülich Supercomputing Center (JSC)
2015-2017	**Principal Investigator in Computing Time Grants 10438 and 11225**, *Synaptic timescales and online processing memory*, Jülich Supercomputing Center (JSC)
2011	**EuroSPIN PhD Fellowship**, Erasmus Mundus Joint Doctoral Programme in Neuroinformatics and Computational Neuroscience

Service & Outreach

2012	**Organizer & Moderator**, iCoNet PhD Conference 2012	*Freiburg, Germany*
	Reviewer, PLoS Computational Biology (7x)	
	Reviewer, Brain Structure and Function (1x)	