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

r.duarte@fz-juelich.de | rcfduarte | Renato Duarte | 0000-0001-6099-667X

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*

4th 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) Retreat — *Jülich, Germany*
Leveraging heterogeneity for neural computation with fading memory in layer 2/3 cortical microcircuits — *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	**4th 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 Clinic Hamburg Eppendorf	*Hamburg, Germany*
2013	**Advanced Statistics and Data Mining Summer School**, Universidad Politècnica de Madrid	*Madrid, Spain*
2013	**Oberseminar: *Alzheimer's Disease***, Bernstein Center Freiburg	*Freiburg, Germany*
2013	**EuroSPIN/NeuroTime Workshop**, Bernstein Center Freiburg	*Beuggen, Germany*
2012	**Oberseminar: *Language and the Brain***, Bernstein Center Freiburg	*Freiburg, Germany*
2012	**Oberseminar: *Brain and Cognition - Exploring the relations between structure, dynamics and function of biological neural networks***, Bernstein Center Freiburg	*Freiburg, Germany*
2012	**Oberseminar: *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)	

References

- Prof. Dr. Abigail Morrison

  affiliation: Computation in Neural Circuits, Institute for Advanced Simulation (IAS-6), Theoretical Neuroscience and Institute of Neuroscience and Medicine (INM-6), Computational and Systems Neuroscience and JARA-Institut Brain structure-function relationships (INM-10)

  address: Forchungszentrum Jülich GmbH. Wilhelm-Johnen-Straße, 52425 Jülich, Germany

  e-mail: a.morrison@fz-juelich.de

- Prof. Dr. Karl Magnus Petersson

  affiliation: Neurobiology of Language, Max-Planck Institute for Psycholinguistics

  address: Wundtlaan 1, 6525 XD Nijmegen. The Netherlands

  e-mail: Karl-Magnus.Petersson@mpi.nl

- Prof. Dr. Markus Diesmann

  affiliation: Institute for Advanced Simulation (IAS-6), Theoretical Neuroscience and Institute of Neuroscience and Medicine (INM-6), Computational and Systems Neuroscience and JARA-Institut Brain structure-function relationships (INM-10)

  Department of Psychiatry, Psychotherapy and Psychosomatics, RWTH Aachen University

  address: Forchungszentrum Jülich GmbH. Wilhelm-Johnen-Straße, 52425 Jülich, Germany

  e-mail: diesmann@fz-juelich.de