

Loic Matthey

Goodenough College  
Mecklenburg Square  
WC1N2AB London  
+44 7547 312367

27 years old, single

Swiss

[loic.matthey@gatsby.ucl.ac.uk](mailto:loic.matthey@gatsby.ucl.ac.uk)



## COMPUTATIONAL NEUROSCIENTIST

PhD at **Gatsby Computational Neuroscience Unit (UCL)**

### Education

<b>PhD Computational Neuroscience</b>	<i>University College London (UCL)</i>	2009-now
	<b>Gatsby Computational Neuroscience Unit</b> Supervisor: Peter Dayan.	
Master of Computer Science	<i>Swiss Federal Institute of Technology (EPFL)</i>	2006-2008
	Biocomputing specialization <b>EPFL Excellency Scholarship</b> <b>Swiss Informatics Society Prize</b> (Second best grade average award: 5.87 / 6.0)	
Bachelor of Computer Science	<i>Swiss Federal Institute of Technology (EPFL)</i>	2003-2006
	<b>Adrien Tschumi Prize</b> (Best average grade over first year; all academic departments considered)	2005

### Experience

R&D Engineer	DISAL Laboratory, EPFL	2008-2009
<b>Master Thesis</b> Hybrid Reactions Modeling for Top-down Design Framework	GRASP Laboratory, <b>University of Pennsylvania, USA</b> <i>Published at IEEE ICRA 2009</i> <b>Annaheim Foundation Prize</b> (Rewards a high-quality Master Thesis bringing life science and computer science closer together)	2008
Semester project <b>Chaotic systems</b> for escape and exploration in robots	BIRG Group, EPFL <i>Published at IEEE IROS 2008</i>	2008
Summer project Odor Source Localizations implementation on mobile robots	Swarm Intelligent System Group, EPFL <i>Published at IEEE ICRA 2008</i>	2007
IT Department, summer work	Johnson & Johnson, Neuchâtel	2002-2005

### Languages

French:	Native language
<b>English:</b>	IELTS Band 8. Fluency (spoken & written)
German:	Proficiency
Japanese:	Elementary knowledge of grammar and vocabulary

### Technical knowledge

**Mathematical Modeling**  
Machine learning

Non-linear Optimization  
Bioinformatics

Bio-inspired Computing  
**Neurophysiology**

## Activities

<b>Teaching Assistant:</b>	Theoretical Neuroscience, Gatsby Unit course	2010
	Machine Learning, Gatsby Unit course	2010
	Swarm Intelligence, EPFL course	2007
	Models of biological sensory-motor systems, EPFL course	
Polymanga:	Executive Committee for the 1 <sup>st</sup> edition of the biggest manga and videogames show of Switzerland.	2005
	<b>Budget: CHF 40'000.-</b> , 6000 spectators. Business contacts, logistics, management of 30 volunteers.	
Sports:	Floor Hockey, Squash	

## Publications

<b>Reservoir dynamics: Feedback and chaos in the network solution of a complex cognitive task</b>	<b>2011</b>
Loic Matthey, Peter Dayan Computational and Systems Neuroscience 2011 conference. To be published in Frontiers in Systems Neuroscience	
<b>Aggregation-mediated collective perception and action in a group of miniature robots</b>	<b>2010</b>
Gregory Mermoud, Loic Matthey, William C Evans and Alcherio Martinoli. Proceedings of the 9th International Conference on Autonomous Agents and Multiagent Systems (AAMAS' 10), Toronto, Canada. <b>Nominated for CoTeSys Best Robotics Paper Award</b>	
<b>Stochastic Strategies for a Swarm Robotic Assembly System</b>	<b>2009</b>
Loic Matthey, Spring Berman, and Vijay Kumar. Proceedings of the 2009 IEEE International Conference on Robotics and Automation (ICRA 2009), Kobe, Japan.	
<b>Experimental Study of Limit Cycle and Chaotic Controllers for the Locomotion of Centipede Robots</b>	<b>2008</b>
Loic Matthey, Ludovic Righetti and Auke Jan Ijspeert. Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2008), pages 1860 – 1865, Nice, France.	
<b>A comparison of casting and spiraling algorithms for odor source localization in laminar flow</b>	<b>2008</b>
Thomas Lochmatter, Xavier Raemy, Loic Matthey, Saurabh Indra and Alcherio Martinoli. Proceedings of the IEEE International Conference on Robotics and Automation, 2008. (ICRA 2008), pages 1138 - 1143, Pasadena, CA.	

## Research interests

PhD subject: memory models with transient states.

Behavior of large scale neuronal networks

Working memory and memory representation

Analysis of spatiotemporal computations in the brain

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## Main projects descriptions

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<b>Hybrid Reactions Modeling for Top-down Design Framework</b> GRASP Lab, University of Pennsylvania, Prof. Vijay Kumar. SWIS Group, EPFL, Prof. Alcherio Martinoli.  We used a Chemical Reaction Network abstraction to represent, simulate and optimize a system of multiple robots performing an assembly task. Convergence results were derived for the optimization process and a physical simulation of the robotic platform confirmed the usability of the framework. The model was simulated using ODE approximations and exact stochastic simulations, with reaction rates theoretically initialized and iteratively fitted.	Master thesis	2008
<b>Chaotic systems for escape and exploration in robots</b> Biologically Inspired Robotics Group, EPFL.  We developed a coupled oscillator controller based on Rössler oscillators, able to generate both limit cycle and chaotic behaviors through bifurcation. We develop an experimental test bench to measure quantitatively the performance of different controllers on unknown terrains of increasing difficulty. Inspired by the work of Prof. Y. Kuniyoshi on Chaotic Fields.	Semester project	2007
<b>Animal learning and its optimality in the <i>hole-box</i> task</b> W. Gerstner, Unsupervised and reinforcement learning in neural networks, EPFL  We built and trained a temporal difference RL learning model of mouse behavior. We specifically addressed the effect of eligibility traces with respect to learning speed and power. Other projects in this course addressed principal component analysis and independent component analysis.	Course project	2008
<b>Odor source localization</b> algorithms on mobile robots Swarm Intelligent System Group, EPFL.  Known Odor Source Localization algorithms ('zigzag' and 'spiral') were implemented on the Khepera III robot. They were tested and compared in a wind tunnel with a real odor source. A fully working wind direction detector with thermistors was developed, based on a maximum likelihood decision approach.	Summer project	2007
<b>Simulation of immune system reaction to AIDS</b> Modeling the Immune System course, EPFL  We implemented and validated an existing model using a Hybrid System (de Boer, 2006) in Matlab. Its biological validity and relevance was discussed.	Course project	2007
<b>Movement control and gait transition of a quadruped robot</b> A.J. Ijspeert, Models of Biological Sensory-motor Systems course, EPFL  We studied locomotion of a quadruped Dog robot using different controller. We implemented a Central Pattern Generator of coupled oscillators. We then produced gait transition depending on an external drive signal. We also produced this transition using a biologically inspired CPG of saturating oscillators.	Course project	2006

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