CLÉMENT MOULIN-FRIER

Date of Birth: 27th May 1981 (35 year old).
Nationality: French.
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SHORT BIO AND OBJECTIVES

Since the start of my PhD thesis in 2007 (defended June 2011), I have acquired a 10-year experience in research and teaching by developing my career in leading universities of France, Spain and the US. My main research interest is the modelling of complex cognitive systems and their application on real robotic platforms, with a special focus on multi-agent coordination and communication. I have published more than 30 papers in various international journals and conferences, including a Best Paper Award and the edition of a Special Issue involving a dozens of international collaborators, where I am the first author of the target article (see *Publications*).

I have been teaching Computer Science and Robotics for more than 300 hours in different universities, being currently the responsible professor of the Real-Time Interaction course at the Universitat Pompeu Fabra and having validated a French-government University-level lecturer certification (see *Teaching*). I have scientific responsibilities at the international level: I was program chair of the ICDL-Epirob conference in 2015 and I am the chair of the Language and Cognition Task Force at IEEE (see *Scientific Responsibilities*). I am the initiator and main contributor of the open-source Explauto library in the context of the Poppy project for open-source robotic platforms (see *Outreach activities*).

My professional objective is to obtain a tenure-track research position in a renowned university in Europe as a group leader in Cognitive Robotics and Artificial Intelligence. I believe that the goal of science at large is not only to describe the world but also to change it as much as possible. I envision societal applications of my activity in the domains of education (using robotics as a vector for teaching in primary and high-schools), economy (developing interactions between research institutes, fablabs and startups) and culture (applying contributions from Robotics and AI to digital art performances).

CURRENT POSITION

Since January 2015

POST-DOCTORAL RESEARCHER

SPECS research group, Universitat Pompeu Fabra, Barcelona, Spain

> Research: Adaptive cognitive architectures for robotics and the emergence of social behaviors
> Supervision: Paul Verschure
> Funding: ▪ *What You Say Is What You Did* WYSIWYD (FP7 ICT 612139)
> ▪ *Socialising Sensori-Motor Contingencies* socSMC (641321-H2020FETPROACT-2014).
> ▪ *Role of Consciousness in Adaptive Behavior* ERC's CDAC project (ERC-2013ADG 341196)

RESEARCH EXPERIENCE

January 2012 – November 2014

RESEARCH ASSOCIATE AND POST-DOCTORAL RESEARCHER

Flowers research group, Inria, Bordeaux, France.

> Research: Curiosity-driven learning applied to robotics
> Supervision: Pierre-Yves Oudeyer
> Funding: ERC Starting Grant EXPLORERS 240 007

September 2011 – December 2011

POST-DOCTORAL RESEARCHER

LPPA (Physiology of Perception and Action), Collège de France CNRS, Paris, France.

Research: Bayesian models of decision making for bipedal walking control
Supervision: Jacques Droulez
Funding: French government

January 2009 – July 2009

VISITING SCHOLAR

University of Southern California, Los Angeles, USA.

Research: Recognizing speech in a novel accent: The motor theory of speech perception reframed
Supervision: Prof. Michael A. Arbib
Funding: Explora-Doc French scholarship

ACADEMIC EDUCATION

September 2007 – June 2011

PHD STUDENT

Gipsa-Lab, Speech and Cognition department, Grenoble University

Research: Emergence of communication systems in Bayesian vocal agent populations
Supervision: Jean-Luc Schwartz, Pierre Bessière, and Julien Diard
Research stay: 6 months with M.A. Arbib at University of Southern California, Los Angeles, USA.
Funding: French ministry research scholarship

September 2006 – July 2007

MASTER DEGREE IN COGNITIVE SCIENCE

Grenoble Institute of Technology, France

With honors
Grenoble Institute of Technology

September 2005 – July 2006

MASTER DEGREE IN COMPUTER SCIENCE

University Joseph Fourier, Grenoble, France

SCIENTIFIC RESPONSIBILITIES

2017

ASSOCIATE EDITOR

International Conference on Development and Learning, ICDL/Epirob, Lisbon, Portugal
www.icdl-epirob.org

2015

PROGRAM CHAIR

International Conference on Development and Learning, ICDL/Epirob, Providence, RI, USA
www.icdl-epirob.org

2015-present

CHAIR OF THE LANGUAGE AND COGNITION TASK FORCE

IEEE Technical Committee on Autonomous Mental Development

https://openlab-flowers.inria.fr/t/cds-tc-task-force-on-language-and-cognition

2014 – 2015

CO-EDITOR OF THE SPECIAL ISSUE "ON THE COGNITIVE NATURE OF SPEECH SOUND SYSTEMS"

Journal of Phonetics

First author of the target article, see *Publications*

2015

MEMBER OF THE PROGRAM COMMITTEE

Workshop "Sensorimotor Contingencies for Robotics" at IROS 2015, Hamburg, Germany

http://www.iri.upc.edu/groups/perception/sensorimotorIROS15/

2009 – 2015

REVIEWER

PLoS One, Adaptive Behavior, Interaction studies, Transactions in Autonomous Mental Development, Speech Communication, ICDL/Epirob conference, Living Machine conference…

AWARDS, HONORS, GRANTS AND COMPETITIONS

2017 – 2019

CO-INVESTIGATOR OF THE INSOCO PROJECT

Plan Nacional Spanish research grant (DPI2016-80116-P)

Social interactions based on sensorimotor contingencies
In collaboration with Marti Sanchez-Fibla.
http://specs.upf.edu/projects/3159

April 2013

COMPETITIVE EXAM FOR CNRS (FRENCH NATIONAL RESEARCH COUNCIL)

Second place among 53 international researchers.
Category: Associate scientist in Computer Science

November 2012

BEST PAPER AWARD

International Conference on Development and Learning, ICDL/Epirob, San Diego, USA.

Category: Computational models of development
Paper: Curiosity-driven phonetic learning, see *Publications*

2012

QUALIFICATION AS ASSOCIATE PROFESSOR

French ministry of research

Domain: Computer Science

2009

BEST TEACHING PROJECT

Grenoble CIES (Center for University-level teaching)

2008

EXPLORA-DOC SCHOLARSHIP

French Rhone-Alpes region

Funding for a 6-months visit at the University of Southern California, Los Angeles, USA

2006

MASTER DEGREE FELLOWSHIP

INVITED TALKS

March 2017

"COGNITIVE ARCHITECTURES FOR SOCIAL ROBOTICS"

European Robotics Forum, Edinburgh, Scotland

Empathic Human-Robot Interaction Workshop
Organiser: Kerstin Dautenhahn

August 2015

"EVOLUTION AND DEVELOPMENT OF VOCAL COMMUNICATION STRUCTURES"

Princeton University, USA

Invitation from Asif Ghazanfar, head of the Developmental Neuromechanics & Communication Lab

November 2014

"EXPLORATION STRATEGIES IN DEVELOPMENTAL ROBOTICS"

Humanoids conference, Madrid, Spain. Workshop

Workshop "Active Learning in Robotics: Exploration Strategies in Complex Environments"
Organisers: Johannes Kulick, Herke van Hoof, Marc Toussaint, and Jan Peters

October 2014

"POPPY: A ROBOTIC PLATFORM FOR CODERS, MAKERS, ARTISTS AND RESEARCHERS"

Pycon conference, Lyon, France

Organiser: Françoise Conil

August 2013

"EXPLORATION STRATEGIES IN DEVELOPMENTAL ROBOTICS"

Honda Research Institute, Tokyo, Japan

Invitation by Angelica Lim, visiting scholar and now researcher at Aldebaran Robotics

TEACHING ACTIVITIES

2015-2017

RESPONSIBLE PROFESSOR (37.5 HOURS)

Universitat Pompeu Fabra, Barcelona, Spain

Course "Real-time Interaction"
Cognitive Systems and Interactive Media (CSIM) Master

2010--2011

TEACHING ASSISTANT IN COMPUTER SCIENCE (92 HOURS)

UFR IMAG, University Joseph Fourier, Grenoble, France

> Computer Science and Applied Mathematics
> Bachelor and Master degrees

2007--2010

TEACHING ASSISTANT IN COMPUTER SCIENCE (192 HOURS)

Université Stendhal, Grenoble, France

> 3 years of teacher training

STUDENT SUPERVISION

2015-present

PHD THESIS CO-SUPERVISION

SPECS group, Universitat Pompeu Fabra, Spain

> Student: Jordi-Ysard Puigbo
> *Value modulation in cortical visual processing and application to robotic control*

2016 – 2017

MASTER PROJECT SUPERVISION

SPECS group, Universitat Pompeu Fabra, Spain

> Student: Ismael Tito Freire González, CSIM Master, UPF, Spain
> *Modeling the formation of social conventions in agent populations*

2015 – 2016

MASTER PROJECT SUPERVISION

SPECS group, Universitat Pompeu Fabra, Spain

> Student: Yasin Can Akmehmet, CSIM Master, UPF, Spain
> *Autonomous development of turn-taking behaviors in robots*

2014 – 2015

MASTER PROJECT, THEN PHD THESIS CO-SUPERVISION

Flowers group, Inria, France

> Student: Sébastien Forestier, Ecole Normale Supérieur, Paris, France
> *Active learning strategies for the modelling of infant vocal development*

2014 – 2013

MASTER PROJECT SUPERVISION

Flowers group, Inria, France

> Student: Marie-Morgane Paumard, Ecole Normale Supérieur de Cachan, France
> *Learning the manipulation of flexible tools in developmental robotics: a fishing robot*

2013 – 2014

MASTER PROJECT SUPERVISION

Flowers group, Inria, France

> Student: Jules Brochard, Ecole Normale Supérieur de Cachan, France
> *Emergent maturations in early vocal development.* Journal article, see *Publications*

2010 – 2011

MASTER PROJECT SUPERVISION

GIPSA-Lab, Grenoble Institute of Technology, France

Student: Raphaël Laurent, Master MoSIG, ENSIMAG, Grenoble, France

A computational model to study quantitatively motor, sensory, and sensorimotor model responses in Speech Recognition. 3 co-authored publications, including a journal paper

OUTREACH ACTIVITIES & PARTICIPATION IN INDUSTRIAL INNOVATION

September 2017

CO-ORGANIZER OF THE RE-FLUX PERFORMANCE

Barcelona Cognition Brain and Technology summer school (BCBT 2016)

Multimodal Performance with AI, Robots, VR and Humans
http://bcbt.upf.edu/bcbt16/node/330

2013 – 2017

MAIN CONTRIBUTOR OF THE OPEN-SOURCE *EXPLAUTO* LIBRARY

A library to study, model and simulate intrinsically motivated multitask learning and exploration in virtual and robotic agents
https://github.com/flowersteam/explauto

October 2014

ORGANISATION OF A 3-DAY HACKATHON

Universciences, Paris, France

Conception and programming of the Poppy robot. 25 participants
Video of the event: https://vimeo.com/109145300

September 2014

INTERVIEW FOR THE FRENCH JOURNAL BIOFUTUR

On robotic approaches to language evolution modelling

2013 – 2015

MEMBER OF THE POPPY-PROJECT

Open-source robotics for teacher, makers, artists and researchers
Realisation of a various robotic demonstrations, workshops and dissemination events
https://www.poppy-project.org

LANGUAGES

English (C1), French (native), Spanish (B1)

PUBLICATIONS

JOURNAL ARTICLE IN REVISION

Moulin-Frier, C., Fischer, T., Petit, M. Pointeau, G., Puigbo, J.-Y., Pattacini, U., Low, S.C., Camilleri, D., Nguyen, P. Hoffmann, M. Chang, H.J., Zambelli, M., Mealier, A.-L., Damianou, A., Metta, G. Prescott, T., Demiris, Y., Dominey, P.-F. and. Verschure, P. (2017, in revision). DAC-h3: A Proactive

Robot Cognitive Architecture to Acquire and Express Knowledge About the World and the Self. *IEEE Transactions on Cognitive and Developmental Systems*.

JOURNAL ARTICLES

Moulin-Frier, C., Brochard, J., Stulp, F., & Oudeyer, P.-Y. (2017). Emergent Jaw Predominance in Vocal Development through Stochastic Optimization. *IEEE Transactions On Cognitive and Developmental Systems*. In press

Acevedo Valle, J. M., Angulo, C., & Moulin-Frier, C. (2017). Autonomous Discovery of Motor Constraints in an Intrinsically-Motivated Vocal Learner. *IEEE Transactions On Cognitive and Developmental Systems*. In press.

Moulin-Frier, C., Diard, J., Schwartz, J.-L., and Bessière, P. (2015). COSMO ("Communicating about Objects using Sensory-Motor Operations"): a Bayesian modeling framework for studying speech communication and the emergence of phonological systems. *Journal of Phonetics*. 53: 5–41 **Target paper of a special issue**.

Moulin-Frier, C., Nguyen, S. M., and Oudeyer, P.-Y. (2013). Self-organization of early vocal development in infants and machines: The role of intrinsic motivation. *Frontiers in Psychology (Cognitive Science)*, 4(1006).

Moulin-Frier, C. and Arbib, M. A. (2013). Recognizing speech in a novel accent: The motor theory of speech perception reframed. *Biological Cybernetics*, 107 (4):421–447.

N'Guyen, S., Moulin-Frier, C., and Droulez, J. (2013). Decision Making under Uncertainty: A Quasimetric Approach. *PLoS ONE*, 8(12).

Moulin-Frier, C., Laurent, R., Bessière, P., Schwartz, J.-L., and Diard, J. (2012). Adverse conditions improve distinguishability of auditory, motor and perceptuo-motor theories of speech perception: an exploratory Bayesian modeling study. *Language and Cognitive Processes*. 27(7-8): 1240–1263. Special Issue: Speech Recognition in Adverse Conditions.

INVITED COMMENTARIES IN INTERNATIONAL JOURNALS

Moulin-Frier, C., & Verschure, P. (2016). Two possible driving forces supporting the evolution of animal communication: Comment on "Towards a Computational Comparative Neuroprimatology: Framing the language-ready brain" by Michael A. Arbib. *Physics Of Life Reviews*, 16, 88–90.

Schwartz, J.-L., Barnaud, M.-L., Bessière, P., Diard, J., & Moulin-Frier, C. (2016). Phonology in the mirror: Comment on "Towards a Computational Comparative Neuroprimatology: Framing the language-ready brain" by Michael A. Arbib . *Physics Of Life Reviews*, 16, 93–95.

Laurent, R., Moulin-Frier, C., Bessière, P., Schwartz, J.-L., & Diard, J. (2013). Integrate yes, but what and how? A computational approach of sensorimotor fusion in speech. Commentary In *Behavioral and Brain Sciences*, 36(4):36–37.

BOOK CHAPTER

Moulin-Frier, C., Schwartz, J., Diard, J., and Bessière, P. (2011b). Emergence of articulatory-acoustic systems from deictic interaction games in a "Vocalize to Localize" framework. Chapter in Primate communication and human language: Vocalisations, gestures, imitation and deixis in humans and non-humans. *Advances in Interaction Studies'* series by John Benjamins Pub. Co.

INTERNATIONAL CONFERENCES – FULL PAPERS

Moulin-Frier, C., Arsiwalla, X. D., Puigbò, J.-Y., Sánchez-Fibla, M., Duff, A., and Verschure, P. F. M. J. (2016). Top-Down and Bottom-Up Interactions between Low-Level Reactive Control and Symbolic Rule Learning in Embodied Agents. In *Proceedings of the Workshop on Cognitive Computation: Integrating neural and symbolic approaches. 30th Annual Conference on Neural Information Processing Systems (NIPS 2016).*

Puigbò, J.-Y., Moulin-Frier, C., and Verschure, P. F. M. J. (2016). Towards Self-controlled Robots Through Distributed Adaptive Control. In *Conference on Biomimetic and Biohybrid Systems* (pp. 490–497). Springer.

Arsiwalla, X. D., Herreros-Alonso, I., Moulin-Frier, C., Sánchez-Fibla, M., and Verschure, P. F. M. J. (2016). Is Consciousness a Control Process? In *Proceedings of the 19th International Conference of the Catalan Association for Artificial Intelligence*.

Moulin-Frier, C., Sanchez-Fibla, M., and Verschure, P. F.M.J (2015b). Autonomous development of turn-taking behaviors in agent populations: a computational study. In *International Conference on Development and Learning, ICDL/Epirob, Providence (RI), USA*.

Puigbò, J.-Y., Moulin-Frier, C., Vouloutsi, V., Sanchez-Fibla, M., Herreros, I., and Verschure, P. F. M. J. (2015). Skill refinement through cerebellar learning and human haptic feedback: an iCub learning to paint experiment. In *IEEE-RAS Conference on Humanoids Robots (Humanoids 2015)*, Seoul, Korea.

Puigbò, J.-Y., Herreros, I., Moulin-Frier, C., and Verschure, P. F. M. J. (2015). Towards a two-phase model of sensor and motor learning. In *Conference on Biomimetic and Biohybrid Systems* (pp. 453–460). Springer.

Acevedo Valle, J. M., Angulo, C., Agell, N., and Moulin-Frier, C. (2015). Proprioceptive Feedback and Intrinsic Motivations in Early-Vocal Development. In *Proceedings of the 18th International Conference of the Catalan Association for Artificial Intelligence*. Armengol, E., Boixader, D., Grimaldo, F.

Moulin-Frier, C. and Oudeyer, P.-Y. (2013a). Exploration strategies in developmental robotics: A unified probabilistic framework. In *International Conference on Development and Learning, ICDL/Epirob, Osaka, Japan*.

Moulin-Frier, C. and Oudeyer, P.-Y. (2013b). Learning how to reach various goals by autonomous interaction with the environment: unification and comparison of exploration strategies. In *1st Multidisciplinary Conference on Reinforcement Learning and Decision Making (RLDM2013), Princeton University, New Jersey*.

Moulin-Frier, C. and Oudeyer, P.-Y. (2013c). The role of intrinsic motivations in learning sensorimotor vocal mappings: a developmental robotics study. In *Proceedings of Interspeech, Lyon, France*, Lyon, France.

Moulin-Frier, C. and Oudeyer, P.-Y. (2012). Curiosity-driven phonetic learning. In *International Conference on Development and Learning, Epirob, San Diego, USA*. **Best paper award.**

Moulin-Frier, C., Laurent, R., Bessière, P., Schwartz, J., and Diard, J. (2011a). Noise and inter-speaker variability improve distinguishability of auditory, motor and perceptuo-motor theories of speech perception : An exploratory bayesian modeling study. In *9th International Seminar on Speech Production, ISSP'11*, Montreal, Canada.

Moulin-Frier, C., Schwartz, J., Diard, J., and Bessière, P. (2010). A unified theoretical bayesian model of speech communication. In *1st conference on Applied Digital Human Modeling, Miami, USA*.

Moulin-Frier, C., Schwartz, J., Diard, J., and Bessière, P. (2008c). Emergence of a language through deictic games within a society of sensori-motor agents in interaction. In *International Workshop on "Speech and Face to Face Communication"*, Grenoble France.

Moulin-Frier, C., Schwartz, J., Diard, J., and Bessière, P. (2008b). Emergence of a language through deictic games within a society of sensori-motor agents in interaction. In *8th International Seminar on Speech Production, ISSP'08*, Strasbourg, France.

Moulin-Frier, C., Schwartz, J., Diard, J., and Bessière, P. (2008a). Emergence du langage par jeux déictiques dans une société d'agents sensori-moteurs en interaction. In *27e Journées d'Etudes sur la Parole, JEP'2008*, Avignon France.

INTERNATIONAL CONFERENCES – ABSTRACTS

Puigbò, J.-Y., Vouloutsi, V., Moulin-Frier, C., & Verschure, P. F. M. J. (2015). Reactive and adaptive control loops for social learning in human--robot interaction. Workshop "Mechanisms of learning in social contexts", *IEEE International Conference on Development and Learning, ICDL/Epirob*, Providence (RI), USA.

Moulin-Frier, C., Rouanet, P., and Oudeyer, P.-Y. (2014). Explauto: an open-source Python library to study autonomous exploration in developmental robotics. In *International Conference on Development and Learning, ICDL/Epirob, Genova, Italy*.

Arbib, M. A. and Moulin-Frier, C. (2010). Recognizing speech in a novel accent: The motor theory of speech perception reframed. In *Neurobiology of Language Conference, San Diego, USA*.

Schwartz, J., Rochet-Capellan, A., and Moulin-Frier, C. (2007). Speech at reach of hand and mouth: Theoretical arguments, experimental facts and computational advances. In *Workshop " Vocoid – Vocalization, COmmmunication, Imitation and Deixis in adult and infant human and non human primates "*, Grenoble France.

THESES

Moulin-Frier, C. (2011). Rôle des relations perception-action dans la communication parlée et l'émergence des systèmes phonologiques : étude, modélisation computationnelle et simulations. PhD thesis, Université de Grenoble.

Moulin-Frier, C. (2007). Jeux déictiques dans une société d'agents sensori-moteurs en interaction. Master's thesis, Grenoble-INP.

Moulin-Frier, C. (2006). Objets communicants : la traçabilité. Master's thesis, Université Joseph Fourier, Grenoble.

RECOMMENDATIONS

PIERRE-YVES OUDEYER

INRIA Research Director, Head of the Flowers research group, Bordeaux, France
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Specialized in developmental robotics.
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Specialized in computational neuroscience, psychology and robotics
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CNRS Research Director, Sorbonne Universités – UPMC -ISIR, Paris, France
PhD thesis co-advisor
Specialized in computer and cognitive sciences
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