

## Olivier L. Georgeon PhD

### Current affiliation

Institution: Université Claude Bernard Lyon 1 (UCBL).

Lab/Department: LIRIS: Laboratoire d'InfoRmatique en Images et Systèmes d'information.

Research group: TWEAK (Traces, Web, Education, Adaptation, Knowledge) (former SILEX team).

<http://liris.cnrs.fr/equipes?id=75>.

Address: Bâtiment Nautibus, 23-25 avenue Pierre de Coubertin, 69622 Villeurbanne, France.

### Contact

Olivier Georgeon

19 rue Clément Michut

69100 Villeurbanne

France

Cell +33 6 88 10 68 59

[olivier.georgeon@liris.cnrs.fr](mailto:olivier.georgeon@liris.cnrs.fr)

<http://www.oliviergeorgeon.com>

### Personal Data

Birth Favèrges, Haute-Savoie (France).

Nationality French

### Language Skills

French Native language

English Fluent spoken and written

### Research Interests

#### Keywords

Developmental artificial Intelligence in artificial agents and robots, biologically inspired cognitive architectures (BICAs), constructivist learning, trace-based reasoning, intrinsic motivation, bottom-up sensorimotor self-programming, embodied cognition.

#### Trace-Based Reasoning

We, the TWEAK research group, developed the new field of research called *Trace-Based Reasoning* (TBR, e.g., Cordier, Lefevre, Champin, Georgeon, & Mille 2013). TBR pertains to the domain of *Dynamical Knowledge Engineering*. More specifically, TBR is a sort of *Case-Based Reasoning* applied

to learning from initially unsegmented and possibly uninterpreted sequences of events of interaction. A TBR system incrementally discovers, records, hierarchically abstracts, and reuses interesting episodes of interaction at different levels of abstraction.

TBR has many practical applications including autonomous robot adaptation, co-evolution of human-machine interaction, and behavioral analysis and modeling. TBR also brings theoretical insights for implementing *constructivist learning* and *developmental artificial intelligence*. This is because TBR provides a technical framework for implementing *intrinsically-motivated bottom-up self-programming* agents. Intrinsically-motivated bottom-up self-programming contributes to achieving *constitutive autonomy*, which theoreticians of *enaction* consider amongst the major challenges of strong AI (e.g., Froese & Ziemke 2009). In essence, the agent (e.g., robot) self-develops by “sedimentation of habitudes”, as some philosophers of mind have intuited since the enlightenments (e.g., David Hume).

## Biologically Inspired Cognitive Architectures and Developmental Artificial Intelligence

I am drawing inspiration from TBR, epistemology, and neuroscience to design architectures, algorithms, and methods to replicate *situated cognition* (i.e., in which, “knowledge develops as a means of coordinating activity within activity itself”, Clancey 1997). My colleagues and I proposed the *Enactive Cognitive Architecture* (ECA, Georgeon, Marshall, & Manzotti, 2013). ECA avoids making common assumptions made by other cognitive architectures, for example that the environment is stationary, deterministic, or discrete, or that input data is Markovian or representative of a predefined model of the environment. ECA addresses the *symbol-grounding problem* (Harnad 1992) by allowing a robot to engage in the construction of its own proto-ontology of reality based on its individual experience of interaction. ECA’s implementation rests upon the *Radical Interactionism* design commitment (Georgeon & Aha 2013) inspired by Trace-Based Reasoning, which endows ECA with constitutive autonomy.

For more, I recommend my *Implementation of DEvelopmental Learning Massive Open Online Course* (IDEAL MOOC) as an entry point to my work: <http://liris.cnrs.fr/ideal/mooc>.

## Awards

Winner of the ANR-RPDOC Fellowship (the French government’s “*Retour post-doctorant*” program). IDEAL project: 576 k€. See the *2011-2014 Research Experience* section below.

## Trans-disciplinary scientific background

I have a trans-disciplinary background in computer science and cognitive science. I have a Master degree of computer/software engineering, an industrial experience as a software developer and as a project manager (industrial processes and robotics), and a PhD in cognitive science (psychology). This trans-disciplinary background allows me to imagine new approaches to artificial cognition inspired by the neurosciences and epistemology, and, simultaneously, to manage the rapid implementation of prototypes. It also allows me to entertain the dialogue between these scientific communities, as I did during the organization of BICA-2015 in Lyon.

## Research Experience

**Since 2015** PEDAGOGICAL ENGINEER. Department of innovative pedagogical techniques (ICAP/ NUMEDUC) at the University Claude Bernard Lyon 1 (UCBL). My 2014 experience creating the IDEAL MOOC made me a MOOC specialist, and now I

am helping professors to design MOOCs based upon their courses.  
I organized and chaired the sixth International Conference on Biologically Inspired Cognitive Architectures (BICA 2015-Lyon, <https://liris.cnrs.fr/bica/>). In parallel, I am doing research as an associate researcher of the LIRIS Lab.

- 2011 – 2014**  
(3 years)  
ASSOCIATE RESEARCHER at the UCBL/ LIRIS Lab/ SILEX team in LYON.  
ANR-RPDOC Fellow. Full time principal investigator of the IDEAL project (Implementation of DEvelopmentAI Learning).  
The IDEAL project investigates mechanisms of autonomous cognitive development through bottom-up self-programming driven by experience of interaction and intrinsic motivation. <http://liris.cnrs.fr/ideal>.
- 2008 – 2010**  
(2.5 years)  
POST DOCTORATE at the ACS Lab, Information Sciences and Technology Department, Penn State University, in partnership with the International Center for the Study of Terrorism. Adviser: Pr. Frank E. Ritter.  
I developed techniques for interactive analysis and abstraction of activity traces (based on TBR) with applications to terrorism intelligence. I received training in the domain of cognitive architectures and their applications to learning from interaction (initially with *Soar*).
- 2004 – 2007**  
(3 years)  
PHD STUDENT. Université Lumière Lyon 2, in collaboration with the French institute for transportation research (IFSTTAR). Multidisciplinary PhD thesis in the domains of psychology and computer sciences. Advisers: Pr. Robert Martin (psychology) and Pr. Alain Mille (Computer science). Title: “Activity Trace Analysis for Cognitive Modeling: Application to the car Driver”. Honors (*félicitations du jury*).
- 2003 – 2004**  
(1 year)  
MASTER OF PSYCHOLOGY. Université Lumière Lyon 2. Car driving activity analysis for road safety.

## Industrial Experience

- 1995 – 2003**  
(8 years)  
ENGINEER at Novaxiom SA, Lyon.  
Programmer and project manager for the development of industrial software systems (Manufacturing Executing Systems), for clients such as: Renault, Alstom, Snecma, Sidel, Merck, Gambro
- 1990 – 1994**  
(4 years)  
ENGINEER at Frappaz SA, Lyon.  
Programmer of industrial robots for chemical surface processing.
- 1988 – 1990**  
(2 years)  
PROJECT MANAGER at AFVP (association for international solidarity).  
In the framework of the French national service: manager of a water-well development program in Senegal.

## Background Education

- 1985 – 1988**  
(3 years)  
MASTER OF ENGINEERING (Diplôme d’ingénieur) at Ecole Centrale de Marseille (former Ecole Supérieure d’Ingénieurs de Marseille, ESIM). Option: industrial

computer engineering.

**1984 – 1985**      ADVANCED MATHEMATICS (*Mathématiques supérieures et spéciales, série M*).  
(2 years)          Lycée Berthollet, Annecy.

**1983**              BACCALAUREATE SCIENCE AND TECHNOLOGY (*Série E*). Lycée Berthollet, Annecy.  
Honors (*mention Très Bien*).

## Teaching

Year	Course designation	Level, institution	Hours
2016/2017	Developmental AI	Master 2, Université Lyon 1	8
2013/2014	Developmental AI	Master 1, Université Lyon 1	10
2013/2014	Dynamic knowledge engineering	Master 2, Université Lyon 1	4
2012/2013	Java programming	Elève ingénieur 2ème année, INSA	18
2012/2013	Developmental AI	Master 1, Université Lyon 1	10
2012/2013	Dynamic knowledge engineering	Master 2, Université Lyon 1	4
2011/2012	Developmental AI	Master 1, Université Lyon 1	4
2008-2010	Organization and Design of Information Systems: User and System Principles	As a teacher (2009-2010): As a teaching assistant (2008): Undergraduate 3. College of Information Sciences and Technology, Penn State.	90 (45)
2006/2007	Activity analysis	Master 2. Université Lyon 2.	3
2005-2007	Knowledge engineering	License 2, Université Lyon 2.	13
1988	General software engineering	Elèves ingénieur, Ecole Centrale de Marseille.	20
<b>Total</b>			<b>184</b>

In addition, I taught the IDEAL MOOC in 2014 (see the *Dissemination* section below).

My Developmental-AI lectures (audio + slides) are at: <http://www.oliviergeorgeon.com/radical-interactionism/developmental-learning.htm> (more than 10 000 views).

## Student Mentorship (selection)

2015: Florian Bernard. Master degree. Université Lyon 1. Constructing phenomenal knowledge from experience of interaction. 5 months.

2015: Rémi Casado. Master degree. Université Lyon 1. Modeling biological agents beyond the reinforcement-learning paradigm. 5 months.

2011-2014 Simon Gay. PhD student in computer science. Université Lyon 1. Mechanisms of developmental learning and intrinsic motivation. 3 years.

2013 Joseph Garnier. Master degree in computer science. Université Lyon 1. Discovery of persistent entities (proto-ontology) by an intrinsically motivated agent. 6 months.

2011 Pierre-Yves Ronot. Master degree. Université Lyon 1. Design and implementation of software tools for representation and analysis of the behavior of artificial agents. 6 months.

2011 Olivier Voisin. Master of engineering . Ecole Nationale Supérieure d'Ingénieur des Etudes et Techniques d'Armement (ENSIETA). Design and implementation of a simulation platform for developmental agents. 5 months.

2005-2006. Benoit Mathern. Master of engineering, Ecole Centrale Lyon / Master 2 intelligence artificielle, Université Lyon 1. Design and implementation of software tools for activity analysis for car driving. 6 months.

2004-2005. Jean-Marc Trémeaux. Master 2 informatique. Université Lyon 1. Université Claude Bernard. Activity trace analysis system. 4 months.

## Publications

Most of my papers can be downloaded from <https://cv.archives-ouvertes.fr/olivier-georgeon>.

### Research papers in peer-reviewed international journals

Gay, S., Mille, A., Georgeon, O., Dutech, A. (2016). Autonomous construction and exploitation of a spatial memory by a self-motivated agent. *Cognitive Systems Research*, 41: 1-35.

Georgeon O., Marshall J., & Manzotti R. (2013). ECA: An enactivist cognitive architecture based on sensorimotor modeling. *Biologically Inspired Cognitive Architectures* 6: 46-57.

Georgeon O. & Marshall J. (2013). Demonstrating sense-making emergence in artificial agents: A method and an example. *International Journal of Machine Consciousness* 5(2): 131-144.

Georgeon O. & Ritter F. (2012). An intrinsically-motivated schema mechanism to model and simulate emergent cognition. *Cognitive Systems Research* 15-16: 73-92.

Georgeon O., Mille, A., Bellet, T., Mathern, B., and Ritter F. (2012). Supporting activity modeling from activity traces. *Expert Systems* 29(3): 261-275.

### Short papers in peer-reviewed international journals and bulletins

Georgeon O. & Boltuc P. (2016). Circular constitution of observation in the absence of ontological data. *Constructivist Foundations* 12(1): pp 17-19.

Georgeon O. (2014). Learning by experiencing versus learning by registering. *Constructivist Foundations*, 9(2) 211-213.

Georgeon, O. & Aha D. (2013). The Radical Interactionism Conceptual Commitment. *Journal of Artificial General Intelligence* 4(2): pp 31-36.

Georgeon, O. & Hassas, S. (2013). Single Agents Can Be Constructivist too. *Constructivist Foundations* 9(1): 40-42.

Georgeon, O. (2008). Analyzing traces of activity for modeling cognitive schemes of operators. *Artificial Intelligence and Simulation of Behaviour (AISB) Quarterly Bulletin* 127: pp 1-3.

### **Research papers in peer reviewed French journals**

Georgeon O., Mille A., Gay S. (2016). Intelligence artificielle sans données ontologiques sur une réalité presupposée [Artificial intelligence without using ontological data about a presupposed reality]. *Intellectica* 65: 143-168.

A. Cordier, M. Lefevre, P-A. Champin, A. Mille, O. Georgeon, B. Mathern (2014). Connaissances et raisonnement sur les traces d'interaction [Knowledge and reasoning upon interaction traces]. *Revue d'Intelligence Artificielle* 28(3): pp 1-15, Lavoisier, Hermès.

### **Papers in peer reviewed international conferences**

Georgeon O., Bernard F., & Cordier A. (2015). Constructing phenomenal knowledge in an unknown noumenal Reality. *Procedia Computer Science*, 71: 11-16. The Sixth international conference on Biologically Inspired Cognitive Architectures. Lyon, France.

Georgeon O., Casado R., & Matignon L. (2015). Modeling biological agents beyond the reinforcement-learning paradigm. *Procedia Computer Science*, 71: 17-22. The Sixth international conference on Biologically Inspired Cognitive Architectures. Lyon, France.

Georgeon O. & Cordier A. (2014). Inverting the interaction cycle to model embodied agents. *Procedia Computer Science*, 41: 243-248. The Fifth international conference on Biologically Inspired Cognitive Architectures. Boston, MA.

Gay, S., Georgeon, O., & Wolf, C. (2014). Autonomous object modeling based on affordances for spatial organization of behavior. *Fourth Joint International Conference on Development and Learning and on Epigenetic Robotics*, IEEE ed. Genoa, Italy, pp. 1-6.

Georgeon O., Wolf C., & Gay S. (2013). An Enactive Approach to Autonomous Agent and Robot Learning. *Third Joint International Conference on Development and Learning and on Epigenetic Robotics*, IEEE ed. Osaka, Japan, pp. 1-6.

Mille, A., Champin, P.-A., Cordier, A., Georgeon, O., & Lefevre, M. (2013). Trace-Based Reasoning — Modeling interaction traces for reasoning on experiences. *26th annual conference of the Florida AI Research Society (FLAIRS 2013)*.

Gay, S., Georgeon, O., & Kim, J. (2012). Implementing spatial awareness in an environment-agnostic agent. *21st Annual Conference on Behavior Representation in Modeling and Simulation (BRIMS 2012)*. Amelia Island, Florida, pp. 62-69.

Georgeon O. & Marshall J. (2012). The Small Loop Problem: A Challenge for Artificial Emergent Cognition. *International Conference on Biologically Inspired Cognitive Architectures (BICA 2012)*. Palermo, Italy, pp. 137-144.

Olivier Georgeon, James Marshall & Pierre-Yves Ronot (2011). Early-stage vision of composite scenes for spatial learning and navigation, in proc. First Joint IEEE Conference on Development and Learning and on Epigenetic Robotics (ICDL-EPIROB 2011), Frankfurt, Germany, pp. 224-229.

Olivier Georgeon, Mark Cohen & Amélie Cordier (2011). A model and simulation of early-stage vision as a developmental sensorimotor process, International Conference on Artificial Intelligence Applications and Innovations (AIAI 2011) Corfu, Greece pp. 11-16.

Olivier Georgeon, Jonathan H. Morgan, & Frank E. Ritter (2010). An algorithm for self-motivated hierarchical sequence learning. 10th International Conference on Cognitive Modeling (ICCM 2010), pp. 73-78.

Olivier Georgeon, Jonathan H. Morgan, John Horgan, & K. Braddock (2010). Process modeling for the study of non-state political violence. 19th Annual Conference on Behavior Representation in Modeling and Simulation (BRIMS 2010), Charleston, NC: Brims Society, pp. 240-247.

Olivier Georgeon, Frank E. Ritter, & Steven R. Haynes. (2009) Modeling Bottom-Up Learning from Activity in Soar. 18th Annual Conference on Behavior Representation in Modeling and Simulation (BRIMS 2009). Sundance, Utah, pp. 65-72.

Olivier Georgeon, Matthias J. Henning, Thierry Bellet & Alain Mille. (2007). Creating Cognitive Models from Activity Analysis: A Knowledge Engineering Approach to Car Driver Modeling. International Conference on Cognitive Modeling (ICCM 2007). Ann Arbor, MI, pp. 43-48.

Matthias J. Henning, Olivier Georgeon & Josef Krems (2007). The quality of behavioral and environmental indicators used to infer the intention to change lanes, 4th International Driving Symposium on Human Factors in Driver Assessment. Stevenson, Washington USA, pp. 231-237.

### **Position papers and workshop papers**

Georgeon, O., Barbier-Gondras, C. & Morgan, J. (2016). Developmental-AI MOOC Assessment. Fourth European MOOCs Stakeholders Summit (EMOOCs 2016). Graz, Austria. pp. 539-543.

Joseph Garnier, Olivier Georgeon, & Amélie Cordier (2013). Inferring actions and observations from interactions. Goal Driven Autonomy Workshop (GDA) at Advanced Cognitive Systems (ACS2013), Baltimore, ML, pp. 26-35.

Simon Gay & Olivier Georgeon (2013). Interaction-based space representation for environment-agnostic agents. Adaptive Learning Agents workshop (ALA2013), at the 12th International Conference on Autonomous Agents and Multiagent Systems (AAMAS2013), Saint Paul, Minnesota.

Georgeon, O. & Sakellariou, I. (2012). Designing environment-agnostic agents. Adaptive Learning Agents workshop (ALA 2012) at the 11th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2012). Valencia, Spain, pp. 25-32.

Georgeon O., Marshall J. & Gay S. (2012). Interactional motivation in artificial systems: Between extrinsic and intrinsic motivation. Second International Conference on Development and Learning and on Epigenetic Robotics (ICDL-EPIROB 2012), pp. 1-2.

Olivier Georgeon, Alain Mille & Thierry Bellet (2006). Analyzing behavioral data for refining cognitive models of operator. 2nd International Workshop on Philosophies and Methodologies for Knowledge

Discovery, in the Seventeenth international workshop on Database and Expert Systems Applications (DEXA 2006). Krakow, Poland: IEEE Computer Society Press. ISBN 9780769526416, pp. 588-592.

### **Book chapters**

Bellet, T., Bailly, B., Mayenobe, P., & Georgeon O. (2007). Cognitive modelling and computational simulation of drivers' mental activities. *Critical Issues in Advanced Automotive Systems and Human-Centred Design*. P. C. Cacciabue and C. Re. London: Springer Verlag, pp. 317-345.

### **Editor**

Georgeon, O. (2015). *Proceedings of the Sixth International Conference on Biologically Inspired Cognitive Architectures*. Lyon November 7-9 2015.

### **Invited talks**

Georgeon, O. (2016). From events to objects: investigating Alfred N. Whitehead's process of abstraction in artificial intelligence. *First International Workshop on Cognition and Ontologies at the Ninth International Conference on Formal Ontology in Information Systems (CAOS / FOIS-2016)*. Annecy, July 6.

Georgeon, O. (2016). Implementing Trace-Based Reasoning in a cognitive architecture with the aim of achieving developmental learning. *First International Early Research Career Enhancement School on Biologically Inspired Cognitive Architectures (Fierces on BICA-2016)*. Moscow, April 21-24.

## **Research-Related Activities**

### **Conference General Chair**

Sixth International Conference on Biologically Inspired Cognitive Architectures (BICA 2015-Lyon) <https://liris.cnrs.fr/bica2015/>.  
Chair of the *Developmental Learning Tutorial* at BICA 2015.



### **Reviewer for international journals**

Cognitive Systems Research, Biologically Inspired Cognitive Architectures, Constructivist Foundations.

### **Program committee**

AAAI Cognitive Track 2013.  
Biologically Inspired Cognitive Architecture (Conference).

### **Tutorial program committee**

ICCM (International Conference on Cognitive Modeling) 2011, 2012, 2013.

## **Dissemination**

My colleagues, students, and I designed and taught the IDEAL MOOC from October to December 2014 (Georgeon, Barbier-Gondras, & Morgan, 2016). We won a 1300€ support from the CNRS's "Connaissances Ouvertes à Tous" (COAT) Program, and an assistance from the department of



innovative pedagogical techniques (ICAP) of UCBL. The IDEAL MOOC gathered more than 900 participants. It remains available as a "permamoc" at <http://liris.cnrs.fr/ideal/moc>.

I created *Little IA*, a pedagogical game for iPhone and iPad to illustrate constructivist learning and developmental artificial intelligence. It is used in class and in the IDEAL MOOC as a pedagogical resource. More information is available at <http://little-ai.com/>. Please try it; it's free!

My team won the jury's special prize ("*coup de coeur du jury*" - 4th prize) at the Lyon Startup Weekend (21-23 February 2014, <http://www.up.co/communities/france/lyon/startup-weekend/3065> ).

## Referrers

Professor Alain Mille (PhD adviser)  
Laboratoire LIRIS / UMR 5205  
Université Claude Bernard Lyon1  
Bâtiment Nautibus, 23-25 avenue Pierre de Coubertin  
69622 Villeurbanne, France

Professor James Marshall (Mentor in the domain of Developmental AI)  
Computer Science Department  
Sarah Lawrence College, One Mead Way  
Bronxville, NY 10708, USA

Professor Frank Ritter (post-doctoral adviser)  
frank.ritter@psu.edu  
College of IST  
Penn State/University Park  
University Park, PA 16802, USA

### Other referrers who know my work, alphabetically sorted

Agnar Aamodt (Norwegian University of Science and Technology), David Aha (Naval Research Laboratory), Peter Boltuc (University of Illinois), Antonio Chella (Università de Palermo), Alain Dutrech (INRIA), Pierre De Loor (ENIB/LABSTICC), Philippe Gaussier (ENSEA/ETIS), Salima Hassas (Université Lyon 1), Riccardo Manzotti (IULM University, Milan), Pierre-Yves Oudeyer (INRIA). Alexei Samsonovich (George Mason University, chair of the BICA Society).