




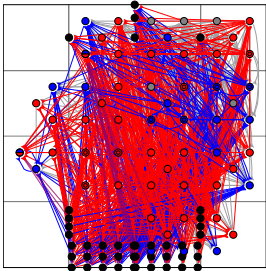
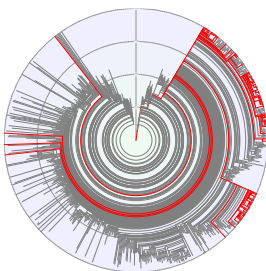
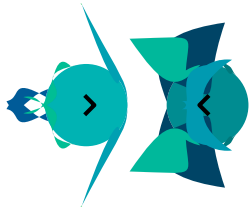


# Dr. Kevin Godin-Dubois

<b>Contact</b>	 Toulouse University IRIT - CNRS UMR 5505 2 rue du Doyen Gabriel Marty 31042 Toulouse, France	 kevin.dubois@irit.fr  kgd-al@github.com  godinduboisalife  R <sup>6</sup> ResearchGate
<b>Since 2021</b>	Temporary Lecturer and Research Assistant	

## Highlights

<b>Research</b>	<i>Artificial Life: Cognition, Interaction &amp; Language</i>		
<b>Main fields</b>			
	Artificial Neural Networks	Species Dynamics	Morphogenetic Engineering
<b>Publications</b>	1 journal article ( <i>Artificial Life</i> , in press) 4 international conference articles ( <i>ALife</i> , <i>IEEE ALife</i> , <i>EvoAPP</i> ) 4 international workshops short submissions ( <i>ALife</i> , <i>ECAL</i> )		
<b>Thesis</b>	Computer Science / Artificial Life <i>"Environment-driven speciation: long term interactions in artificial plant communities"</i> REVA Team, IRIT - Toulouse I University, France Supervisors: Pr. Y. Duthen (yves.duthen@irit.fr) Pr. S. Cussat-Blanc (sylvain.cussat-blanc@irit.fr)		
<b>Teaching</b>	5 years (492 hours)		
<b>Computer Science</b>	Programming languages: Python, C, R Algorithms, Data Structures, Information theory Programming projects		
<b>Generalists</b>	Data Science tools and languages Database modeling, SQL		
<b>Skills</b>			
<b>Programming</b>	Fluent: C++, Bash, Python, L <sup>A</sup> T <sub>E</sub> X Working Knowledge: C, Java, R, VB, VBA		
<b>Technical</b>	Evolutionary Algorithms, Machine Learning, Multi-Agents Systems, High-Performance Computing		
<b>Languages</b>	French (Mother tongue), English (Fluent - 980/990 at the TOEIC)		

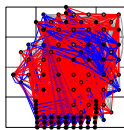
# Research

## Synopsis

My main interests revolve around the production of autonomous artificial life forms: from the autonomous design of efficient morphologies to the emergence of high-level control schemes and the evolutionary constraints that favor both. The former and latter were investigated throughout my thesis whereas my more recent work deals with Artificial Neural Networks (ANN), with a special focus on the transition from communication to language and its neural implementation.

## Artificial Neural Networks

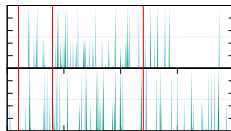
Studying the emergence of various “cognitive” capabilities in virtual robots, controlled by a spontaneously differentiated neural network, in response to biologically plausible stimuli.



### [4, 1] VIRTUAL FMRI

Extracting stimulus-specific regions of an ANN by applying a virtual equivalent to functional Magnetic Resonance Imaging (fMRI) and building high-level cognitive maps.

**Software:** ES-HyperNEAT (Custom implementation)

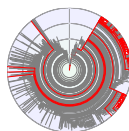


### [3, 2] COMMUNICATION

Exploring the mechanisms leading to emergent communication, how it becomes structured and its neural implementation.

## Species Dynamics

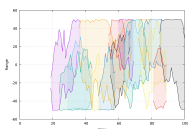
Promoting complex evolutionary trajectories and extracting species-level information from individual reproductions.



### [11, 8] PHYLOGENETICS

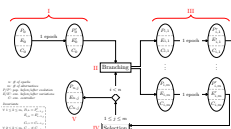
Automatically transforming genealogic trees into phylogenetic abstraction to access the emergent species-level dynamics.

**Software:** APOGeT(Automated Phylogeny Over Geological Timescales)



### [10] SPECIATION

Application of a bio-inspired reproduction operator (Bail-Out Crossover) capable of spontaneously generating species barriers thereby allowing for emergent speciation.

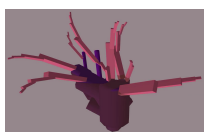


### [6, 5] EVOLUTIONARY ALGORITHMS

Introduced a novel paradigm, EDeNS (Environment-Driven Evolutionary Selection), relying on the indirect controlling of whole populations' evolutionary trajectories through an evolvable environmental controller.

## Morphogenetic Engineering

Concerned with the development of functional morphology in response to environmental constraints and evolutionary pressures.



### [12, 6, 9, 11] DEVELOPMENTAL MORPHOLOGIES

Production of mature, functional virtual plants from a single cell/structure using various genetic encodings (rules-based, L-Systems, Graphtals) in response to environmental constraints.



### [1] VIRTUAL ROBOTS

Use of genetically parameterized cubic bézier curves to control both static and mobile structures on the perimeter of virtual circular robots.

**Software:** Splinoids

**Videos:** on Vimeo

<b>Expertise</b>	
Evolutionary Algorithms	<ul style="list-style-type: none"> <li>• Environment-Driven Evolutionary Selection (EDEnS)</li> <li>• Multi-objective Optimisation</li> <li>• High Performance Computing (HPC), Co-evolution, Novelty</li> </ul>
Machine Learning	<ul style="list-style-type: none"> <li>• Artificial Neural Networks (ANN)</li> <li>• Composite Pattern-Producing Networks (CPPN)</li> <li>• Cartesian Genetic Programming (CGP)</li> <li>• Genetic Regulatory Networks (GRN)</li> <li>• Hidden Markov Models (HMM)</li> </ul>

## Teachings

<b>Course management</b> 2021-2022	Toulouse I University & Toulouse III University, France	
	• Computer Science projects	72h
	<i>Multi-Agent Systems, Complex Systems, Simulation</i>	
	• R programming	67.5h
	<i>English lectures</i>	
<b>Teaching fellow</b> 2017-2021	• Information theory	22.5h
	• Servers and contents	18.75h
<b>Practical work supervisor</b> 2016-2021	Toulouse I University & Toulouse III University, France	
	• Statistical software (R & Python)	36h
	• Algorithms	60h
	• Excel & VBA	60h
	• Modeling in databases	21h
<b>Practical work supervisor</b> 2016-2021	Toulouse III University, France	
	• Software projects	69.2h
	• Data structures	18.8h
	• C Programming	36h
	• Python	8h

## Outreach

<b>EduMix</b> <b>Aspi-Friendly</b> 2021	Initiated a project for the self-monitoring of well-being in students with autistic disorders alongside a heterogeneous team of neuro-(a)typical and various profiles (faculty, designers, developers ...).
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## Internships

<b>Morphogenetic Engineering</b> 2016 (6 months)	<p>Toulouse Research Institute on Computer Science (IRIT), France</p> <p><i>“Rule-based artificial embryogenesis in a complex 3D environment”</i></p> <p>Deployed rule-based genomes on the MecaCell platform to study artificial plant growth and cell specialization.</p> <p><b>Contact:</b> Pr. Y. Duthen (<a href="mailto:yves.duthen@irit.fr">yves.duthen@irit.fr</a>)</p>
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<b>Machine Learning</b> 2015 (3 months)	IRIT, “ <i>Comparison of different evolutionary approaches, an application to the GECCO 2015 challenge</i> ” Performed a performance comparison (accuracy, efficiency) between Artificial Neural and Genetic Regulatory Networks on the 2015 GECCO temperature prediction challenge data. <b>Contact:</b> Pr. H. Luga ( <a href="mailto:herve.luga@irit.fr">herve.luga@irit.fr</a> )
<b>Machine Learning</b> 2014 (2 months)	IRIT, “ <i>An architecture for automated bird discrimination</i> ” Applied Hidden Markov Models to the BirdClef2014 challenge on the identification of specific bird species in a corpus of thousands of recordings. <b>Contact:</b> Pr. J. Farinas ( <a href="mailto:jerome.farinas@irit.fr">jerome.farinas@irit.fr</a> )

## Education

<b>PhD</b> 2016 - 2020	Toulouse I University, France Defended the 15th of July 2020 Thesis title: “ <i>Environment-driven speciation: long term interactions in artificial plant communities</i> ” Investigated how complexification of artificial creatures could be further enhanced through the indirect control provided by a co-evolved, highly dynamical environment. <b>Rapporteurs:</b> Pr. P. Collet & DoR. F. Vico <b>Contact:</b> Pr. Y. Duthen ( <a href="mailto:yves.duthen@irit.fr">yves.duthen@irit.fr</a> )
<b>Master</b> 2014 - 2016	Toulouse III University, France ( <i>with honours</i> ) Artificial Intelligence: mathematical & symbolic models, training methods
<b>Bachelor</b> 2011 - 2014	Toulouse III University ( <i>with distinction</i> ) Computer Science: networks, programming, systems, mathematics

## Scholarships and Fellowships

<b>2016</b> 70K €	PhD Fellowship from the French Minister of Higher Education and Research (MESR) - over 3 years
<b>2015</b> 10K €	Master Scholarship from the International Mathematics and Computer Science Center (LabEx CIMI, Toulouse)
<b>2014</b> 3K6 €	Merit Scholarship from the Regional Student Welfare Office (CROUS, Toulouse) - over 2 years

## Research Output

### International Journal (peer-reviewed)

- [1] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. “Explaining neuro-evolution of fighting creatures through virtual fMRI”. In: *Artificial Life* (2023), in press.

## International conferences (peer-reviewed)

- [4] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. “Spontaneous modular NeuroEvolution arising from a life/dinner paradox”. In: *The 2021 Conference on Artificial Life*. Cambridge, MA: MIT Press, 2021, p. 95. DOI: 10.1162/isal\_a\_00431. Presentation: <https://vimeo.com/godinduboisalife/alife2021main>.
- [6] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. “Beneficial Catastrophes: Leveraging Abiotic Constraints through Environment-Driven Evolutionary Selection”. In: *2020 IEEE Symposium Series on Computational Intelligence (SSCI)*. 2020, pp. 94–101. DOI: 10.1109/SSCI47803.2020.9308411.
- [9] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. “Self-sustainability Challenges of Plants Colonization Strategies in Virtual 3D Environments”. In: *Applications of Evolutionary Computation*. Ed. by P. Kaufmann and P. A. Castillo. Cham: Springer International Publishing, 2019, pp. 377–392. ISBN: 978-3-030-16692-2. DOI: 10.1007/978-3-030-16692-2\_25.
- [10] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. “Speciation under Changing Environments”. In: *ALIFE 19*. Vol. 31. Cambridge, MA: MIT Press, 2019, pp. 349–356. ISBN: 978-0-262-35844-6. DOI: 10.1162/isal\_a\_00186. Presentation: <https://vimeo.com/godinduboisalife/alife2019>.

## Workshops

- [2] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. “Emergent communication for coordination in teams of embodied agents”. In: *4th International Workshop on Agent-Based Modelling of Human Behaviour (ALife2022)*. 2022, in press.
- [3] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. “On the benefits of emergent communication for threat appraisal”. In: *3rd International Workshop on Agent-Based Modelling of Human Behaviour*. Online, 2021. URL: [https://abmhub.cs.ucl.ac.uk/2021/camera\\_ready/Godin-Dubois\\_etal.pdf](https://abmhub.cs.ucl.ac.uk/2021/camera_ready/Godin-Dubois_etal.pdf). Presentation: <https://vimeo.com/godinduboisalife/abmhub2021>.
- [8] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. “APOGeT: Automated Phylogeny Over Geological Timescales”. In: *MethAL workshop at ALife 2019*. 2019. DOI: 10.13140/RG.2.2.33781.93921.
- [12] K. Dubois, S. Cussat-Blanc, and Y. Duthen. “Towards an Artificial Polytrophic Ecosystem”. In: *Morphogenetic Engineering Workshop, at the European Conference on Artificial Life (ECAL) 2017 September 4*. 2017.

## Poster

- [11] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. “Studying long term interactions between plants and their environment”. In: *Alife 2018*. Tokyo, 2018. DOI: 10.13140/RG.2.2.27553.97125.

## Oral presentations

- [7] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. *Splinoids: first steps out of EDENs*. Lightning talk. Montreal (Virtual), 2020. DOI: 10.13140/RG.2.2.11048.19200.

## Thesis

- [5] K. Godin-Dubois. “Environment-Driven Speciation: Long-Term Interactions in Artificial Plant Communities”. PhD thesis. Doctoral school of Mathematics, Computer Science and Telecommunications (Toulouse, France), 2020. URL: <http://www.theses.fr/2020TOU10026/document>.