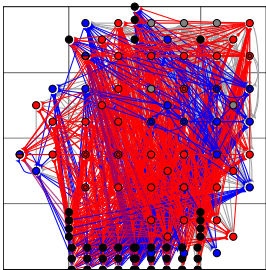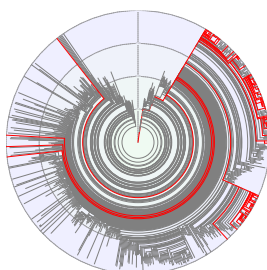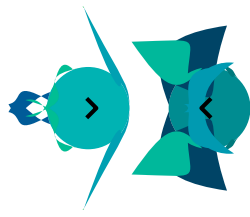# Dr. Kevin Godin-Dubois

Contact
- ✉ k.j.m.godin-dubois@vu.nl
- ⌂ Vrije Universiteit Amsterdam
  Amsterdam
  The Netherlands
- kgd-al@github.com
- godinduboisalife
- Google Scholar
- R⁶ ResearchGate

Position | Researcher in Evolutionary Robotics (since November 2022)

Highlights

Research | *Artificial Life: Cognition, Interaction & Language*

Main fields

| Artificial Neural Networks | Species Dynamics | Morphogenetic Engineering |

Publications | 1 journal article (*Artificial Life*)
4 international conference articles (*ALife, IEEE ALife, EvoAPP*)
4 international workshops short submissions (*ALife, ECAL*)

Thesis | Computer Science / Artificial Life
"Environment-driven speciation: long term interactions in artificial plant communities"
REVA Team, IRIT - Toulouse I University, France
Supervisors: Pr. Y. Duthen   (yves.duthen@irit.fr)
                  Pr. S. Cussat-Blanc (sylvain.cussat-blanc@irit.fr)

Teaching | 5 years (492 hours)

Computer Science | Programming languages: Python, C, R
Algorithms, Data Structures, Information theory
Programming projects

Generalists | Data Science tools and languages
Database modeling, SQL

Skills
Programming | Fluent: C++, Bash, Python, LaTeX
Working Knowledge: C, Java, R, VB, VBA

Technical | Evolutionary Algorithms, Machine Learning, Multi-Agents Systems, High-Performance Computing

Languages | 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.
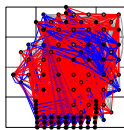
[4, 2] VIRTUAL FMRI
Extracting stimulus-specific regions of an ANN by applying a virtual equivalent to functional Magnetic Resonance Imaging (fMRI) and building high-level cognitive maps.
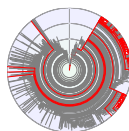**Software:** ES-HyperNEAT (Custom implementation)
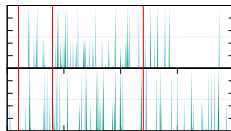
[3, 1] COMMUNICATION
Exploring the mechanisms leading to emergent communication, how it becomes structured and its neural implementation.
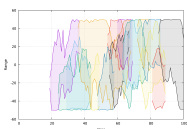
Species Dynamics — Promoting complex evolutionary trajectories and extracting species-level information from individual reproductions.


[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.
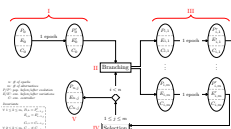
[6, 5] EVOLUTIONARY ALGORITHMS
Introduced a novel paradigm, EDEnS (Environment-Driven Evolutionary Selection), relying on the indirect controlling of whole populations' evolutionary trajectories through an evolvable environmental controller.

Morphogenetic Engineering — Concerned with the development of functional morphology in response to environmental constraints and evolutionary pressures.
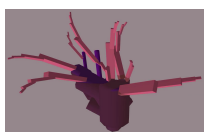
[12, 6, 9, 11] DEVELOPMENTAL MORPHOLOGIES
Production of mature, functional virtual plants from a single cell/structure using various genetic encodings (rules-based, L-Systems, Graphtals) in response to environmental constraints.

[2] 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

Expertise	
Evolutionary Algorithms	• Environment-Driven Evolutionary Selection (EDEnS) • Multi-objective Optimisation • High Performance Computing (HPC), Co-evolution, Novelty
Machine Learning	• Artificial Neural Networks (ANN) • Composite Pattern-Producing Networks (CPPN) • Cartesian Genetic Programming (CGP) • Genetic Regulatory Networks (GRN) • Hidden Markov Models (HMM)

Teachings

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

Outreach

EduMix **Aspi-Friendly** 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 ...).

Internships

Morphogenetic **Engineering** 2016 (6 months)	Toulouse Research Institute on Computer Science (IRIT), France *"Rule-based artificial embryogenesis in a complex 3D environment"* Deployed rule-based genomes on the MecaCell platform to study artificial plant growth and cell specialization. **Contact:** Pr. Y. Duthen (`yves.duthen@irit.fr`)

Machine Learning 2015 (3 months)	IRIT, *"Comparison of different evolutionary approaches, an application to the GECCO 2015 challenge"* Performed a performance comparison (accuracy, efficiency) between Artificial Neural and Genetic Regulatory Networks on the 2015 GECCO temperature prediction challenge data. **Contact:** Pr. H. Luga (`herve.luga@irit.fr`)
Machine Learning 2014 (2 months)	IRIT, *"An architecture for automated bird discrimination"* Applied Hidden Markov Models to the BirdClef2014 challenge on the identification of specific bird species in a corpus of thousands of recordings. **Contact:** Pr. J. Farinas (`jerome.farinas@irit.fr`)

Education

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

Scholarships and Fellowships

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

Research Output

International Journal (peer-reviewed)

[2] K. Godin-Dubois, S. Cussat-Blanc, and Y. Duthen. "Explaining the Neuroevolution of Fighting Creatures Through Virtual fMRI". In: *Artificial Life* (Sept. 2022), pp. 1–28. ISSN: 1064-5462. DOI: 10.1162/artl_a_00389.

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

[1] 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`. 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`.