

JEAN **DISSET** PhD

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## EDUCATION

### PHD IN COMPUTER SCIENCE

2013 - 2017

UNIVERSITY OF TOULOUSE, FRANCE

*"Virtual Cells And Gene Regulatory Networks for the development of Self-Organising Structures"*

Supervised by Prof. Yves Duthen, Dr. Sylvain Cussat-Blanc

### MASTER'S DEGREE

2011 - 2013

UNIVERSITY OF TOULOUSE, FRANCE

**Master of Science** in Artificial Intelligence, Pattern Recognition and Robotics.

*Magna Cum Laude*

EDINBURGH NAPIER UNIVERSITY, UNITED KINGDOM

**First Year of master** as an exchange student

*With merits*

### BACHELOR'S DEGREE

2008 - 2011

UNIVERSITY OF TOULOUSE, FRANCE

**Bachelor of Science** in Computer Science (Computer Science, Mathematics and Physics)

*Cum Laude*

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## PUBLICATIONS

### FULL PUBLICATIONS IN PEER REVIEWED INTERNATIONAL CONFERENCES

- Bader C, Disset J, Sharma S, Soo Hoo R, Oxman N, (2018), A Position-Based Dynamics Model For Microcolony Simulation. In Artificial Life Proceedings
- Tai T., Bader C., Ling A., **Disset J.**, Darweesh B., Duro-Royo J., Van Zak J., Hogan N., Oxman N. (2018) - "Designing (for) Decay: Parametric Material Distribution for Hierarchical Dissociation of Water-based Biopolymer Composites". Proceedings of IASS Annual Symposia Bader C, **Disset J**, Sharma S, Soo Hoo R, Oxman N, (2018), A Position-Based Dynamics Model For Microcolony Simulation. In Artificial Life Proceedings

- Tai T., Bader C., Ling A., **Disset J.**, Darweesh B., Duro-Royo J., Van Zak J., Hogan N., Oxman N. (2018) - "Designing (for) Decay: Parametric Material Distribution for Hierarchical Dissociation of Water-based Biopolymer Composites". Proceedings of IASS Annual Symposia
- **Disset J.**, Wilson D. G., Cussat-Blanc S., Sanchez S., Luga H., & Duthen Y., (2017) - "A comparison of genetic regulatory network dynamics and encoding". In Proceedings of the Genetic and Evolutionary Computation Conference (pp. 91-98). ACM
- Wilson D., **Disset J.**, Cussat-Blanc S., Duthen Y., Luga H., (2017) - "Learning Aquatic Locomotion With Animats". 14th European Conference on Artificial Life (ECAL 2017)
- **Disset J.**, Cussat-Blanc S., Duthen Y., (2016) - "Evolved Developmental Strategies of Artificial Multicellular Organisms". The Fifteenth International Conference on the Synthesis and Simulation of Living Systems (ALIFE 2016)
- Cussat-Blanc S., **Disset J.**, Sanchez S., (2016) - "Dangerousness Metric for Gene Regulated Car Driving" - European Conference on the Applications of Evolutionary Computation
- **Disset J.**, Cussat-Blanc S., Duthen Y., (2015) - "MecaCell: an Open-source Efficient Cellular Physics Engine" - 13th European Conference on Artificial Life (ECAL 2015)
- **Disset J.**, Cussat-Blanc S., Duthen Y., (2014) - "Self Organisation Of Symbiotic Multicellular Structures". The Fourteenth International Conference on the Synthesis and Simulation of Living Systems (ALIFE 2014)

## SHORT PUBLICATIONS IN PEER REVIEWED INTERNATIONAL CONFERENCES

- **Disset J.**, Cussat-Blanc S., Duthen Y., (2014) - "Toward organogenesis of artificial creatures". -Proceedings of the Companion Publication of the 2014 Annual Conference on Genetic and Evolutionary Computation

## BOOK CHAPTERS

Cussat-Blanc S., **Disset J.**, Sanchez S., Duthen Y., (2016) - "Artificial Gene Regulatory Networks for Agent Control" - Evolutionary Computation in Gene Regulatory Network Research

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# RESEARCH EXPERIENCE & COLLABORATIONS

## POSTDOCTORAL ASSOCIATE

2018 - 2019

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, USA

I worked for 18 months on a federal DARPA grant, at MIT, under the supervision of Prof. Neri Oxman and in close collaboration with Profs. Chris Voigt, Tim Lu and Cullen Buie. The goal of this interdisciplinary research was to program and simulate the growth of a multicellular aggregate, compile the virtual genotype of the simulated organisms into real DNA, and subsequently implant this into real cells.

I have developed a specialized agent-based simulation engine with custom physics, a logic-gate based virtual gene regulatory network and a machine learning framework that heavily relies on evolutionary computations. The machine learning part is both fascinating and challenging, as it applies to both the calibration of the simulation (trying to reduce the reality gap) and the inverse problem (finding the correct genotype for a desired phenotype).

A journal publication is currently being written.

## PHD STUDENT IN ARTIFICIAL LIFE

2013 - 2017

UNIVERSITY OF TOULOUSE, FRANCE

My research during my PhD revolved around the **simulation of cells**, both in their **physics** and their **behavior**, in order to better understand and eventually exploit the mechanisms behind **self-organization**, one of the most defining and fascinating properties of living systems. The goals are multiple: from getting insights about the origins of multicellular life to being able to use these properties in the context of user-defined desired phenotypical characteristics (**morphogenetic engineering**).

- I collaborated with biologists and applied my physics model to the modelling of tumors.
- I worked on several **Gene Regulatory Networks** representation and studied their performance when used in an evolutionary context.
- I experimented with the concept of cell **specialization**, and more particularly studied the impact of the definition of differentiated states (using high level abilities and weaknesses descriptions) on the final morphologies of the developing virtual embryos.
- I developed an open source 3D cell simulation platform for Artificial Life (MecaCell)
- I studied the role of **adhesions** in **artificial embryogenesis**.
- I produced novel artificial creatures surviving with no complex explicit fitnesses and no separation between development or evaluation of the individual (as is commonly seen).

## VISITING PHD STUDENT

2015

LABORATORY OF INTELLIGENT SYSTEMS, EPFL, SWITZERLAND

- I investigated the **auto-organization** properties of **adhesive soft robots** through differential adhesion rules in the team of Prof. **Dario Floreano**. I developed a model of differential adhesion on virtual cells and successfully showed that various geometric formations of cells could spontaneously appear in a population, through crafted adhesion rules.

## MASTER'S THESIS IN ARTIFICIAL INTELLIGENCE & ROBOTICS

2013

UNIVERSITY OF TOULOUSE, FRANCE

I developed a fast computational model for the simulation of 2D cells cytoskeleton.

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## TEACHING EXPERIENCE

## PHD CONTRACT TEACHER & GRADUATE TEACHING ASSISTANT

2013 - 2017

UNIVERSITY OF TOULOUSE, FRANCE

~400 hours of teaching; teaching algorithms, databases, dev ops, and computer architecture to various levels (under-graduate and post-graduate).

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## AWARDS AND NOMINATIONS

### ACADEMIC

- **Winner** of the GECCO 2015 Simulated Car Racing Competition. with an Artificial Gene Regulatory Network controller. (with S. Cussat-Blanc and S. Sanchez). 2015
- **Nominee** best paper at ALIFE 14. "*Self organization of multicellular structures*". 2014
- **Winner** of the Artificial Intelligence In Games course competition at Napier Edinburgh University. 2012

### OTHER

- First runner-up at the French Robotics Competition and third place at the European Robotics Competition (Eurobot) - As lead electronics engineer & Artificial Intelligence specialist in a team of 7 - 2017, then 2nd at the French Robotics cup again in 2019.
- Innovation Price winner at the French Robotics Competition - 2016.

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## PRESENTATIONS & COMMUNICATION

- **Oral presentation** for every full paper published in a Rank A international conference - 2013-2019
- Morphogenetic Engineering **Workshop participation** at the ECAL international conference - "*MecaCell: an Open-source Efficient Cellular Physics Engine*" in York, UK - 2015
- **Presenter** at the "Night of the Researchers" public event in Toulouse - 2016, 2017
- **Radio Interview** about my research activities - 2015
- Interactive computer generated **art exhibition** focusing on the development and simulation of cells, using a leap motion and a video projector. - 2015
- Presentation at **MIT CSAIL lab** - Invited at Una-May O'Reilly ALFA Group. "*Self-organization of cell populations through differentiation*" - 2014

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## ADMINISTRATION

- **Student representative** for the computer science faculty of the University of Toulouse - 2014-2017