Introduction to the ECAL 2017 Special Issue

Carole Knibbe, Guillaume Beslon, Dusan Misevic

EDITORIAL - INTRODUCTION TO THE ECAL 2017 SPECIAL ISSUE

GUEST EDITORS: CAROLE KNIBBE[1,2], GUILLAUME BESLON[1,3], AND DUSAN MISEVIC[4]

ECAL 2017, the Fourteenth European Conference on Artificial Life, was held in Lyon, France, September 4-8th 2017, hosted by the National Institute for Applied Sciences of Lyon (INSA Lyon) and by Inria Rhône-Alpes. Since the first ECAL in 1991, the conference was the main international event of the International Society for Artificial Life (`http://alife.org/`) in odd-numbered years, alternating with ALife, the International Conference on the Synthesis and Simulation of Living Systems. The year 2017 marked the 30th anniversary of the first Artificial Life Workshop, held at Los Alamos National Laboratory in 1987. 2017 also happened to be the ultimate edition of ECAL, this series of fourteen conferences held in Paris, Brussels, Granada, Brighton, Lausanne, Prague, Dortmund, Canterbury, Lisbon, Budapest, Taormina, York and finally Lyon. But this closure is not an end, since the two alternating conferences are now merged into a single event, held every year.

The 2017 edition gathered two hundred participants, coming from Europe of course, but also from America, Asia, Africa and Oceania. Seven plenary talks were presented, covering

[1]Inria, F-69100, Villeurbanne, France

[2]Univ Lyon, CarMeN Laboratory, INSERM, INRA, INSA-Lyon, Université Claude Bernard Lyon 1, F-69621, Villeurbanne, France

[3]Univ Lyon, CNRS, INSA-Lyon, LIRIS, UMR5205, F-69621, Villeurbanne, France

[4]Center for Research and Interdicisiplinarity, F-75015, Paris, France

a wide range of artificial life topics, related to the conference theme – "Create, play, experiment, discover: revealing the experimental power of virtual worlds". Indeed, one goal of the conference was to investigate the place of the experimental approaches within the artificial life field, both in terms of how we can use experimental results from chemistry, biology or social sciences, and in terms of how we experiment with our own artefacts.

Six workshops were held during the conference, on topics ranging from agency in the physical sciences to living architecture, not forgetting evolution of physical systems, morphogenic engineering, synthetic biology and embodied artificial intelligence, and social learning and cultural evolution. In addition to the well-established ISAL School, nine tutorials gave the participants the opportunity to learn about MABE (Modular Agent Based Evolution), Empirical (to build artificial life systems for the web), FLAME GPU (to simulate complex systems), Avida-ED (a GUI implementation of Avida for educational use), evolutionary game theory, evolution of neural networks, evolutionary robotics with real hardware, evolution in the cloud, and digital coevolution.

The 64 contributed talks (for a total of 131 submissions) and 23 contributed posters covered all the topics of Artificial Life, the most represented being (i) Evolutionary dynamics, (ii) Complex dynamical systems and networks, (iii) Perception, cognition and behavior and (iv) Bioinspired robotics and embodied systems. The whole proceedings [1] are available in open access at MIT Press (`http://cognet.mit.edu/journal/ecal2017`). This issue of the Artificial Life Journal brings together four of the best papers from the conference,

as determined by the original review process. The authors were invited to extend their original contributions for this special issue.

In analogy to Chris Langton's research program on life-as-it-could-be, Andrei Robu et al. investigate time-as-it-could-be-measured by minimal systems, or how a Markovian agent can keep track of the flow of time under strong limitations of memory capacity. With an analysis rooted in information theory, they show that even a 1-bit probabilistic clock can provide information about time, either about local phase (is the current time step odd or even?) with an oscillator clock, or about total elapsed time (is it early or late?) with a decay-based clock. They also investigate the optimal individual clock parameters when several clocks work together independently, in a cascade or in a composite system where they can influence each other.

Time in minimal systems is also at the heart of the second article of this issue, but with a different perspective. Starting from the observation that neural conduction velocities vary over three orders of magnitude across neuron types and can change over time, Matthew Egbert et al. invite us to wonder whether signal delay could be used functionally, instead of being merely an annoying result of physical and biological constraints. To address this question, they evolve a minimal robot controller modelled as a single neuron with a recurrent connection, using delay differential equations instead of the ordinary differential equations of conventional continuous-time recurrent neural networks. They show how delay destabilizes certain attractors and creates other stable attractors, resulting in an agent that performs well at the target task.

With the third article, we move from minimal to complex systems with a study on evolution of complexity, an important question both in artificial life and in evolutionary biology. In "Evolving complexity in cooperative and competitive noisy prediction games", Nick Moran and Jordan Pollack explore which types of co-evolutionary interactions can lead to evolution of complexity. While the "evolutionary arms race" model of competitive co-evolution is probably the most popular in the artificial life literature, the authors show that in the context of a noisy string-matching game, a mix of cooperation and competition is actually the most effective in driving complexity growth.

Finally, in his essay on "Circular causation, circular cognition", Inman Harvey highlights, with his peculiar Sussex style, how challenging circular causation can be for our intuition, by exploring different dynamical systems in physics, engineering, biology and cognitive science, and by discussing some errors that people make when thinking about it. He argues that most confusions result from failing to distinguish between seemingly-similar concepts used to describe both local and global features of a system. He also clarifies that explanations in terms of circular causation typically do not explain the *origins* of a phenomenon, but can explain its *persistence*, through what he calls the principles of "normal settlement".

Acknowledgments

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