

Artificial Life Down Under

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Abstract For many years, Australian researchers have been contributing to the areas of artificial life and complex adaptive systems. This report highlights some of the Australian-based activities in these areas.

Keywords

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For many years, Australian researchers have been contributing to the areas of artificial life and complex adaptive systems. Since the early papers by David Green and Terry Bossomaier in the late eighties [2], complex systems research has been a focal interest of many groups in Australia. Nowadays, artificial life and complex adaptive systems research in Australia covers the whole field from cellular automata to robotics and genetic networks and from theoretical physics to real-world applications. There are many groups in Australia working in the area:

- Terry Bossomaier's group at Charles Sturt University is looking among other things at cellular automata, distributed information systems, network models, neural models, and parallel computing.
- Alan Dorin and Jon McCormack at Monash University work in the area of generative electronic art, applying artificial life research to applications in music, computer graphics, animation, and interactive art.
- David Green's group at Monash University is looking among other things at distributed information systems, ecological and biological models, geographical information systems, and social networks.
- Janet Wiles' Complex and Intelligent Systems group at the University of Queensland is working on evolutionary computation for cognitive, linguistic, and biological modeling. Their work on genetic regulatory networks is in collaboration with colleagues at the ARC Centres for Complex Systems (ACCS) and Bioinformatics (ACB).
- My Artificial Life and Adaptive Robotics Laboratory at the Canberra campus of the University of New South Wales is working on the theory and applications of evolutionary computation for games, learning, and robotics as well as network theory and network evolution for multi-agent systems. The group hosts the Canberra node of the ARC Centre on Complex Systems.

In addition to the Australian Conference on Artificial Life (ACAL), Australian researchers also organize the Asia-Pacific Conference on Complex Systems. The journal *Complexity International* is an on-line journal published in Australia and is dedicated to complex systems research.

With these activities going around Australia, it was apparent that we needed a local conference to better interact with each other in Australia and with other international colleagues. On December 11,

2001, I organized the first Australian Workshop on Artificial Life in conjunction with the 14th Australian Conference on Artificial Intelligence, which attracted 15 people. In 2002, Russell Standish, Mark Bedau, and I organized the eighth International Conference on the Simulation and Synthesis of Living Systems (ALife 8) with researchers coming from around the globe for a very successful event in Sydney. By December 2002, many agreed that we needed to take the first steps to establish the Australian Conference on Artificial Life (ACAL) series. Janet Wiles and I carried the first flag and announced ACAL 2003, which was held in Canberra, the Capital Territory of Australia, on December 6–7, 2003. The aim was to provide Australian artificial life researchers with a biannual event where their work is peer reviewed, assessed, and discussed. As Mark Bedau continued his leadership in promoting ALife research, he encouraged ALife down under by (among other things) providing an opportunity to publish extended versions of the best work from the conference, so that it can get the appropriate worldwide exposure. The conference received 30 papers; only 20 were accepted and were included in the conference proceedings. Out of the 20, we received 6 substantially revised papers, and we accepted 2 for publication in this issue of *Artificial Life* [1, 3].

ACAL 03 heard four distinguished speakers. The Rector of the Australian Defence Force Academy, Prof. Robert King, announced the opening of the conference and introduced the first distinguished speaker, Stefano Nolfi, from Italy. Stefano kicked off the conference with an inspiring presentation on evolutionary robotics that not only presented this revolutionary field, but also offered new food for thought on how to tackle the complex problems in the emerging field of robotics. In the afternoon, the second invited speaker was Mark Ragan from the University of Queensland, Australia, who took the audience on an intriguing journey in genetics and evolution. Mark continued the presentation with his work in bioinformatics and phylogenetic trees to offer a stimulating environment and interesting discussion. The second day started with the third invited speaker, David Fogel, from Natural Selection, USA. The people who listened to David Fogel talking would agree with me when I say that he played a beautiful symphony covering the field of evolutionary games and concluding with his pretty Blondie playing checkers against the audience. In the afternoon, David Green provided an artful presentation that took a holistic view of complex systems covering biology and ecology as the basis for understanding and modeling complex systems.

In addition to the two papers that appear here, ACAL 03 heard a number of interesting papers, including seven papers from Canada, France, Japan, and the UK. Yoshikazu Suemitsu and Shigetoshi Nara, from Japan, presented exciting work on the use of chaotic dynamics to control a moving object in 2D. Also from Japan, Hideaki Suzuki and Naoaki Ono presented a paper on segregational instability under cell selection pressure. Christian Jacob's students presented two exciting papers, one on a 3D visualization of gene regulatory networks, and the other on bacterial chemotaxis. The latter paper, by Joanne Penner, Ricardo Hoar, and Christian Jacob, was named the best student paper in the conference. Peter Bentley's group, from the UK, presented two papers on cell division and reaction-diffusion models. Nicolas Guionnet and Guy Gouardères, from France, gave a paper on adaptive artificial coagulation for query flow control in a grid application.

Australian researchers presented a number of diverse and exciting papers. George Milne's group presented two papers on cellular automata for epidemic modeling and emergent crowd behavior. Luke Harrald presented a cellular automata model for generating music. Inari Thiel and her coauthors provoked the audience with an interesting discussion on the ethics of artificial life. My colleagues at UNSW@ADFA presented an inspiring work on defense and security. Michael Barlow spoke about his multi-agent simulation systems and their use for decision support. Daryl Essam and I presented a paper on the use of artificial life models in security applications. James Watson, Janet Wiles, and Jim Hanan presented a paper on L systems and genetic regulatory networks. Russell Standish investigated the case of the missing neutrality.

Robotics research was the focus of three papers. The first was by Oliver Coleman and Stephan Chalup, discussing their work on navigation. Robert Stewart and Andrew Russell presented an interesting work on swarm robots for sorting breaks. The robotic session was concluded by my presentation on a paper written by Jason Teo and me, investigating the coevolution of morphology and mind of quadruped robots with asymmetric bodies.

The end of ACAL 03 marked the start of a successful Australian biannual series of conferences on artificial life and complex adaptive systems. The preparations for ACAL 05 are on the way, and indications are that it will be a much bigger conference than the one in 2003. ACAL 05 will take place December 5–8, 2005, in conjunction with the 18th Australian Conference on Artificial Intelligence in Sydney, Australia. The Web site can be found at <http://www.itee.adfa.edu.au/~abbass/acal05/>. I wish to take this opportunity to invite the readers of *Artificial Life* to submit their work to ACAL 05 and join their Australian ALife colleagues in beautiful Sydney. In conclusion, I wish to thank everyone who contributed to ACAL 03 and made it as successful as it was. More specifically, I wish to thank Janet Wiles for carrying the conference flag with me. I wish to thank Mark Bedau, the Editor-in-Chief of *Artificial Life*, for his continuous support of the conference series and for providing an opportunity for the best work from ACAL 03 to get international exposure.

Anyone who has organized a conference knows that a major component in the success of any conference is to attract distinguished invited speakers. In particular, David Fogel, David Green, Stefano Nolfi, and Mark Ragan added to the success of ACAL 03. Special thanks are due to the program committee of ACAL 03 and the reviewers, who all ensured the high quality of papers. Thanks also are due to the authors who submitted their work and contributed to the success of ACAL. Finally, we wish to thank the sponsors of ACAL 03: Air Force Office of Scientific Research, Asian Office of Aerospace Research and Development, Army Research Office—Far East, ARC Centre for Bioinformatics, ARC Centre for Complex Systems, and the Artificial Life and Adaptive Robotics Laboratory, UNSW@ADFA.

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