

# The Fourth International Conference on Autonomous Agents

*Carles Sierra*

The Fourth International Conference on Autonomous Agents took place in Barcelona (Catalonia, Spain) from 3 to 7 June 2000, the first one held outside the United States. It had a similar attendance to previous years (435 attendees), thus opening the possibility of other conferences outside the United States. The program committee chairs were Maria Gini, the University of Minnesota, and Jeff Rosenschein, the Hebrew University in Israel. There were 199 submissions from 20 countries, from which 48 papers and 65 posters were selected.

Gini managed to obtain some key sponsorship from the Defense Advanced Research Projects Agency (DARPA) and the National Science Foundation to support the travel expenses of more than 25 U.S. students. This support helped to raise the number of students attending the conference to around 120, providing evidence of the increasing interest in the field among young Ph.D. students. Eighteen students volunteered to help in the organization of the conference, assisting in the sessions and at the registration desk.

The social events were well attended. Especially notable was the banquet held at the Hipostila room, a magnificent masterpiece by Antoni Gaud. You can see many pictures of the conference, including the banquet, at [www.iiia.csic.es/agents2000](http://www.iiia.csic.es/agents2000). During the banquet, two conference paper awards were announced. The Best Student Paper Award was given to Song-Yee Yoon (MIT Media Lab) for "Motivation-Driven Learning for Interactive Synthetic Characters," and the Best

Conference Paper Award was given to Mihai Barbuceanu and Wai-Kau Lo (both of University of Toronto) for "A Multiattribute Utility Theoretic Negotiation Architecture for Electronic Commerce."

## Tutorials

Wiebe van der Hoek from the University of Utrecht was the tutorial chair. From proposals received, he selected 10 tutorials covering a wide range of topics: "Information Agent Technology for the Internet" (Matthias Klusch, DFKI); "User Modeling and Adaptive Interfaces" (Pat Langley, Daimler

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In this report, I present a summary of the activities that took place during the Fourth International Conference on Autonomous Agents, which took place in Barcelona Spain from 3 to 7 June 2000.

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Chrysler Research and Technology Center, and Haym Hirsh, Rutgers University); "Coordination Technologies for Internet Agents" (Franco Zambonelli, University of Modena and Reggio Emilia, and Andrea Omicini, University of Bologna); "Agents in Electronic Markets" (Tuomas Sandholm, Washington University); "Learning Agents" (Sandip Sen, University of Tulsa); "Autonomous Virtual Humans in Virtual Environments" (Nadia Thalmann, University of Geneva, and Daniel Thalmann, Swiss Federal Institute of Technology in Lau-

sanne); "On Minds and Agents: Social Intelligence in Animals and Artifacts" (Kerstin Dautenhahn, University of Reading); "Understanding Code Mobility" (Gian Pietro Picco, Politecnico di Milano); "Agent Communication Languages: Past, Present, and Future" (Yannis Labrou and Tim Finin, both of University of Maryland); and "Agent-Oriented Software Engineering" (Mike Wooldridge, University of Liverpool, and Nick Jennings, Southampton University). From them, the most well attended were those given by Sen on learning agents and by Wooldridge and Jennings on agent-oriented software engineering. In total, more than 200 people attended the tutorials.

## Workshops

There were 13 workshops (see [www.iiia.csic.es/agents2000](http://www.iiia.csic.es/agents2000) for details). Keith Decker (University of Delaware) assembled a nice collection of topics this year. Two workshops were especially well attended. The first one was a common workshop with a collocated conference—"The Eleventh European Conference on Machine Learning (ECML-2000)—entitled "Learning Agents," chaired by Peter Stone (AT&T Labs) and Sen. The fact that the most attended tutorial was on learning agents as well hints that this is becoming a very hot topic in the agents community. The other workshop was "Infrastructure for Scalable Multi-Agent Systems" by Tom Wagner (University of Maine) and Omer F. Rana (University of Wales). The design of infrastructures was one of the main topics at this conference. One of the invited speakers, James Hendler of DARPA, also centered his talk on the need for developing infrastructures for multiagent systems.

## Invited Talks

There were four invited talks during the conference, covering different interests of the research community traditionally attending this conference.

Marco Dorigo, from the IRIDIA at the Universit Libre de Bruxelles, gave a talk in the time-honored AI tradition

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of getting inspiration from animal behavior. In this case, he gave an introductory talk about ant algorithms, which are inspired by the communication model of these societies of insects based on pheromones, focusing the presentation on the good properties of these algorithms to solve complex optimization and distributed control problems.

Manuela Veloso gave an entertaining talk about the different algorithmic techniques that her research group at Carnegie Mellon has been developing to improve the behavior of their simulated team of soccer players (sensor-resetting localization, role-based team action selection, and layered learning). She presented some videos showing the excellent performance of the well-known CMUNITED team.

Jeffrey Kephart from IBM Thomas J. Watson Research Center gave a vision of the internet as the support of a new emergent economy based on billions of agents, human and software, exchanging goods and services. He presented preliminary results on dynamic pricing by software agents to show how expected properties emerge from societies of thousands of these agents and how unexpected behaviors, such as price wars, can also arise as the result of agents' interactions. Learning appears to be the solution to some of these problems.

Finally, Hender centered his talk on new proposals to support the interaction of agents through the internet.

Although agents have been proposed as the ideal entities to deal with the amount of knowledge and information distributed over the internet, there is still no clear road map of how to develop the necessary infrastructure for this to happen. He presented the idea of a semantic web as a natural program to achieve such an infrastructure in the next four or five years—an initiative that DARPA will be funding and that the computer science community should be looking at carefully.

## Sessions

Sessions were organized in blocks of papers and poster presentations. One of the recent focus areas has been virtual worlds, the creation and management of avatars, and virtual actors and personae, with military and retail applications. Another area that emerged as a cornerstone of this conference is negotiation techniques; contracting methods; and, in general, mediated trading. Several market platforms, algorithms, and applications for this purpose were presented. There was a special interest in the software-engineering aspects of agent design and agent platform design. Three such platforms were presented. Also, several papers were devoted to evaluation frameworks, agent design tools, studies on interoperability, security, and scalability.

Many learning techniques were reported. The most popular technique was reinforcement learning applied to

robotics, but learning by imitation and joint learning were also topics discussed by the attendees. Finally, there was significant interest in biologically inspired models for agents based on hormones or social insect behavior and in the design of all sorts of societies, robot teams, and software teams to model partnership and coalitions as well as coordination and collaboration models. Altogether the program was very interesting and of high scientific and technical quality.

## Demonstrations

This year, there were 27 software demonstrations. A CD was compiled by Josep Puyol-Gruart, the software demonstrations chair from the Artificial Intelligence Research Institute in Barcelona, containing materials of all types: software, videos, papers, summaries. All attendees got a copy of the CD when registering. I think that the demonstrations were a successful part of the conference. Three remotely controlled robot demonstrations were organized by Michael Beetz from the University of Bonn and Gerhard Kraetzschmar from the University of Ulm, the robotic demonstrations chairs.

The next conference will take place in Montreal from Monday 28 May to Friday 1 June 2001 (see [www.csc.liv.ac.uk/~agents2001/](http://www.csc.liv.ac.uk/~agents2001/) for details).



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