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Agent-Oriented Information Systems

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Revised Selected Papers



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Foreword

This proceedings volume of the 5th AOIS Workshop is an opportunity for looking back at five years of organizing AOIS workshops. What did we achieve with the AOIS workshop series? Where were we five years ago, where are we now? Did our theme impact on the information systems field in the way that we had hoped for?

AOIS workshops have taken place in Seattle, Heidelberg, Stockholm, Austin, Montréal, Interlaken, Toronto, Bologna, Melbourne, and Chicago, always in conjunction with a major conference on either multiagent systems in artificial intelligence (AI/MAS) or information systems (IS). We have tried to innovate in holding these workshops as biconference events (each year AOIS held two workshop events, one at an AI/MAS conference and one at an IS conference), as well as using the AOIS web site as a medium for communication among researchers. So, certainly, we have reached a wide audience of researchers around the world from both the AI/MAS and IS communities. But did we also manage to build up a dedicated AOIS community?

Five years ago, we wrote: “Agent concepts could fundamentally alter the nature of information systems of the future, and how we build them, much like structured analysis, ER modeling, and Object-Orientation has precipitated fundamental changes in IS practice.” Of course, a period of five years is too short for evaluating the success or failure of a new scientific paradigm. But still we may observe that while most IS conferences meanwhile list agents as one of their many preferred topics, agent-orientation is generally not considered to be a fundamental IS paradigm. Information systems are still viewed as data stores and not as software agents; customers are still viewed as “business objects” and not as (intentional) business agents an IS software agent has to interact with.

Why is this? Firstly, as always, there is resistance to change. Secondly, there are “cultural differences” between the AI/MAS and IS communities that hamper communication and slow down the exchange of new ideas and approaches. Thirdly, there are still not enough concrete success stories of agent-oriented techniques being exploited to bring benefits in real-world information systems applications. Finally, another obstacle is the need for standards before agent-oriented approaches can gain widespread adoption.

So, should we still believe what we wrote 5 years ago, i.e., that “Agent concepts, which originated in artificial intelligence but which have further developed and evolved in many areas of computing, hold great promise for responding to the new realities of information systems”? Yes! The limitations of today’s IS technologies, in particular with respect to robustness, openness, flexibility, and ability to collaborate, call for further advances in IS concepts and techniques in the direction of agent-orientation. Further work in the area should clarify the benefits of agent-orientation and demonstrate the effectiveness of agent-oriented approaches to IS design. Efforts to develop effective techniques for the “semantic

web,” which also exploit elements of agent-orientation, should also bear fruit for the IS area.

For this reason, we are looking forward to many more years of having the AOIS workshop as a bridge between IS and AI/MAS and as a catalyst for innovation in IS.

Eindhoven and Toronto, March 2004

Yves Lespérance
Gerd Wagner
Eric Yu

Preface

Information systems have become the backbone of all kinds of organizations today. In almost every sector – manufacturing, education, health care, government, and businesses large and small – information systems are relied upon for everyday work, communication, information gathering and decision-making. Yet the inflexibilities in current technologies and methods have also resulted in poor performance, incompatibilities and obstacles to change. As many organizations are reinventing themselves to meet the challenges of global competition and e-commerce, there is increasing pressure to develop and deploy new technologies that are flexible, robust and responsive to rapid and unexpected change.

Agent concepts hold great promise for responding to the new realities of information systems. They offer higher-level abstractions and mechanisms that address issues such as knowledge representation and reasoning, communication, coordination, cooperation among heterogeneous and autonomous parties, perception, commitments, goals, beliefs, intentions, etc., all of which need conceptual modelling. On the one hand, the concrete implementation of these concepts can lead to advanced functionalities, e.g., in inference-based query answering, transaction control, adaptive work flows, brokering and integration of disparate information sources, and automated communication processes. On the other hand, their rich representational capabilities allow more faithful and flexible treatments of complex organizational processes, leading to more effective requirements analysis and architectural/detailed design.

The Agent-Oriented Information Systems (AOIS) workshop series focusses on how agent concepts and techniques will contribute to meeting information systems needs today and tomorrow. To foster greater communication and interaction between the information systems and agents communities, the AOIS workshop is organized as a biconference event. It is intended to be a single “logical” event with two “physical” venues. This arrangement encourages greater participation from, and more exchange between, both communities.

AOIS 2003 was the fifth edition of the workshop. The first part was hosted on the 14th of July at AAMAS 2003 – the 2nd International Joint Conference on Autonomous Agents and Multi-Agent Systems, in Melbourne, Australia, 14–18 July 2003. The second part was held in October at the 22nd International Conference on Conceptual Modeling, in Chicago (ER 2003). The workshop received in total 33 submissions, 16 of which were accepted for presentation (an acceptance rate of 48%). These papers were reviewed by at least 3 members of an international program committee composed of 34 researchers. The submissions followed a call for papers on all aspects of agent-oriented information systems and showed the range of results achieved in several areas, such as methodologies, applications, modelling, analysis and simulation.

This volume contains revised versions of 13 selected papers presented at the workshop. We believe that this carefully prepared volume will be of particular

value to all readers in these key topics, describing the most recent developments in the field of agent-oriented information systems.

We have grouped the papers into three categories: information systems and exemplar applications and case studies; methodologies issues; and, finally, modelling, analysis and simulation. Each section contains 5 papers selected from those presented at the two logical components of AOIS 2003.

The first group of papers discusses particular applications of agent-oriented information systems. Adam and Mandiam report on how they have created an MAS to address security issues in technological watch cells. Their approach, based on holonic as well as agent concepts, focusses on an integration of human (user) and organizational issues as well as agent-based information systems to support the organizational activities. They also describe their method (called AMOMCASYS) for building their MAS and evaluate their approach in a prototype implementation. In the second paper dealing with applications, Soh and colleagues describe an AOIS theory and prototype implementation for the support of teaching and learning. In their I-MINDS project, they show how real-time student response monitoring and feedback, performance evaluation and agent-supported creation of buddies groupings can be accomplished. This provides a more flexible and supportive environment in which students can learn more effectively and in which teachers can provide support more directly and efficiently. In the paper by Udupi and colleagues, we learn how agents have been used to help create trustworthiness in referral-based strategies for caching of information. By interacting with their neighbors, agents are found to develop their own trusted communities. In the next paper in this group, Rahwan and colleagues explore the applicability of agents to mobile computing. Using the AgentSpeak(L) language and the BDI architecture, they create an agent-based intelligent mobile assistant or AbIMA and test this on a handheld computer in situations where plans are volatile. The last paper in this group, by Wei and colleagues, applies agent technology to the problem of recommending information to the user. The particular context used is that of choosing appropriate secondary or sidebar information in a browser that will be of most use to the user. An auction mechanism is proposed and tested in a simulation environment. Evaluations are performed in terms of both user-perceived quality and also internal quality.

The second part of our book contains those papers that describe agent-oriented methodologies. We begin with a paper comparing existing AO methodologies. Here, Dam and Winikoff describe their evaluation of three AO methodologies (MaSE, Prometheus and Tropos) based on an assessment framework derived from the OO one of Ed Berard, covering the areas of concepts, modelling languages, processes and pragmatics. This helps them identify strengths and weaknesses and thus requires work to make these (and other) methodologies “commercial strength.” In the second paper, Sturm and Shehory present a framework useful for the comparison of AO methodologies, as for instance described in the previous paper. They propose four major evaluation property groups: concepts and properties; notations and modelling techniques; processes; and pragmatics. They then construct a set of measures within each of these four

groups and, as an exemplar application of the framework, examine and evaluate the Gaia methodology. The next paper moves us to consider reuse in the requirements for an AOIS and stresses the importance of being purposive. Using a suite of four models derived from use cases, Goss and colleagues argue that these provide a good way of capturing the purpose of the information system, set in the business and human context. In the final paper in this methodology section, one specific AOIS methodology, MaSE, is examined in detail and weaknesses are identified. Using an iterative methodology improvement process, Vafadar and colleagues explain how they have extended MaSE by the addition of two steps and a new agent-object model to provide support for agents and objects within the same system.

The final section of the book contains papers describing agent-oriented modelling, analysis and simulation. The first of these demonstrates the value of an agent pattern language. The template they introduce is used as a vehicle for assessing whether an agent approach is both viable and useful. In the second paper, Bresciani and Donzelli investigate the requirements engineering support found in the Tropos AO methodology. They propose an agent-based Requirements Engineering Framework (REF) aimed at providing support for sociotechnical systems. They use a simplified version of the i^* notation, illustrating their approach with a case study in e-government. Wagner then shows how the AOR modelling language can be used in discrete event simulation. Finally, using speech act theory, Bergholtz and colleagues present a unified framework to assist in integrating business models and process models, uniting the declarative nature of the former with the procedural and communicative aspects of the latter.

We thank the authors, the participants and the reviewers for making AOIS 2003 a high-quality scientific event.

March 2004

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