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Andrea Omicini   Paolo Petta  
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# Engineering Societies in the Agents World II

Second International Workshop, ESAW 2001  
Prague, Czech Republic, July 7, 2001  
Revised Papers



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# Preface

The idea to initiate a series of workshops to be entitled “Engineering Societies in the Agent’s World” (**ESAW**) originated in late 1999, among members of the working group on Communication, Coordination, and Collaboration of the Intelligent Information Agents special interest group of AgentLink, the European Network of Excellence for Agent-Based Computing. By that time, the convergence of scientific and technological progress in numerous areas, including software engineering, distributed problem solving, knowledge-based systems, and dynamic pervasive networking had gained significant momentum. As a result, the reality of multiagent systems was now a given.

In the eyes of the proposers and supporters of **ESAW**, these developments led to a new and manifest need, that was being left all but uncovered by the existing range of conferences and meetings. A platform that would overcome the disparate roots of the multiagent systems field by placing a clear focus on an integrative level of analysis, namely: artificial societies populating a world encompassing the natural and the artificial, comprising autonomous entities and their environment.

The chosen point of view identifies the topics of autonomy, dynamics, interaction patterns, agent lifeworlds, and coordination as central notions. Reflections of these are sought in the “traditional” multiagent systems areas of theoretical foundations for conceptualization, abstractions and models for design, methods and tools for development, supporting hardware technologies for realization, and procedures for deployment and governance. For this purpose, contributions are gathered from an open range of relevant areas in the humanities, natural sciences and engineering, technology and industry, extending those already firmly established within the multiagent systems community. Together with application experiences already gathered in building the first agent societies, these shall enable and facilitate pertinent tasks, including

- development of coordination models and technologies for engineering of agent societies
- engineering of social intelligence and emergent behaviors in MAS
- design of enabling infrastructures for agent societies
- implementation of centralized and decentralized forms of social control
- impacts of visibility and individuality of agents
- verification, validation, and certification of agent societies
- design of interaction/coordination patterns for agent societies
- solving issues of mobility, security, authority, and trust in agent societies
- development of methods, tools, and artifacts for engineering agent societies

**ESAW** thus commits to the use of the notion of multiagent systems as seed for animated constructive discussions of high quality about technologies, methodologies, and models for the engineering of complex distributed applications. Concentrating on social aspects of multiagent systems, an emphasis is placed on technology and methodology issues, while also welcoming theoretical and empirical contributions with well-documented connections to these core subjects. The series enjoyed a successful start as a workshop

at ECAI 2000 in Berlin, with the results documented in the predecessor of the present volume.<sup>1</sup>

The second edition of this workshop series, **ESAW 2001** was held at the premises of the Czech Technical University in Prague (CTU) on July 7, 2001 in co-location with the second AgentLink II general meeting and the MASAP 2001 courses on Multi-Agent Systems and Applications: the 3rd European Agent Systems Summer School (EASSS 2001), and ECCAI's Advanced Course on Artificial Intelligence (ACAI-01). This offered young researchers the opportunity to appreciate first-hand the current consensus as well as topics of debate among the over 50 attendants participating in the discussions until the late afternoon. This volume covers extended versions of papers presented at the workshop, which include results of discussions and insights gained from other presentations. The content covers the areas of Foundations of Engineering with Agents, Logic and Languages for MAS Engineering, Agent Middleware, and Applications.

Three main issues emerged from the presentations: *agent languages* – here the rather well-known debate about homogeneity vs. heterogeneity ranged from direct utilization of natural language technology over results from ontological engineering such as in connection with the Semantic Web initiative, existing standards such as FIPA-ACL, all the way to novel proposals such as Entish language for agent “souls”; *context* – aspects of the environment making up the agents’ lifeworld, context of interaction, available and shared resources, linguistic context; and *responsibility* – in societies of differing degree of openness. These can be captured in the following three questions: What characteristics distinguish a language that is adequate for agents? What does the notion of “context” have to cover for agents and multiagent systems? Who is responsible for the behavior and actions of agents and multiagent systems?

These questions were elaborated and supplemented by contributions presented in an animated plenary discussion that wrapped up this year’s edition of the **ESAW** workshop. There, the central ideas of **ESAW** as presented above were confronted once more. Under the heading “*The many ends in the Agents’ World to make meet: which, whether, how?*”, a probing was undertaken for common ground, but also prominent obstacles and clear divides, based upon the problems and successes, fears and hopes, with respect to one’s *own* experience and the *other’s* domains. In this context, it was initially made clear that “us” and “them” were intended to be represented by top-down MAS designers progressing from single multi-agent systems to the new challenges posed by “multi-MAS”; bottom-up Distributed AI and MAS designers identifying mappings from traditional system structures and properties to situated distributed solutions; middleware designers investigating how to provide services of increasing complexity; researchers in organization theory and game theory, identifying and characterizing abstract notions and measures to structure and analyse the new domain of the societies in the agents’ world; researches in the social sciences and coordination theory, proposing requirements and models in terms of mechanisms and infrastructural constituents; application designers wondering how to predictably bring about all the many “ilities” their case at hand imposes; industrials concerned about how to ensure steady and predictable progress so as

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<sup>1</sup> Omicini, A., Tolksdorf, R., and Zambonelli, F. (Eds.): Engineering Societies in the Agents World, First International Workshop, **ESAW 2000**, Berlin, Germany, August 21, 2000. Revised Papers. LNAI 1972, Springer-Verlag, 2000.

to turn technological promises into a hard reality; and finally the individual perspective of each workshop attendant. Among the many issues brought forward (and to be covered in due detail elsewhere), we summarize a few representative ones in the following.

A basic issue is posed by the need for a clear specification of the notion of “society” in the agents’ world, similar to the request for a definition of “context” spelled out before. While it should capitalize upon what is known about “real” societies, the characterization of an agent society should not be constrained by it, given that artificial societies and their lifeworlds do not only have to be modeled but also constructed from scratch. In particular, giving in to the temptation of anthropomorphism may effectively prevent the discovery of new, more pertinent and effective approaches. As a consequence, the scientific issue of modeling and the engineering issue of construction at least for the time being cannot be clearly separated from each other. Relatedly, real world “Embedded Internet” applications have to deal with potentially hostile and changing environments. These aspects have arguably so far been insufficiently addressed in MAS research and development. A shift of focus would be required therefore, from problem solving to providing societal support that takes the changing and potentially hostile environmental context into account. Along with consideration of the characteristics of individual agents and available means for coordination, this should lead to offering an adequate range of both offensive and defensive operations to different types of threats, including the issues of disclosure and integrity. This call to move “good societies” stands in interesting contrast to other observations offered in the literature suggesting that the danger posed by misbehaving entities in a MAS might be a non-issue after all.

As another significant entry, the importance of proper consideration of business modeling was put forward. The value of MAS as a viable alternative to the breaking down of chain-based services being experienced today has to be demonstrated. This must be accompanied with the provision of adequate tools crucial for business takeup. Also in this context, the co-evolution of technologies; laws, norms, and policies regulating (human) societies and organizations; and habits and trusts in individuals must not be disregarded. The social perspective on MAS also has to stand up to comparisons to other approaches and prove its validity. This asks for the identification of proper ways to characterize performances and system behaviors and procedures for the measurement and comparison of the qualities of different solutions. Also in this regard, the social view on multiagent systems is mostly still waiting for its acceptance as a first-class entity and element of analysis. In fact, the very relationship of the notions of artificial agent and artificial society is still awaiting a detailed analysis. It remains to be seen to what extent we may have already embarked upon a transition from the agent-based to a next, higher, self-contained paradigm.

We hope that these few words managed to convey a little bit of the enthusiasm and liveliness of debate that characterized the second edition of *ESAW*, confirming and even surpassing the success of its predecessor. Its results, compiled in the present volume, form an important step towards the establishment of a rampant new young shoot in multi-agent systems research. We look forward with excitement to the results to be presented at *ESAW 2002*.

In closing, we would like to acknowledge the exemplary local support provided by Hana Krautwurmova, Olga Stepankova, and Vladimir Marik, and the kind sponsorship

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October 2001

Andrea Omicini  
Paolo Petta  
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