An Interdisciplinary Approach to Multi-agent Systems: Bridging the Gap between Law and Computer Science

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1. INTRODUCTION

Research in Multi-agent Systems - MASs has given rise to new issues in sociology, psychology, philosophy, and other social sciences, all the while providing new insights into some abiding issues. But legal science has not quite responded to these developments: the computational simulation of legally relevant social activities and phenomena is a research area that has yet to hit its stride. Why is that so? And what can be done to encourage the development of such simulation?

This paper attempts to answer these questions by developing two related ideas that, if brought to fruition, could change the current situation for the better: the first is the interdisciplinary idea of a boundary object; the second, that of an agent’s autonomy.

As concerns the first idea, that of boundary objects, I argue that an important reason why the simulation of legal phenomena is not making as much headway as legal scholars and computer scientists would like is a certain language barrier that lawyers and computer scientists (in particular, software engineers) have to overcome if they are to achieve the sort of fluent communication needed to create a successful legal MAS. I do not speculate about the causes of this language barrier, but I do point out that one way in which it can be taken down is through an approach that – by bringing to bear the sociological concept of a boundary object, understood as an interactive object

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lying at the boundary between different disciplines – makes it possible for the relative research communities to relate to one another and work together in a mutually beneficial way (here, in building a legal MAS).

The second idea I bring into play and develop is that of the autonomy which can be ascribed to an artificial agent within an MAS. I work out a legal concept of autonomy by setting out the conditions satisfying which an agent’s action can be deemed autonomous, in effect identifying a threshold of autonomous action that would trigger legal consequences. I argue that artificial agents have yet to reach this threshold, and I discuss the legal considerations that would have to be taken into account in light of this future development.

With that done, I tie this idea of autonomy to the previous discussion on boundary objects by treating autonomy itself as a boundary object. In other words, I illustrate how, if we can spell out in a clear enough way what autonomous action means in the law, and what the legal approach to such action ought to be, then we will also have a roadmap we can rely on in developing autonomous artificial agents and building MASs that would be more effective at simulating or reproducing social interactions in areas of activity which fall within the purview of the law. Autonomy so conceived would count as a boundary object by virtue of its lying at the intersection of law and computer science, but what is even more important is that the two broad communities (lawyers, jurists, and legal scholars on the one hand, computer scientists on the other) would be able to share ideas and solutions in working toward MASs “staffed” by artificial agents whose autonomy makes them at once practically intelligent (in replacing human agents) and legally cognizant.

2. LAW AND THE DEVELOPMENT OF MASs

I take a broad view of MASs as any computational system made of artificial agents that interact and communicate with one another and with their environment, and where the system’s overall behavior is more important than that of its single agents\(^1\), and I take an equally broad view of artificial agents as any computational entity that has a role and can “do something” within such a system. An important application in this regard is the use of MASs to simulate or actually do the work that humans do in coordinative


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