Exploring the Effects of Sanctions on Damaging Actions through Artificial Societies: A Simulation Model

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1. INTRODUCTION

After the invention of electronic computers, the role played by computational techniques in social sciences (here defined in a broad sense as the complex of disciplines investigating human and social dynamics at all levels of analysis, from individual cognition to international organizations) has become more and more important. From the second half of the 20th century, social scientists have progressively learned to exploit advanced instruments of computation to gain a deeper understanding of the social world. The emerging methodological paradigm of computational social science, a “fledging interdisciplinary field at the intersection of the social sciences, computational science, and complexity science”\(^1\), is gradually changing the way in which social phenomena are investigated and managed. The set of computational social science methods is wide and encompasses different techniques: automated information extraction; social network analysis;

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geospatial analysis; complexity modeling and social simulations models each of which has several specialized branches.

In this paper we focus on agent-based simulation models (ABM), a specific kind of social simulation\(^3\) that can be considered, from a technical point of view, the result of a turning point in the history of artificial intelligence: the rise of Distributed Artificial Intelligence\(^4\). In general terms, ABM can be defined as a “computational method that enables a researcher to create, analyze, and experiment with models composed of agents that interact within an environment”\(^5\). Based on the identification of the scientific explanation with the reproduction \textit{in silico} (i.e. in a computer simulation), of social processes being investigated, ABM has contributed to promote a generative approach to social science research: social macro-dynamics and structures are interpreted, described, reproduced and explained as the result of micro interactions between computational entities (agents) simulating the behaviour of real individuals\(^6\). In this perspective, modelling the structural properties of social systems and exploring their spatio-temporal development via computer simulation are crucial steps to provide explanations of complex social outcomes, In ABM researchers model agents as distinct parts of a computer program that may contain heterogeneous variables, parameters, and behaviour. Agents interact by exchanging information, react to the environment (programmed to mimic the real social world in more or less detail), learn, adapt, and change rules of behaviour showing cognitive and behavioural properties typical of human agents.

Epistemological consequences of agent-based modeling are relevant. ABM is establishing the primacy of modelling for social science descriptions and theorizing, in contrast with the prevalent use of narrative descriptions and un-formalized theorizing that dominate (with the exception of economics) most social science discourse\(^7\). Moreover ABM has strengthened an