

ROBERT AXELROD

**The
Complexity
of
Cooperation**

Agent-Based
Models of
Competition
and
Collaboration

PRINCETON STUDIES IN COMPLEXITY

The Complexity Of Cooperation Agent Based Models Of Competition And

Guillaume Favre



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The Complexity of Cooperation Robert Axelrod, 1997-09-07 Robert Axelrod is widely known for his groundbreaking work in game theory and complexity theory. He is a leader in applying computer modeling to social science problems. His book *The Evolution of Cooperation* has been hailed as a seminal contribution and has been translated into eight languages since its initial publication. *The Complexity of Cooperation* is a sequel to that landmark book. It collects seven essays originally published in a broad range of journals and adds an extensive new introduction to the collection along with new prefaces to each essay and a useful new appendix of additional resources. Written in Axelrod's acclaimed accessible style, this collection serves as an introductory text on complexity theory and computer modeling in the social sciences and as an overview of the current state of the art in the field. The articles move beyond the basic paradigm of the Prisoner's Dilemma to study a rich set of issues including how to cope with errors in perception or implementation, how norms emerge, and how new political actors and regions of shared culture can develop. They use the shared methodology of agent-based modeling, a powerful technique that specifies the rules of interaction between individuals and uses computer simulation to discover emergent properties of the social system. *The Complexity of Cooperation* is essential reading for all social scientists who are interested in issues of cooperation and complexity.

The Complexity of Cooperation : Agent-based Models of Competition and Collaboration

Robert Axelrod, 1997 Robert Axelrod is widely known for his groundbreaking work in game theory and complexity theory. He is a leader in applying computer modeling to social science problems. His book *The Evolution of Cooperation* has been hailed as a seminal contribution and has been translated into eight languages since its initial publication. *The Complexity of Cooperation* is a sequel to that landmark book. It collects seven essays originally published in a broad range of journals and adds an extensive new introduction to the collection along with new prefaces to each essay and a useful new appendix of additional resources. Written in Axelrod's acclaimed accessible style, this collection serves as an introductory text on complexity theory and computer modeling in the social sciences and as an overview of the current state of the art in the field. The articles move beyond the basic paradigm of the Prisoner's Dilemma to study a rich set of issues including how to cope with errors in perception or implementation, how norms emerge, and how new political actors and regions of shared culture can develop. They use the shared methodology of agent-based modeling, a powerful technique that specifies the rules of interaction between individuals and uses computer simulation to discover emergent properties of the social system. *The Complexity of Cooperation* is essential reading for all social scientists who are interested in issues of cooperation and complexity.

Agent-based Models and Causal Inference Gianluca Manzo, 2022-01-28 Agent-based Models and Causal Inference. Scholars of causal inference have given little credence to the possibility that ABMs could be an important tool in warranting causal claims. Manzo's book makes a convincing case that this is a mistake. The book starts by describing the impressive progress that ABMs have made as a credible methodology in the last several decades. It then goes on to compare

the inferential threats to ABMs versus the traditional methods of RCTs regression and instrumental variables showing that they have a common vulnerability of being based on untestable assumptions The book concludes by looking at four examples where an analysis based on ABMs complements and augments the evidence for specific causal claims provided by other methods Manzo has done a most convincing job of showing that ABMs can be an important resource in any researcher's tool kit Christopher Winship Diker Tishman Professor of Sociology Harvard University USA Agent based Models and Causal Inference is a first rate contribution to the debate on and practice of causal claims With exemplary rigor systematic precision and pedagogic clarity this book contrasts the assumptions about causality that undergird agent based models experimental methods and statistically based observational methods discusses the challenges these methods face as far as inferences go and in light of this discussion elaborates the case for combining these methods respective strengths a remarkable achievement Ivan Ermakoff Professor of Sociology University of Wisconsin Madison USA Agent based models are a uniquely powerful tool for understanding how patterns in society may arise in often surprising and counter intuitive ways This book offers a strong and deeply reflected argument for how ABM's can do much more add to actual empirical explanation The work is of great value to all social scientists interested in learning how computational modelling can help unraveling the complexity of the real social world Andreas Flache Professor of Sociology at the University of Groningen Netherlands Agent based Models and Causal Inference is an important and much needed contribution to sociology and computational social science The book provides a rigorous new contribution to current understandings of the foundation of causal inference and justification in the social sciences It provides a powerful and cogent alternative to standard statistical causal modeling approaches to causation Especially valuable is Manzo's careful analysis of the conditions under which an agent based simulation is relevant to causal inference The book represents an exceptional contribution to sociology the philosophy of social science and the epistemology of simulations and models Daniel Little Professor of philosophy University of Michigan USA Agent based Models and Causal Inference delivers an insightful investigation into the conditions under which different quantitative methods can legitimately hold to be able to establish causal claims The book compares agent based computational methods with randomized experiments instrumental variables and various types of causal graphs Organized in two parts Agent based Models and Causal Inference connects the literature from various fields including causality social mechanisms statistical and experimental methods for causal inference and agent based computation models to help show that causality means different things within different methods for causal analysis and that persuasive causal claims can only be built at the intersection of these various methods Readers will also benefit from the inclusion of A thorough comparison between agent based computation models to randomized experiments instrumental variables and several types of causal graphs A compelling argument that observational and experimental methods are not qualitatively superior to simulation based methods in their ability to establish causal claims Practical discussions of how statistical experimental and

computational methods can be combined to produce reliable causal inferences Perfect for academic social scientists and scholars in the fields of computational social science philosophy statistics experimental design and ecology Agent based Models and Causal Inference will also earn a place in the libraries of PhD students seeking a one stop reference on the issue of causal inference in agent based computational models *Agent-Based Models of Geographical Systems* Alison J. Heppenstall, Andrew T. Crooks, Linda M. See, Michael Batty, 2011-11-24 This unique book brings together a comprehensive set of papers on the background theory technical issues and applications of agent based modelling ABM within geographical systems This collection of papers is an invaluable reference point for the experienced agent based modeller as well those new to the area Specific geographical issues such as handling scale and space are dealt with as well as practical advice from leading experts about designing and creating ABMs handling complexity visualising and validating model outputs With contributions from many of the world's leading research institutions the latest applied research micro and macro applications from around the globe exemplify what can be achieved in geographical context This book is relevant to researchers postgraduate and advanced undergraduate students and professionals in the areas of quantitative geography spatial analysis spatial modelling social simulation modelling and geographical information sciences **A Passion for Cooperation** Robert Axelrod, 2023-11-08 A Passion for Cooperation is the exciting autobiography of Robert Axelrod one of the most acclaimed and wide ranging scientists of the last fifty years After being recognized by President Kennedy for being a promising young scientist while in high school Axelrod built a career dedicated to collaborating with business school professors international relations scholars political scientists computer scientists and even evolutionary biologists and cancer researchers Fifty years later he was honored by President Obama with the National Medal of Science for scientific achievement and leadership and his work has been referred to as the gold standard of interdisciplinary research Yet Axelrod's autobiography is not just an account of his wide ranging passion for cooperation It reveals his struggles to overcome failures and experience the joys of gaining new insights into how to achieve cooperation A Passion for Cooperation recounts Robert Axelrod's adventures talking with the leader of the organization Hamas the Prime Minister of Israel and the Foreign Minister of Syria Axelrod also shares stories of being hosted in Kazakhstan by senior Soviet retired generals and visiting China with well connected policy advisors on issues of military aspects of cyber conflict Through stories of the difficulties and rewards of interdisciplinary collaborations readers will discover how Axelrod's academic and practical work have enriched each other and demonstrated that opportunities for cooperation are much greater than generally thought *Handbook of Research on Agent-Based Societies: Social and Cultural Interactions* Trajkovski, Goran, Collins, Samuel G., 2009-02-28 This volume addresses a variety of issues in particular the emergence of societal phenomena in the interactions of systems of agents software robot or human Provided by publisher **Agent-Based Computational Sociology** Flaminio Squazzoni, 2012-04-23 Most of the intriguing social phenomena of our time such as international terrorism social inequality and urban ethnic segregation are

consequences of complex forms of agent interaction that are difficult to observe methodically and experimentally This book looks at a new research stream that makes use of advanced computer simulation modelling techniques to spotlight agent interaction that allows us to explain the emergence of social patterns It presents a method to pursue analytical sociology investigations that look at relevant social mechanisms in various empirical situations such as markets urban cities and organisations This book Provides a comprehensive introduction to epistemological theoretical and methodological features of agent based modelling in sociology through various discussions and examples Presents the pros and cons of using agent based models in sociology Explores agent based models in combining quantitative and qualitative aspects and micro and macro levels of analysis Looks at how to pose an agent based research question identifying the model building blocks and how to validate simulation results Features examples of agent based models that look at crucial sociology issues Supported by an accompanying website featuring data sets and code for the models included in the book Agent Based Computational Sociology is written in a common sociological language and features examples of models that look at all the traditional explanatory challenges of sociology Researchers and graduate students involved in the field of agent based modelling and computer simulation in areas such as social sciences cognitive sciences and computer sciences will benefit from this book

Generative Social Science Joshua M. Epstein, 2012-01-02 Agent based computational modeling is changing the face of social science In Generative Social Science Joshua Epstein argues that this powerful novel technique permits the social sciences to meet a fundamentally new standard of explanation in which one grows the phenomenon of interest in an artificial society of interacting agents heterogeneous boundedly rational actors represented as mathematical or software objects After elaborating this notion of generative explanation in a pair of overarching foundational chapters Epstein illustrates it with examples chosen from such far flung fields as archaeology civil conflict the evolution of norms epidemiology retirement economics spatial games and organizational adaptation In elegant chapter preludes he explains how these widely diverse modeling studies support his sweeping case for generative explanation This book represents a powerful consolidation of Epstein's interdisciplinary research activities in the decade since the publication of his and Robert Axtell's landmark volume *Growing Artificial Societies* Beautifully illustrated Generative Social Science includes a CD that contains animated movies of core model runs and programs allowing users to easily change assumptions and explore models making it an invaluable text for courses in modeling at all levels

Agent-Based Approaches in Economic and Social Complex Systems V Takao Terano, Hajime Kita, Shingo Takahashi, Hiroshi Deguchi, 2009-04-14 Agent based modeling simulation is an emergent approach to the analysis of social and economic systems It provides a bottom up experimental method to be applied to social sciences such as economics management sociology and politics as well as some engineering fields dealing with social activities This book includes selected papers presented at the Fifth International Workshop on Agent Based Approaches in Economic and Social Complex Systems held in Tokyo in 2007 It contains two invited papers given as the plenary and invited

talks in the workshop and 21 papers presented in the six regular sessions Organization and Management Fundamentals of Agent Based and Evolutionary Approaches Production Services and Urban Systems Agent Based Approaches to Social Systems and Market and Economics I and II The research presented here shows the state of the art in this rapidly growing field

Modelling Transitions Enayat A. Moallemi, Fjalar J. de Haan, 2019-11-28 Modelling Transitions shows what computational formal and data driven approaches can and could mean for sustainability transitions research presenting the state of the art and exploring what lies beyond Featuring contributions from many well known authors this book presents the various benefits of modelling for transitions research More than just taking stock it also critically examines what modelling of transformative change means and could mean for transitions research and for other disciplines that study societal changes This includes identifying a variety of approaches currently not part of the portfolios of transitions modellers Far from only singing praise critical methodological and philosophical introspection are key aspects of this important book This book speaks to modellers and non modellers alike who value the development of robust knowledge on transitions to sustainability including colleagues in congenial fields Be they students researchers or practitioners everyone interested in transitions should find this book relevant as reference resource and guide

Neurotechnology in National Security and Defense James Giordano, 2014-09-25 Neurotechnology in National Security and Defense Practical Considerations Neuroethical Concerns is the second volume in the Advances in Neurotechnology series It specifically addresses the neuroethical legal and social issues arising from the use of neurotechnology in national security and defense agendas and applications Of particular concern

Agent-based Modeling and Simulation S. Taylor, 2014-08-27 Operational Research OR deals with the use of advanced analytical methods to support better decision making It is multidisciplinary with strong links to management science decision science computer science and many application areas such as engineering manufacturing commerce and healthcare In the study of emergent behaviour in complex adaptive systems Agent based Modelling Simulation ABMS is being used in many different domains such as healthcare energy evacuation commerce manufacturing and defense This collection of articles presents a convenient introduction to ABMS with papers ranging from contemporary views to representative case studies The OR Essentials series presents a unique cross section of high quality research work fundamental to understanding contemporary issues and research across a range of Operational Research OR topics It brings together some of the best research papers from the esteemed Operational Research Society and its associated journals also published by Palgrave Macmillan

Guide to Simulation-Based Disciplines Saurabh Mittal, Umut Durak, Tuncer Ören, 2017-07-26 This invaluable text reference reviews the state of the art in simulation based approaches across a wide range of different disciplines and provides evidence of using simulation based approaches to advance these disciplines Highlighting the benefits that simulation can bring to any field the volume presents case studies by the leading experts from such diverse domains as the life sciences engineering architecture arts and social sciences Topics and features includes

review questions at the end of every chapter provides a broad overview of the evolution of the concept of simulation stressing its importance across numerous sectors and disciplines addresses the role of simulation in engineering design and emphasizes the benefits of integrating simulation into the systems engineering paradigm explains the relation of simulation with Cyber Physical Systems and the Internet of Things and describes a simulation infrastructure for complex adaptive systems investigates how simulation is used in the Software Design Life Cycle to assess complex solutions and examines the use of simulation in architectural design reviews the function and purpose of simulation within the context of the scientific method and its contribution to healthcare and health education training discusses the position of simulation in research in the social sciences and describes the simulation of service systems for simulation based enterprise management describes the role of simulation in learning and education as well as in military training With its near exhaustive coverage of disciplines this comprehensive collection is essential reading for all researchers practitioners and students seeking insights into the use of various modeling paradigms and the need for robust simulation infrastructure to advance their field into a computational future

Advances in Computational Social Science Shu-Heng Chen, Takao Terano, Ryuichi Yamamoto, Chung-Ching Tai, 2014-05-22 This volume is a post conference publication of the 4th World Congress on Social Simulation WCSS with contents selected from among the 80 papers originally presented at the conference WCSS is a biennial event jointly organized by three scientific communities in computational social science namely the Pacific Asian Association for Agent Based Approach in Social Systems Sciences PAAA the European Social Simulation Association ESSA and the Computational Social Science Society of the Americas CSSSA It is therefore currently the most prominent conference in the area of agent based social simulation The papers selected for this volume give a holistic view of the current development of social simulation indicating the directions for future research and creating an important archival document and milestone in the history of computational social science Specifically the papers included here cover substantial progress in artificial financial markets macroeconomic forecasting supply chain management bank networks social networks urban planning social norms and group formation cross cultural studies political party competition voting behavior computational demography computational anthropology evolution of languages public health and epidemics AIDS security and terrorism methodological and epistemological issues empirical based agent based modeling modeling of experimental social science gaming simulation cognitive agents and participatory simulation Furthermore pioneering studies in some new research areas such as the theoretical foundations of social simulation and categorical social science also are included in the volume

Agent-Based Modeling Meets Gaming Simulation K. Arai, H. Deguchi, H. Matsui, 2006-10-10 This collection of excellent papers cultivates a new perspective on agent based social system sciences gaming simulation and their hybridization Most of the papers included here were presented in the special session titled Agent Based Modeling Meets Gaming Simulation at ISAGA2003 the 34th annual conference of the International Simulation and Gaming Association ISAGA at Kazusa Akademia

Park in Kisarazu Chiba Japan August 25 29 2003 This post proceedings was supported by the twenty first century COE Centers of Excellence program Creation of Agent Based Social Systems Sciences ABSSS established at the Tokyo Institute of Technology in 2004 The present volume comprises papers submitted to the special session of ISAGA2003 and provides a good example of the diverse scope and standard of research achieved in simulation and gaming today The theme of the special session at ISAGA2003 was Agent Based Modeling Meets Gaming Simulation Nowadays agent based simulation is becoming very popular for modeling and solving complex social phenomena It is also used to arrive at practical solutions to social problems At the same time however the validity of simulation does not exist in the magnitude of the model R Axelrod stresses the simplicity of the agent based simulation model through the Keep it simple stupid KISS principle As an ideal simple modeling is essential An Interpretive Account to Agent-based Social Simulation Martin Neumann, 2023-09-11

Using the investigation of criminal culture as an example application this edited volume presents a novel approach to agent based simulation interpretive agent based social simulation as a methodological and transdisciplinary approach to examining the potential of qualitative data and methods for agent based modelling ABM Featuring updated articles as well as original chapters which provide a cohesive and novel approach to the digital humanities the book challenges the common conviction that hermeneutics and simulation are two mutually exclusive ways to understand and explain human behaviour and social change Exploring how methodology benefits from taking cultural complexities into account and bringing these methods together in an innovative combination of qualitative hermeneutic and digital techniques the book unites experts in the field to connect ABM to narrative theories thereby providing a novel tool for cultural studies An innovative methodological contribution to narrative theory this volume will be of primary benefit to researchers scholars and academics in the fields of ABM hermeneutics and criminology The book will also appeal to those working in policing security and forensic consultation

Models for Research and Understanding Stanislaw Raczynski, 2023-01-01 This introductory textbook reference addresses the fundamental and mostly applied kinds of models The focus is on models of dynamic systems that move and change over time However the work also proposes new methods of uncertainty treatment offering supporting examples Topics and features Chapters suitable for textbook use in teaching modeling and simulation Includes sections of questions and answers helpful in didactic work Proposes new methodology in addition to examining conventional approaches Offers some cognitive more abstract models to give a wider insight on model building The book's readership may consist of researchers working on multidisciplinary problems as well educators and students It may be used while teaching computer simulation applied mathematics system analysis and system dynamics **Artificial War: Multiagent-based Simulation Of Combat** Andrew Ilachinski, 2004-06-14

Military conflicts particularly land combat possess the characteristics of complex adaptive systems combat forces are composed of a large number of nonlinearly interacting parts and are organized in a dynamic command and control network local action which often appears disordered self organizes into long range order military conflicts by their

nature proceed far from equilibrium military forces adapt to a changing combat environment and there is no master voice that dictates the actions of every soldier i e battlefield action is decentralized Nonetheless most modern state of the art military simulations ignore the self organizing properties of combat This book summarizes the results of a multiyear research effort aimed at exploring the applicability of complex adaptive systems theory to the study of warfare and introduces a sophisticated multiagent based simulation of combat called EINSTEIN EINSTEIN whose bottom up generative approach to modeling combat stands in stark contrast to the top down or reductionist philosophy that still underlies most conventional military models is designed to illustrate how many aspects of land combat may be understood as self organized emergent phenomena Used worldwide by the military operations research community EINSTEIN has pioneered the simulation of combat on a small to medium scale by using autonomous agents to model individual behaviors and personalities rather than hardware

Intersections between Corporate and Antitrust Law Marco Corradi, Julian Nowag, 2023-06-08 Examines the intersections between corporate and antitrust law focusing on corporate interest governance and the financial links among companies

Agent-Based Approaches in Economic and Social Complex Systems VIII Yutaka Nakai, Yuhsuke Koyama, Takao Terano, 2015-06-05 Agent based modeling simulation is an emergent approach to the analysis of social and economic systems It provides a bottom up experimental method to be applied to social sciences such as economics management sociology and politics as well as some engineering fields dealing with social activities This book includes selected papers presented at the Eighth International Workshop on Agent Based Approaches in Economic and Social Complex Systems held in Tokyo Japan in 2013 At the workshop 23 reviewed full papers were presented and of those 13 were selected to be included in this volume

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