AMPM 2021
First Workshop in Agent-based Modeling & Policy-Making,
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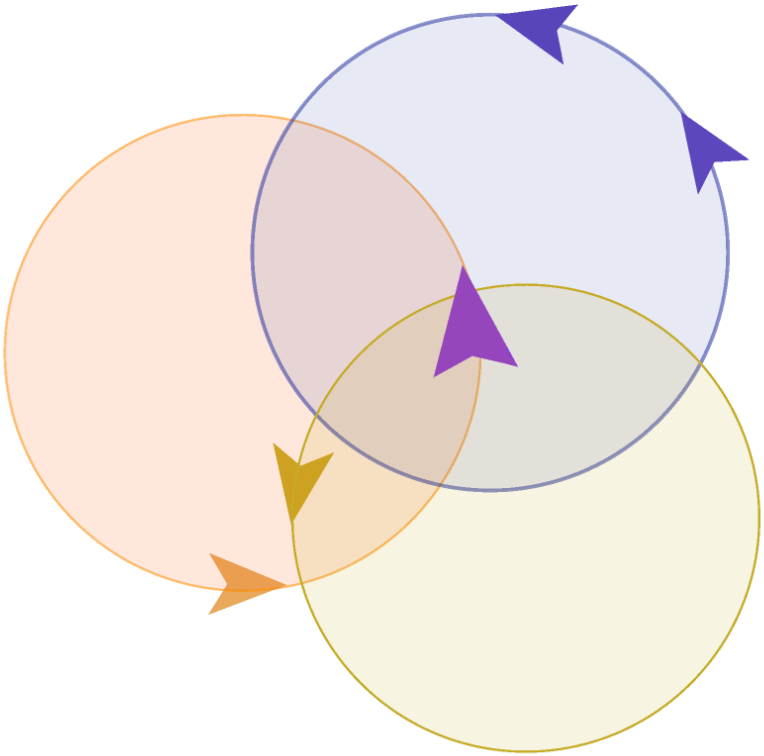

Exploring the **boundaries** between **law**, **ABM** and **policy-making**

On the clash between formal and informal norms

8th December 2021

Margherita Vestoso
Ilaria Cecere
University of Sannio, Benevento

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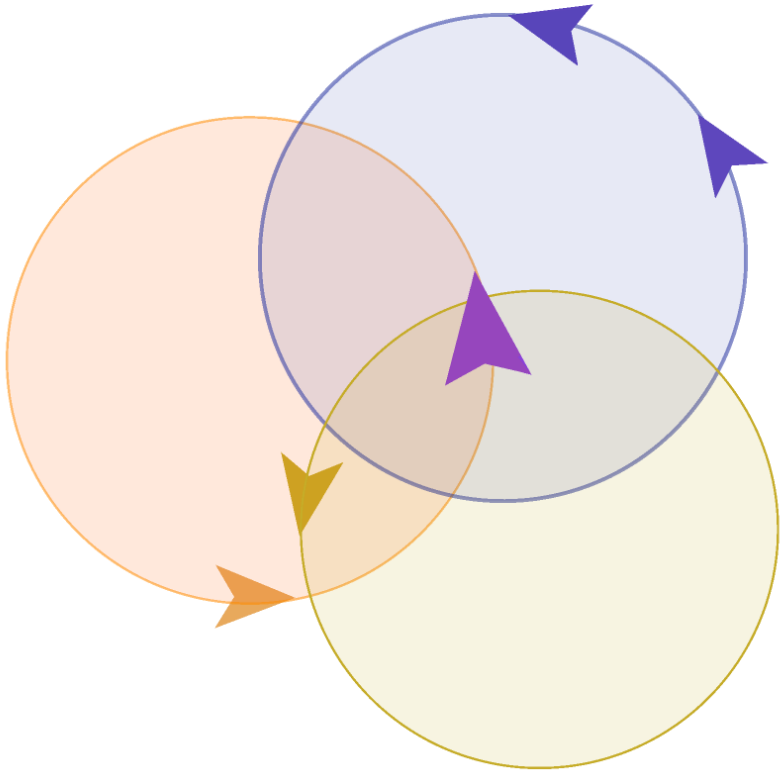

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1. About the presentation

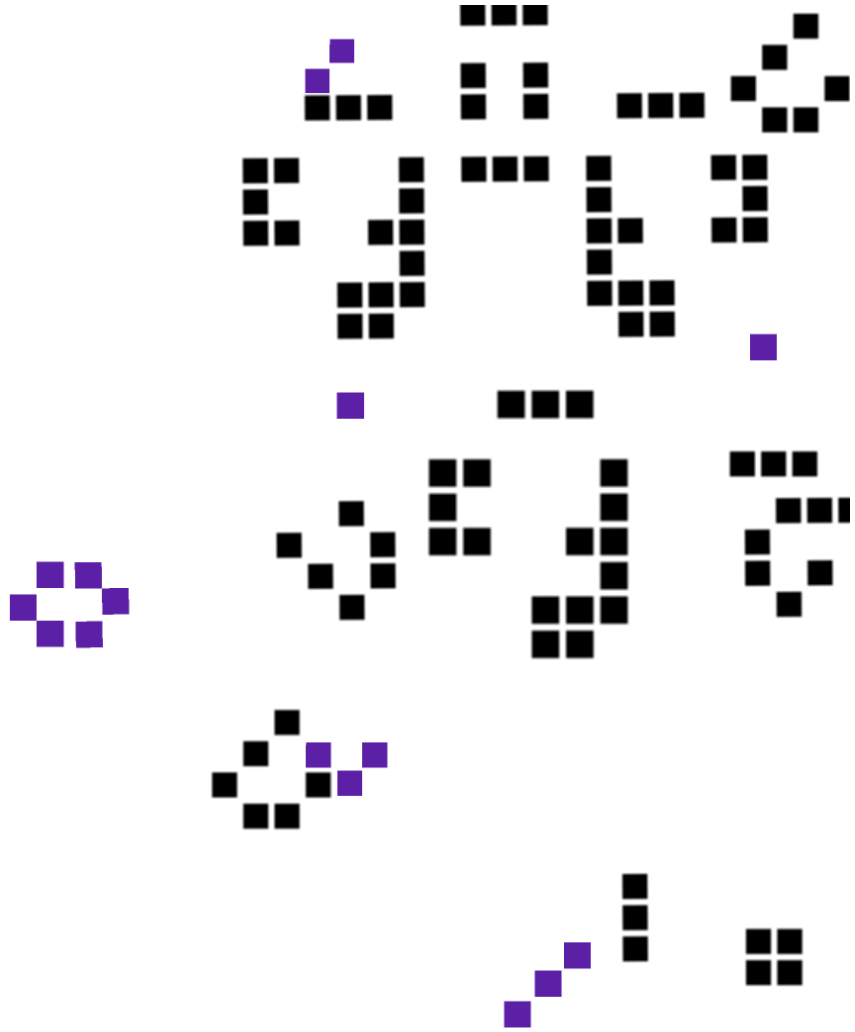
2. Law, policy-making & ABM

3. ABM in legal field: insights from an empirical view

4. Focus: formal vs. informal norms

5. Fiddling with norms conflict simulation

6. Final remarks



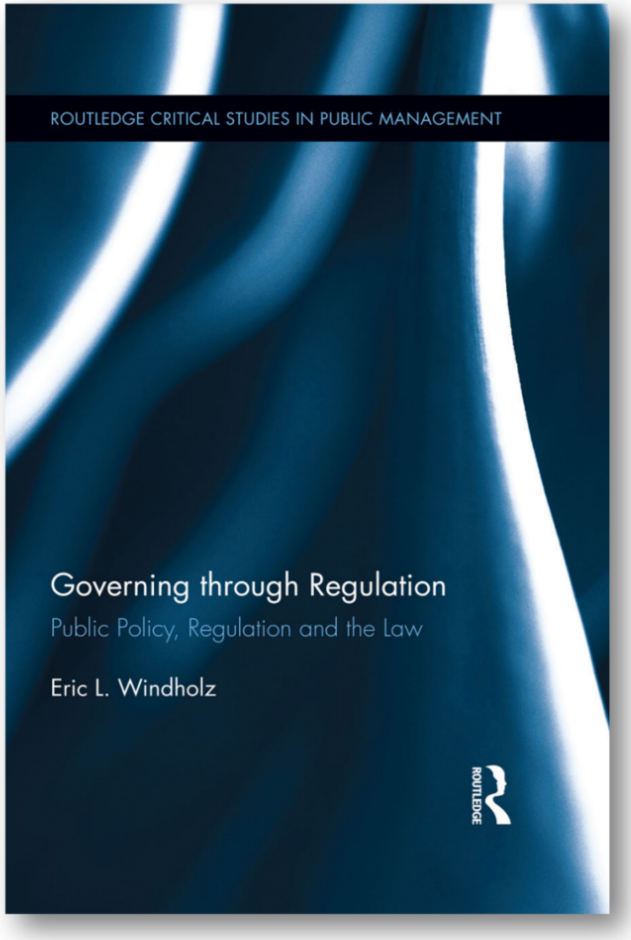
1. About the presentation

We dwell on the **potential intersections** between **ABM** and **policy-making** from a **legal perspective**, drawing inspiration from a new research view suggesting a sort of computationally-enhanced legal empiricism.

In particular, we draw attention to **the clash between formal and informal norms**, a topic lying at this border area we will discuss based on results of a recent agent-based research experience.

2. Law, policy-making & ABM

A first intersection...



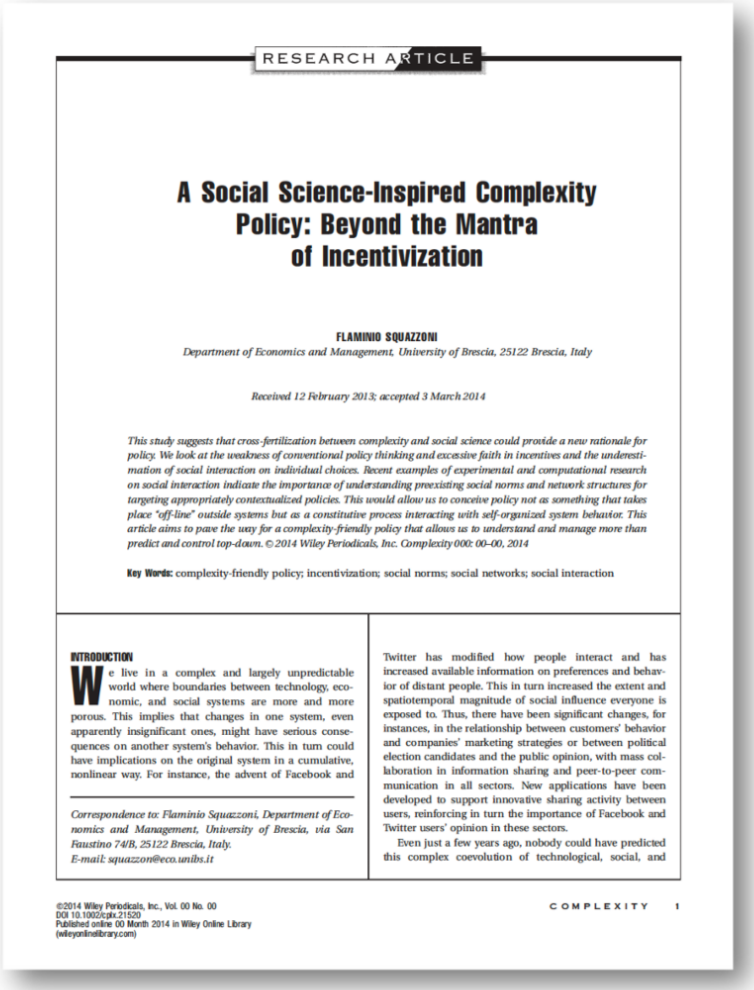
The **law** provides the **vehicles** through which **governments** undertake their **core functions** of **provision, (re)distribution** and **regulation**.

"[...] the law prescribes and proscribes desired standards of behaviour; establishes institutions to undertake regulatory activities; creates and shapes the regulatory tools those institutions use; furnishes the infrastructure for enforcement and dispute resolution; and establishes mechanisms through which regulatory institutions and actors are held accountable for the decisions they make and the activities they undertake"

Windholz, E. L. (2017). Governing through regulation: public policy, regulation and the law. Routledge.

There is a **overlap** between illuminating *dynamics* behind legal norms and improving policy effectiveness

Behind unsuccessful policies, there are often laws or other legal implementation tools designed without **any knowledge** of mental models, beliefs, societal norms and other contextual factors that influence people behaviours.



RESEARCH ARTICLE

A Social Science-Inspired Complexity Policy: Beyond the Mantra of Incentivization

FLAMINIO SQUAZZONI
Department of Economics and Management, University of Brescia, 25122 Brescia, Italy

Received 12 February 2013; accepted 3 March 2014

This study suggests that cross-fertilization between complexity and social science could provide a new rationale for policy. We look at the weakness of conventional policy thinking and excessive faith in incentives and the underestimation of social interaction on individual choices. Recent examples of experimental and computational research on social interaction indicate the importance of understanding preexisting social norms and network structures for targeting appropriately contextualized policies. This would allow us to conceive policy not as something that takes place "off-line" outside systems but as a constitutive process interacting with self-organized system behavior. This article aims to pave the way for a complexity-friendly policy that allows us to understand and manage more than predict and control top-down. © 2014 Wiley Periodicals, Inc. Complexity 000: 00–00, 2014

Key Words: complexity-friendly policy; incentivization; social norms; social networks; social interaction

INTRODUCTION

We live in a complex and largely unpredictable world where boundaries between technology, economic, and social systems are more and more porous. This implies that changes in one system, even apparently insignificant ones, might have serious consequences on another system's behavior. This in turn could have implications on the original system in a cumulative, nonlinear way. For instance, the advent of Facebook and Twitter has modified how people interact and has increased available information on preferences and behavior of distant people. This in turn increased the extent and spatiotemporal magnitude of social influence everyone is exposed to. Thus, there have been significant changes, for instances, in the relationship between customers' behavior and companies' marketing strategies or between political election candidates and the public opinion, with mass collaboration in information sharing and peer-to-peer communication in all sectors. New applications have been developed to support innovative sharing activity between users, reinforcing in turn the importance of Facebook and Twitter users' opinion in these sectors.

Even just a few years ago, nobody could have predicted this complex coevolution of technological, social, and

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"[...]it must be recognized that the principal cause of policy failure is not the size of the state or the magnitude of the action or resources involved, [...] The real cause lies in the **intellectual framework** in which a policy is conceived. This also includes the **theory** and **methodology** used for policy design and implementation"

Squazzoni, F. (2014).
A social scienceinspired complexity policy: Beyond the mantra of incentivization.
Complexity.

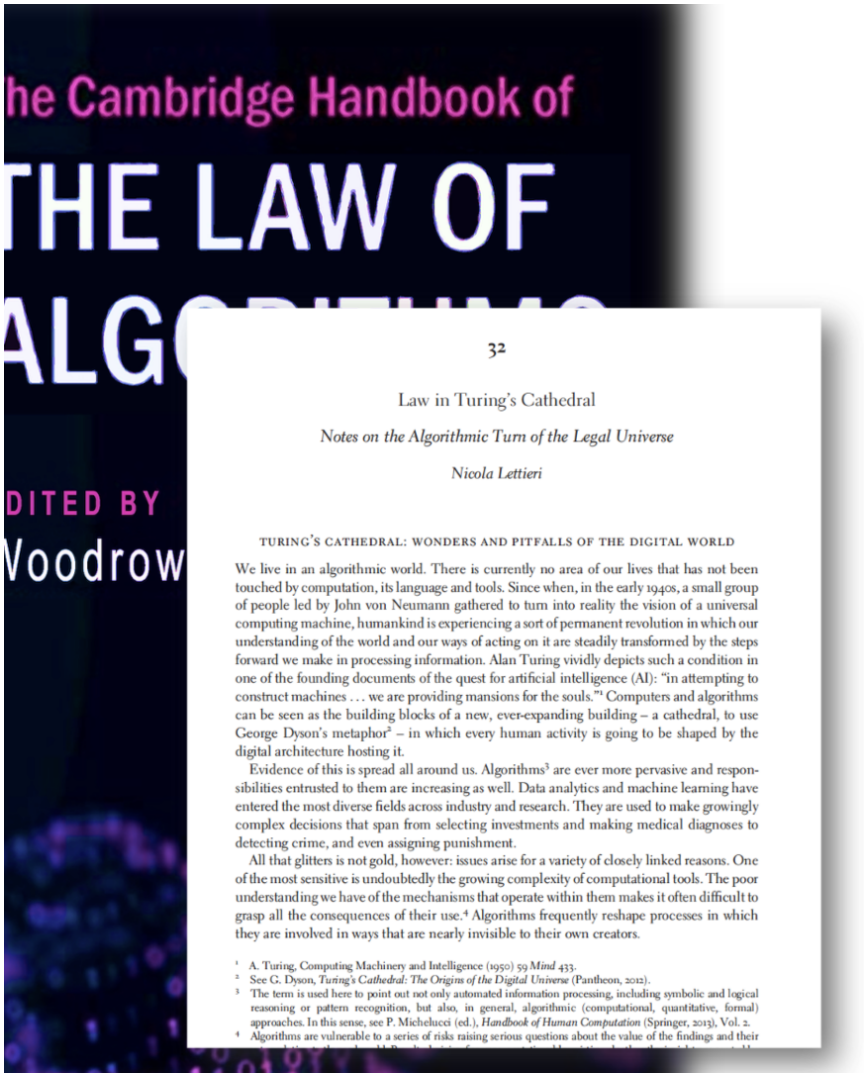
Exploring
epistemological and **methodological** issues
emerging at this border area is
a **worthy effort** also for legal scholars

3. ABM in legal field: insights from an empirical view

In the legal field,

the use of social simulation is **a relatively unexplored frontier...**

A new empirical and computational legal research view...



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Law in Turing's Cathedral

Notes on the Algorithmic Turn of the Legal Universe

Nicola Lettieri

TURING'S CATHEDRAL: WONDERS AND PITFALLS OF THE DIGITAL WORLD

We live in an algorithmic world. There is currently no area of our lives that has not been touched by computation, its language and tools. Since when, in the early 1940s, a small group of people led by John von Neumann gathered to turn into reality the vision of a universal computing machine, humankind is experiencing a sort of permanent revolution in which our understanding of the world and our ways of acting on it are steadily transformed by the steps forward we make in processing information. Alan Turing vividly depicts such a condition in one of the founding documents of the quest for artificial intelligence (AI): "in attempting to construct machines … we are providing mansions for the souls."[1] Computers and algorithms can be seen as the building blocks of a new, ever-expanding building – a cathedral, to use George Dyson's metaphor[2] – in which every human activity is going to be shaped by the digital architecture hosting it.

Evidence of this is spread all around us. Algorithms[3] are ever more pervasive and responsibilities entrusted to them are increasing as well. Data analytics and machine learning have entered the most diverse fields across industry and research. They are used to make growingly complex decisions that span from selecting investments and making medical diagnoses to detecting crime, and even assigning punishment.

All that glitters is not gold, however: issues arise for a variety of closely linked reasons. One of the most sensitive is undoubtedly the growing complexity of computational tools. The poor understanding we have of the mechanisms that operate within them makes it often difficult to grasp all the consequences of their use.[4] Algorithms frequently reshape processes in which they are involved in ways that are nearly invisible to their own creators.

[1] A. Turing, Computing Machinery and Intelligence (1950) 59 *Mind* 433.
[2] See G. Dyson, *Turing's Cathedral: The Origins of the Digital Universe* (Pantheon, 2012).
[3] The term is used here to point out not only automated information processing, including symbolic and logical reasoning or pattern recognition, but also, in general, algorithmic (computational, quantitative, formal) approaches. In this sense, see P. Michelucci (ed.), *Handbook of Human Computation* (Springer, 2013), Vol. 2.
[4] Algorithms are vulnerable to a series of risks raising serious questions about the value of the findings and their

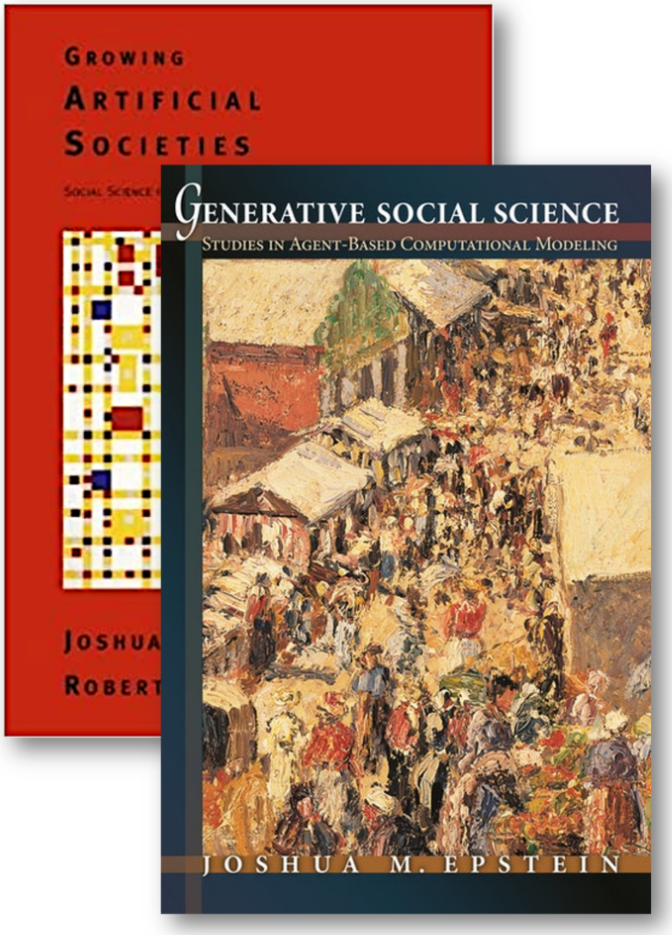
"Algorithms and heuristics currently available could open up the gates to what we define as "**computation-enhanced legal empiricism**", a vision of legal empiricism exploiting computation [...] also to **investigate other aspects of the legal phenomenon,** like the intricate networks of cognitive and social **mechanisms through which law emerges, is applied, and exerts its effects.**"

Lettieri, N. (2020).
Law in the turing's cathedral: Notes on
the algorithmic turn of the legal universe.
The Cambridge Handbook of the Law of Algorithms.

In this view, computational social sciences methods are seen as an **enabling factor** for an evolution in empirical sense of **the way legal phenomena are conceptualized** and studied.

ABM, in particular, is conceived as a potential ally to better understand the **factual underpinnings** of **phenomena heavily affecting** the evolution of the legal universe and, thus, **policy and rulemaking**

Lettieri, N. (2013).
Ius in silico. *Diritto, computazione, simulazione.*
Edizioni scientifiche italiane.



ABM paved the way to a fundamentally new standard of explanation in social science, allowing researchers to **"grow"** the phenomenon of interest in an artificial society of interacting agents.

By this way, they are able to observe how the macro-level structure of the phenomenon emerges from micro-interactions among individuals and between them and the environment.

Epstein, J. M. (2012).
Generative social science.
Princeton University Press.

The list of phenomena relevant for policy and rulemaking that can be explored this way is long...

Agent-Based Simulation of Collective Cooperation: From Experiment to Model*

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(Dated: October 8, 2020)

Electronic Government and Electronic Participation
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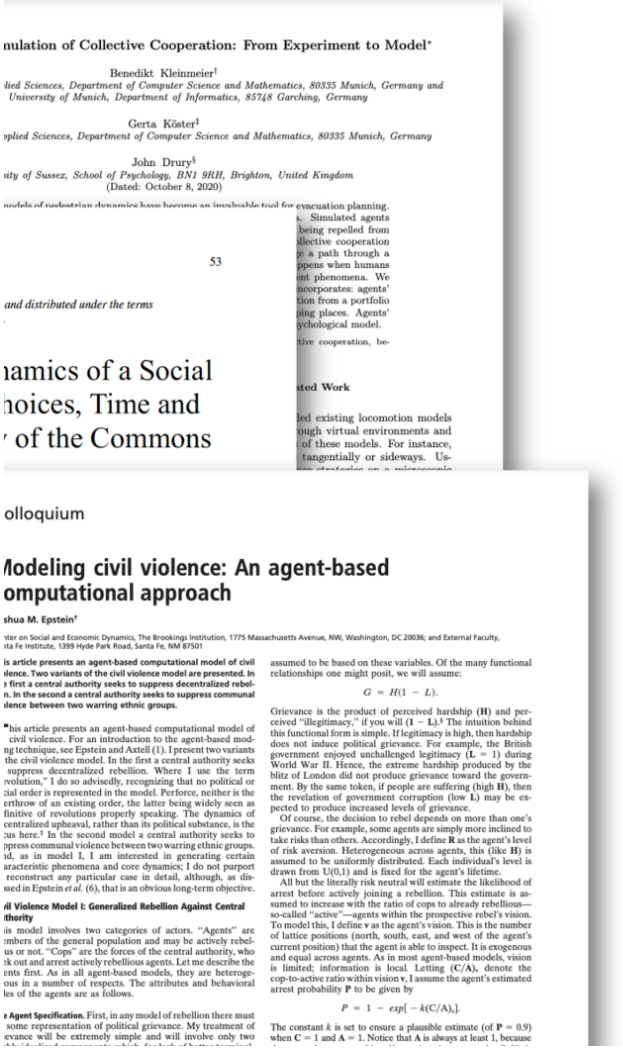
Simulating the Core Dynamics of a Social Dilemma. Individual Choices, Time and Sanctions in the Tragedy of the Commons

Colloquium

Modeling civil violence: An agent-based computational approach

Joshua M. Epstein*

Center on Social and Economic Dynamics, The Brookings Institution, 1775 Massachusetts Avenue, NW, Washington, DC 20036; and External Faculty, Santa Fe Institute, 1399 Hyde Park Road, Santa Fe, NM 87501



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models of pedestrian dynamics have become an invaluable tool for evacuation planning.

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olloquium

Modeling civil violence: An agent-based
omputational approach

shua M. Epstein†

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is article presents an agent-based computational model of civil lence. Two variants of the civil violence model are presented. In first a central authority seeks to suppress decentralized rebel- n. In the second a central authority seeks to suppress communal lence between two warring ethnic groups.

his article presents an agent-based computational model of civil violence. For an introduction to the agent-based mod- ng technique, see Epstein and Axtell (1). I present two variants the civil violence model. In the first a central authority seeks suppress decentralized rebellion. Where I use the term volution," I do so advisedly, recognizing that no political or ial order is represented in the model. Perforce, neither is the erthrow of an existing order, the latter being widely seen as finitive of revolutions properly speaking. The dynamics of centralized upheaval, rather than its political substance, is the us here.‡ In the second model a central authority seeks to ppress communal violence between two warring ethnic groups. d, as in model I, I am interested in generating certain aracteristic phenomena and core dynamics; I do not purport reconstruct any particular case in detail, although, as dis- ssed in Epstein *et al.* (6), that is an obvious long-term objective.

il Violence Model I: Generalized Rebellion Against Central thority

is model involves two categories of actors. "Agents" are mbers of the general population and may be actively rebel- us or not. "Cops" are the forces of the central authority, who k out and arrest actively rebellious agents. Let me describe the nts first. As in all agent-based models, they are heteroge- ous in a number of respects. The attributes and behavioral les of the agents are as follows.

Agent Specification. First, in any model of rebellion there must some representation of political grievance. My treatment of evance will be extremely simple and will involve only two

assumed to be based on these variables. Of the many functional relationships one might posit, we will assume:

$$G = H(1 - L).$$

Grievance is the product of perceived hardship (**H**) and perceived "illegitimacy," if you will (**1 − L**).§ The intuition behind this functional form is simple. If legitimacy is high, then hardship does not induce political grievance. For example, the British government enjoyed unchallenged legitimacy (**L** = 1) during World War II. Hence, the extreme hardship produced by the blitz of London did not produce grievance toward the government. By the same token, if people are suffering (high **H**), then the revelation of government corruption (low **L**) may be expected to produce increased levels of grievance.

Of course, the decision to rebel depends on more than one's grievance. For example, some agents are simply more inclined to take risks than others. Accordingly, I define **R** as the agent's level of risk aversion. Heterogeneous across agents, this (like **H**) is assumed to be uniformly distributed. Each individual's level is drawn from U(0,1) and is fixed for the agent's lifetime.

All but the literally risk neutral will estimate the likelihood of arrest before actively joining a rebellion. This estimate is assumed to increase with the ratio of cops to already rebellious—so-called "active"—agents within the prospective rebel's vision. To model this, I define **v** as the agent's vision. This is the number of lattice positions (north, south, east, and west of the agent's current position) that the agent is able to inspect. It is exogenous and equal across agents. As in most agent-based models, vision is limited; information is local. Letting (**C/A**)$_{\mathbf{v}}$ denote the cop-to-active ratio within vision **v**, I assume the agent's estimated arrest probability **P** to be given by

$$P = 1 - exp[-k(C/A)_v].$$

The constant k is set to ensure a plausible estimate (of **P** = 0.9) when **C** = 1 and **A** = 1. Notice that **A** is always at least 1, because

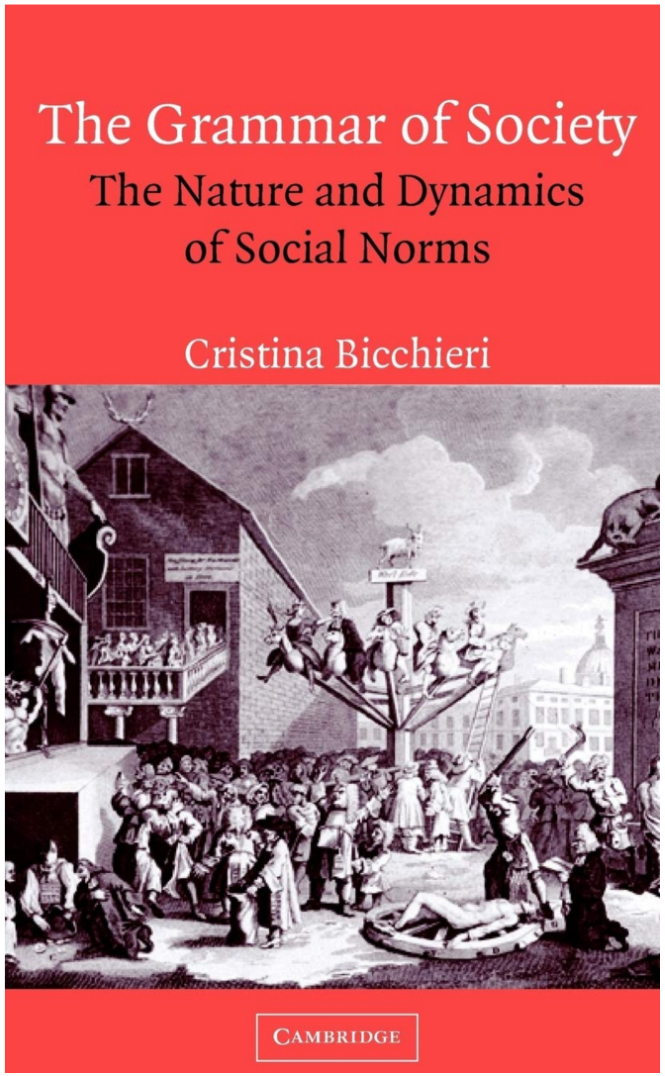
The emergence of **informal norms** and their interplay with formal ones is a meaningful example...

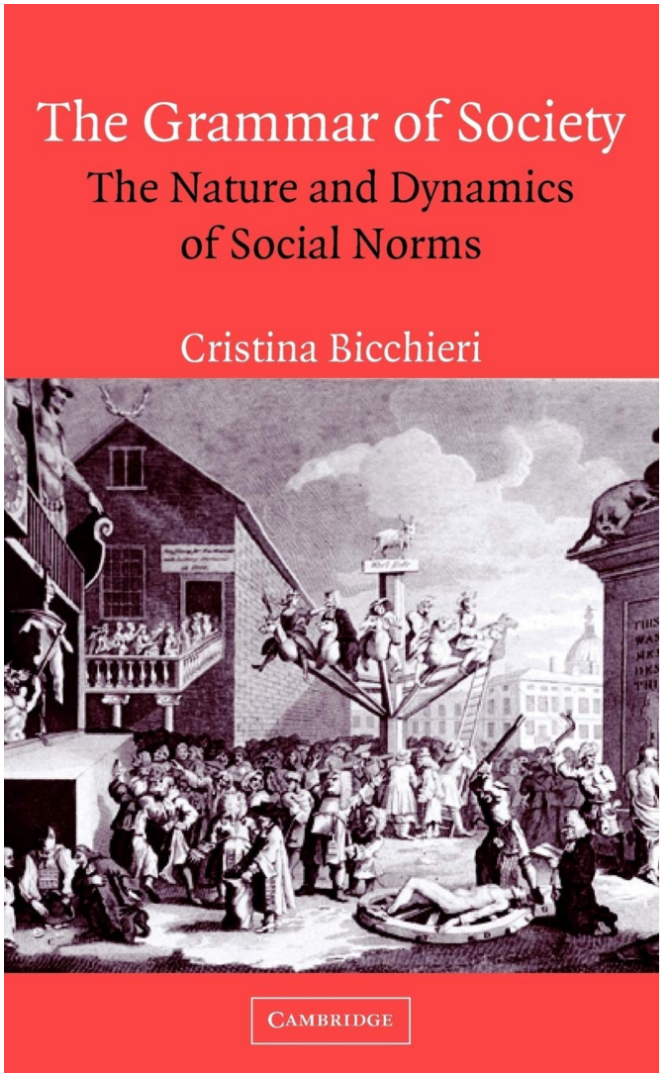
4. Focus: formal vs. informal norms

Do informal norms
affect **law** and **policy-making**?

Legal norms are not the only driver of regulation...

Collective behaviours are often affected by moral, cultural or other **informal rules** which are **not encoded in formal provisions**

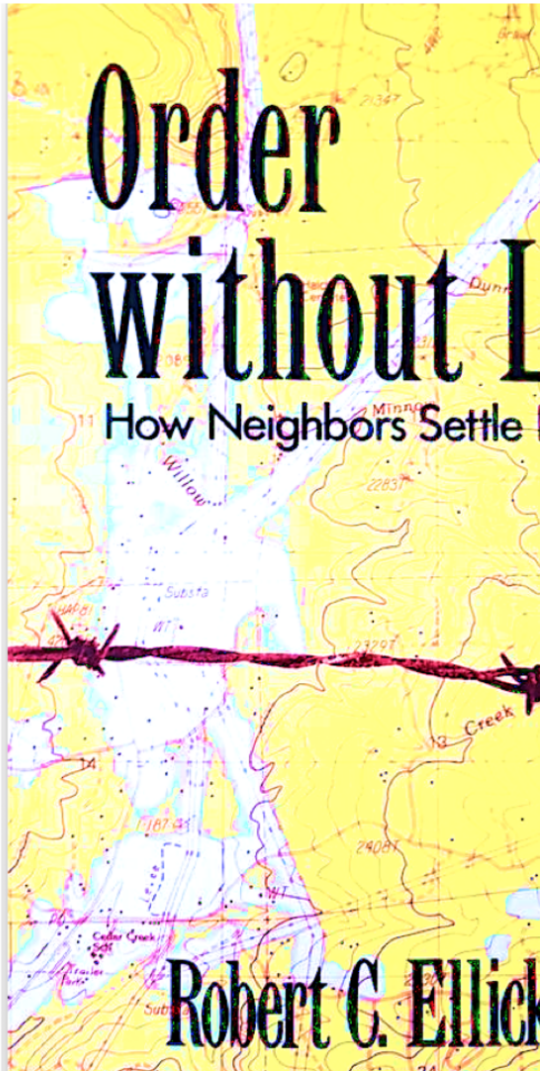


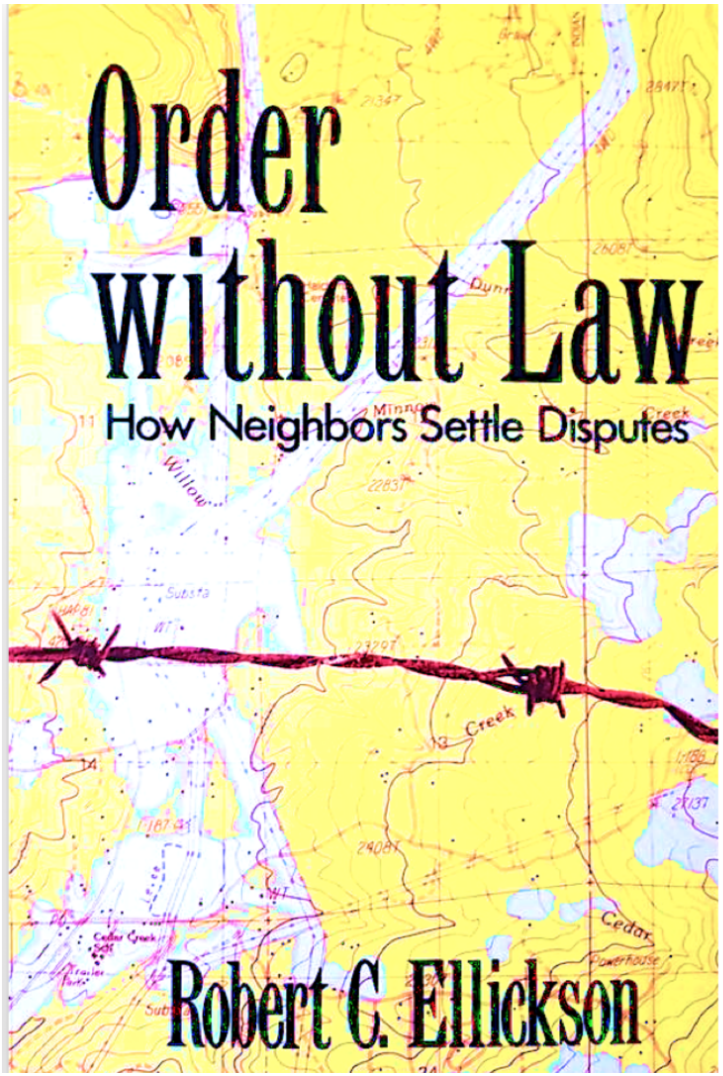


" [...] When they are enforced, the **sanctions** are **informal**, as when the violation of a group norm brings about responses that range from gossip to open censure, ostracism, or dishonor for the transgressor. Some **such norms may become part of our system of values**, and we may feel a strong obligation to obey them"

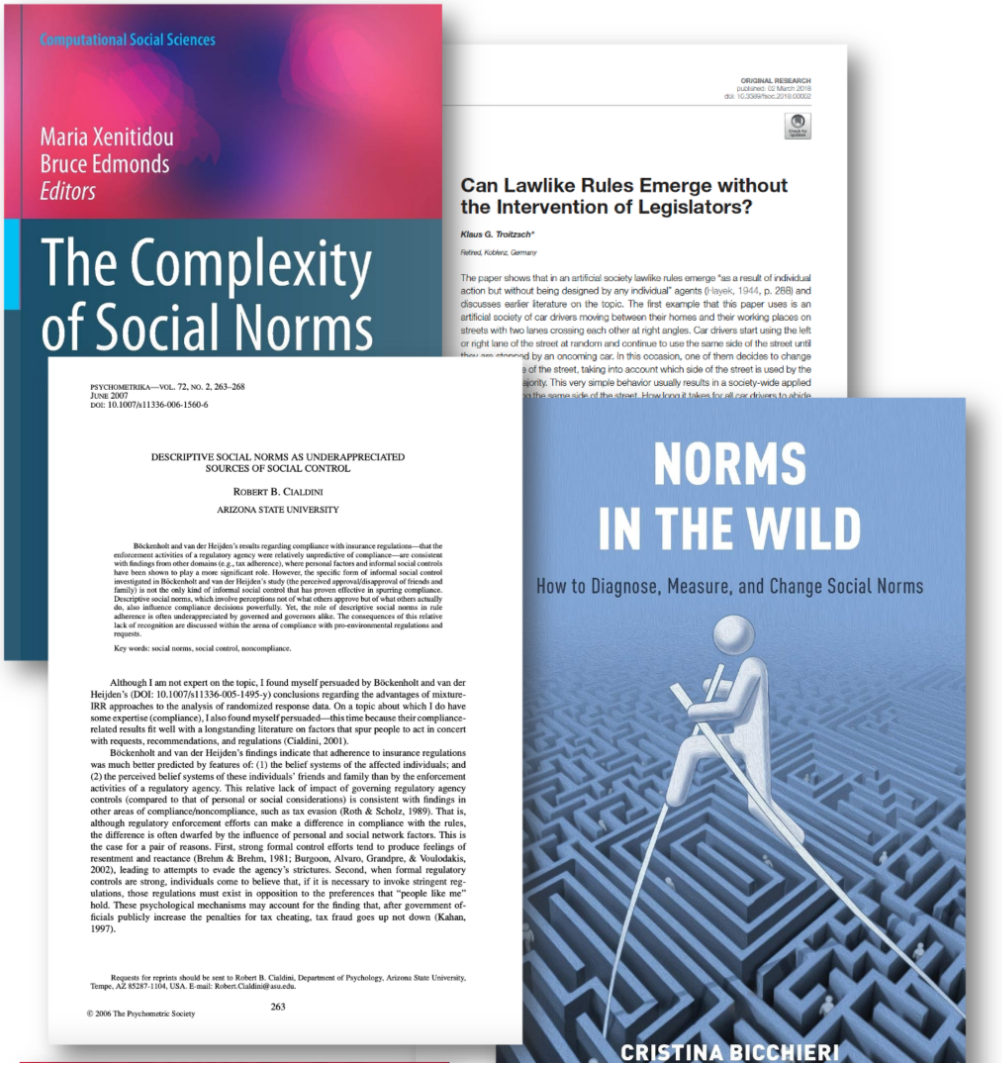
Bicchieri, Cristina, 2006.
The grammar of society: The nature and dynamics of social norms. Cambridge University Press.

An issue that can heavily
impacts policy effectiveness

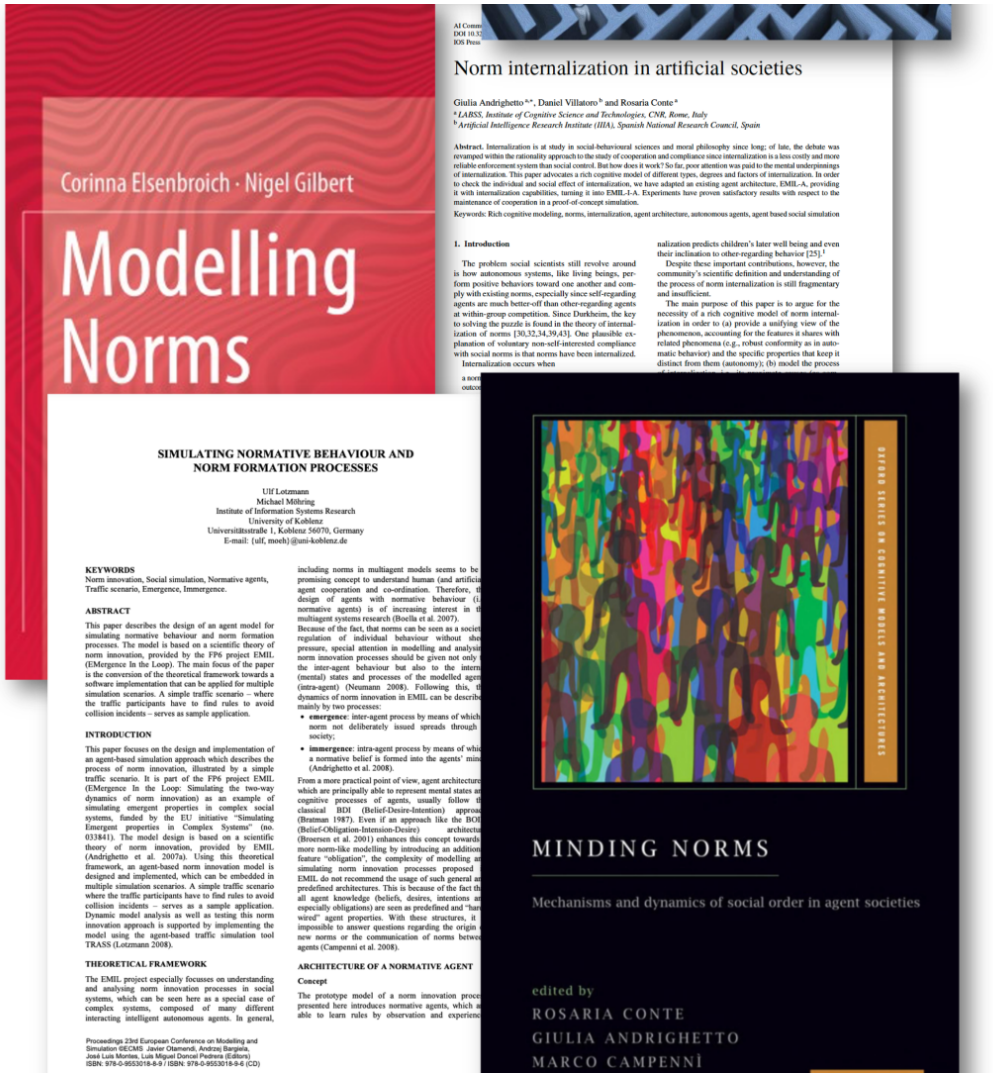




Informal rules can end up **hindering or completely excluding co-existing formal norms** that interplay with them.



A widely investigated topic in social sciences...



A new slant came from **CSS research approaches** and, in particular, **ABM** ability to enlighten the **dynamics underlying informal norms emergence** and interplay with other kinds of rules.

INSIGHTS

POLICY FORUM

COLLECTIVE ACTION

Social norms as solutio

Policies may influence large-scale behavioral t

By Karine Nyborg, John M. Anderies, Astrid Dannenberg, Therese Lin
Maja Schlüter, W. Neil Adger, Kenneth J. Arrow, Scott Barrett, Stephe
Chapin III, Anne-Sophie Crépin, Gretchen Daily, Paul Ehrlich, Carl Fo
Nils Kautsky, Simon A. Levin, Ole Jacob Madsen, Stephen Polasky, Ma
Walker, Elke U. Weber, James Wilen, Anastasios Xepapadeas, Aart de

Climate change, biodiversity loss, antibiotic resistance, and other global challenges pose major collective action problems: A group benefits from a certain action, but no individual has sufficient incentive to act alone. Formal institutions, e.g., laws and treaties, have helped address issues like ozone depletion, lead pollution, and acid rain. However, formal institutions are not always able to enforce collectively desirable outcomes. In such cases, informal institutions, such as social norms, can be important. If conditions are right, policy can support social norm changes, helping address even global problems. To judge when this is realistic, and what role policy can play, we discuss three crucial questions: Is a tipping point likely to exist, such that vicious cycles of socially damaging behavior can potentially be turned into virtuous ones? Can policy create tipping points where none exist? Can policy push the system past the tipping point?

In small groups, social norms can facilitate cooperation (1). Soluti
context (e.g., small-sc
dies in Nepal) and loc
norms can affect beha
e.g., cessation of smoki
3), abandonment of foc
and changed fertility
large-scale transforma
proval and behavior.

The concept of soci
disciplines [e.g., psych
ics (4)] and that crea
terdisciplinary commu
social norm as a predo
tern within a group,
understanding of acce
tained through social i
group (1). We focus o
patterns that are wid
are also widely percei
to do. Social feedback
reinforcing and thus st

When norms do c
can happen abruptly
veloped a thorough
ping points—and the
in crossing them—th

See supplementary materials for author affiliations. Email: karine.nyborg@econ.uio.no

42 7 OCTOBER 2016 • VOL 354 ISSUE 6308

to understanding social norm changes (6). Here, we try to integrate these views.

IS THERE A TIPPING POINT?

For vicious and virtuous behavioral cycles to arise, people must be more willing to choose a behavior the more widespread it

"...a potentially powerful role of policy is to provide reasons for people to change their expectations."

30% in a year (14). Pioneers may invent a better (nonconformist) practice or perform new behavior just to deviate from the crowd (anticonformist). If others recognize an individual benefit of this behavior (5), a local cluster of adopters may emerge. The more socially infectious this group is and the more visible and easy to copy the new behavior, the faster and more widely the behavior spreads (14). Role models are critical in this process. The tipping point occurs when sufficient positive social feedback emerges, causing the new behavior to become cool and ultimately normal.

Information on what others do can affect behavior via direct messaging; metrics, such as fuel-efficiency labels; or other feedback (5, 15). Before the tipping point is reached, however, awareness of others' nonadoption tends to work against change. For example, telling students that a majority of their peers drink more alcohol than they do may increase drinking (15). The potential impact of policy is also observed in negative examples. If not compatible with local social norms, legal and institutional measures may turn virtuous cycles into vicious ones (1).

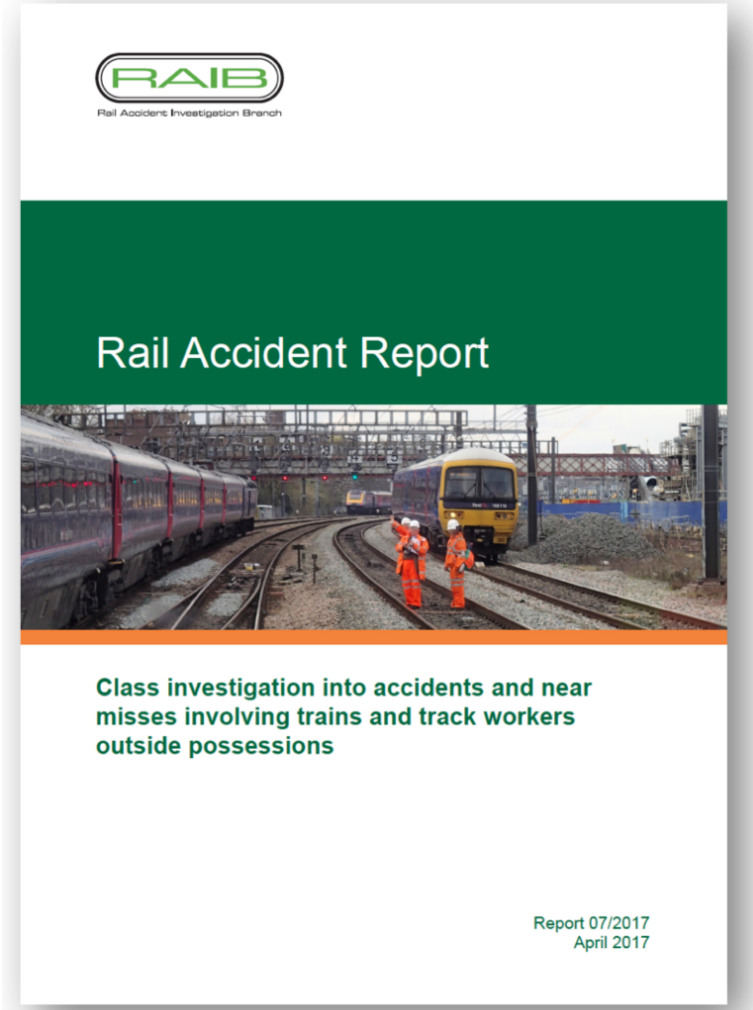
What benefits for policy and rule making?

exploring how informal rules spread, stabilize, and replace formal ones could help institutional authorities issue rules able to **neutralize**, as necessary, the impact of social norms **or**, in other cases, to **use them as an effectiveness booster.**

5. Fiddling with norms conflict simulation

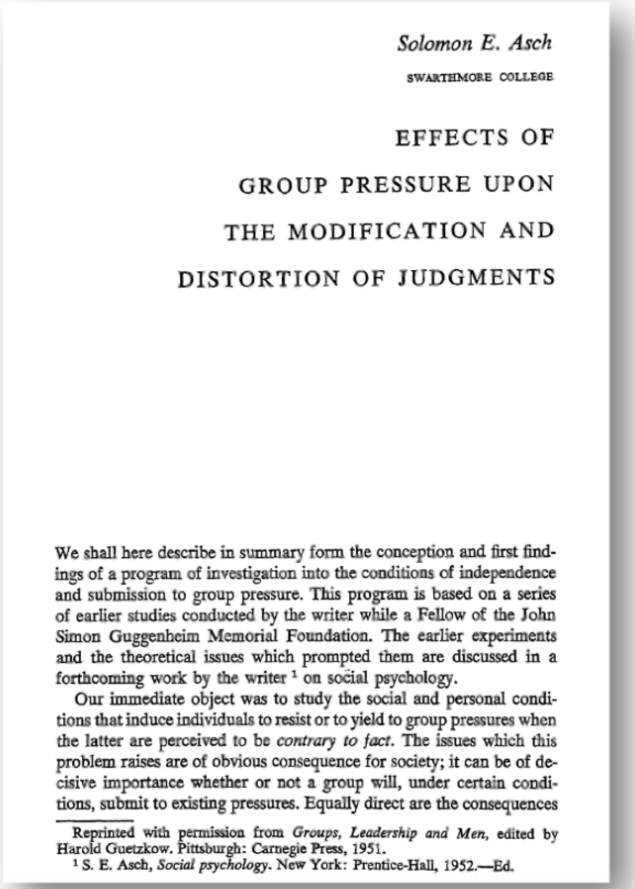
Exploring
the clash between formal and informal norms
in the **railway maintenance**

About the scenario



The *innovation of railway systems* has re-designed **maintenance interventions**, making them increasingly precise, **specialized, and standardized**. However, this has accentuated the **tendency of maintenance technicians to deviate** from operational protocols and to rely on informal unverified rules, increasing the opportunities for hazards or accidents to occur.

Our research integrates behavioural experiments and ABM to explore the phenomenon and, specifically, the role played by **conformism** with regard to maintenance informal norms spread.



Solomon E. Asch

SWARTHMORE COLLEGE

EFFECTS OF GROUP PRESSURE UPON THE MODIFICATION AND DISTORTION OF JUDGMENTS

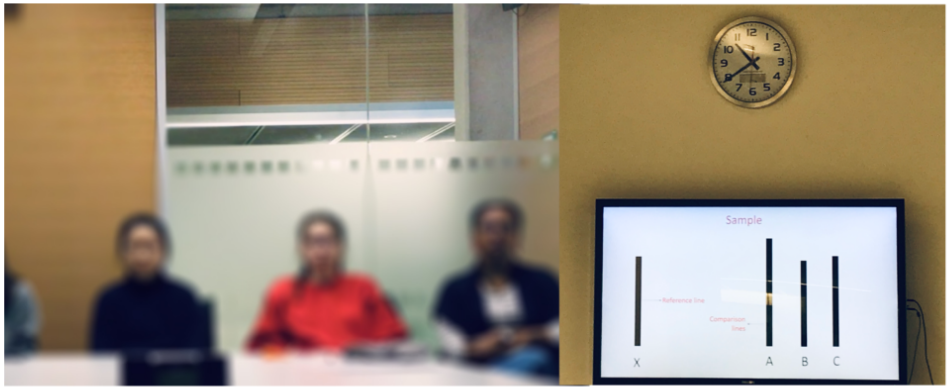
We shall here describe in summary form the conception and first findings of a program of investigation into the conditions of independence and submission to group pressure. This program is based on a series of earlier studies conducted by the writer while a Fellow of the John Simon Guggenheim Memorial Foundation. The earlier experiments and the theoretical issues which prompted them are discussed in a forthcoming work by the writer [1] on social psychology.

Our immediate object was to study the social and personal conditions that induce individuals to resist or to yield to group pressures when the latter are perceived to be *contrary to fact*. The issues which this problem raises are of obvious consequence for society; it can be of decisive importance whether or not a group will, under certain conditions, submit to existing pressures. Equally direct are the consequences

Reprinted with permission from *Groups, Leadership and Men*, edited by Harold Guetzkow. Pittsburgh: Carnegie Press, 1951.

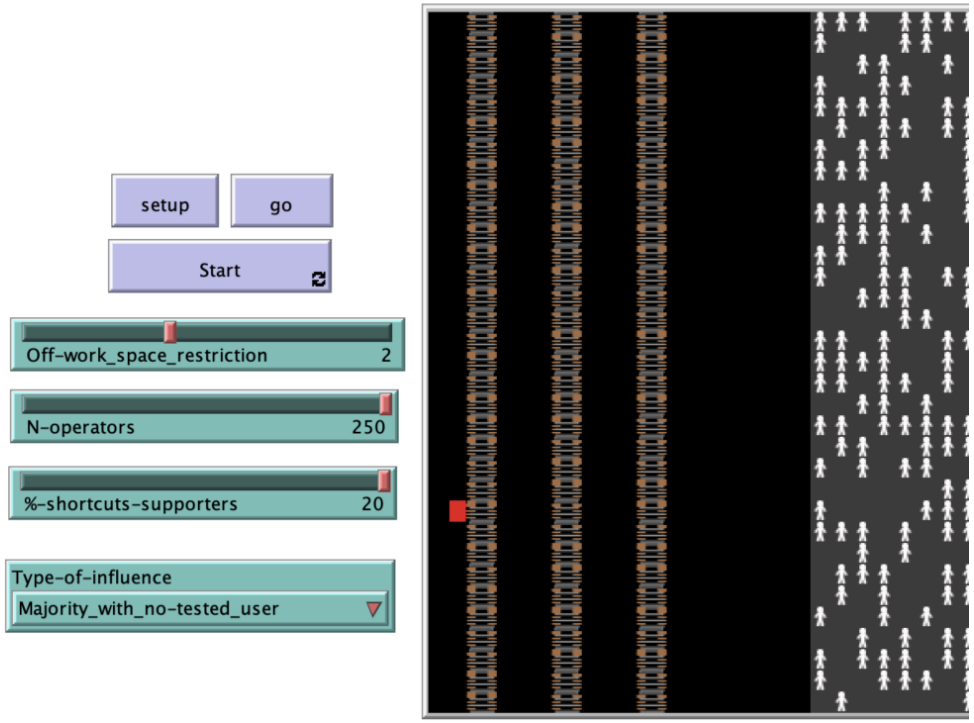
[1] S. E. Asch, *Social psychology*. New York: Prentice-Hall, 1952.—Ed.

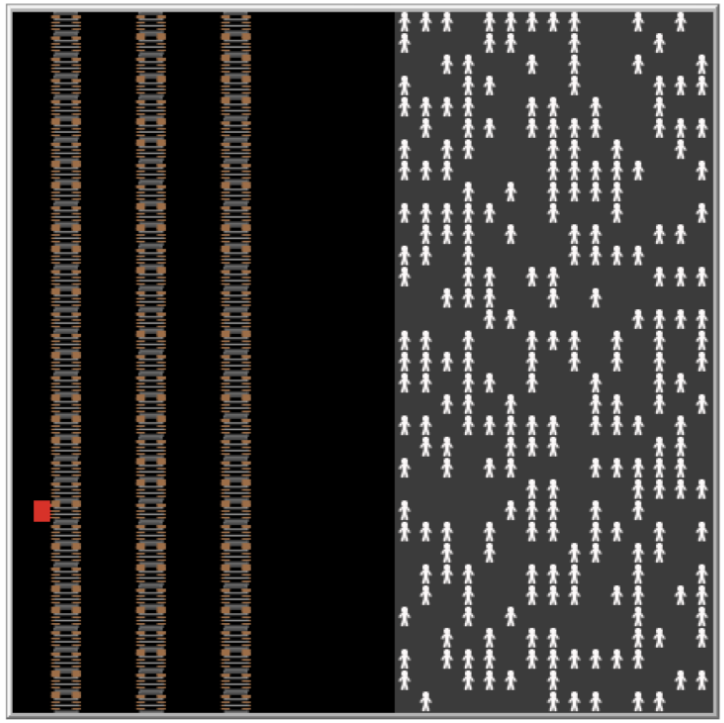
Behavioural experiments, inspired by the Asch model, have been used to understand the impact exerted on **conformism** by two typical conditions of railway maintenance - i.e. time pressure and the habit to share anecdotes about the methods used "to get the job done"



The **agent-based simulation** allowed us to observe how tendencies enlightened by the experiment work in **a collective scenario** (inspired by railway maintenance tasks) where many agents interact with one another led by the same conformist rule.

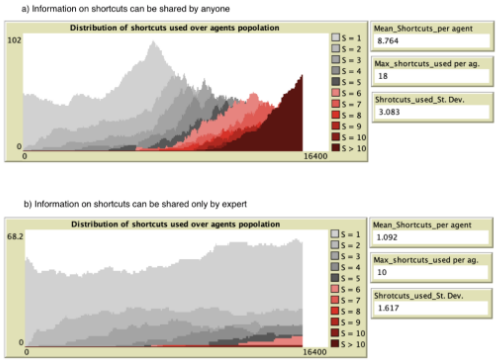
The basic idea was to observe if and how conformism can impact the spread of informal norms in the maintenance context, leading staff to share the opinion that such norms work better than formal ones in having the job done.





The simulation, developed using **NetLogo**, involves a population of agents endowed with an equal probability to conform to the majority (based on behavioural experiment) and no specific propensity to use informal norms - except for a few individuals (from 1 to 10 as the user picks).

Each step, a random set of five agents, is called to repair a fault on railway tracks. During the intervention, team members have to decide whether they agree about using informal norms instead of formal ones to solve the problem. If all agree, the group breaches the protocol and uses the informal norm.



We explored the decision-making procedure in combination with alternative information-sharing conditions, able to affect individual preference toward informal norms:

a) any agent can share with their neighborhood stories on informal norms, regardless of experience with using them;

b) agents can share with their neighborhood stories on informal norms only if they have experience with using them;

c) no information-sharing about norms.

6. Final remarks

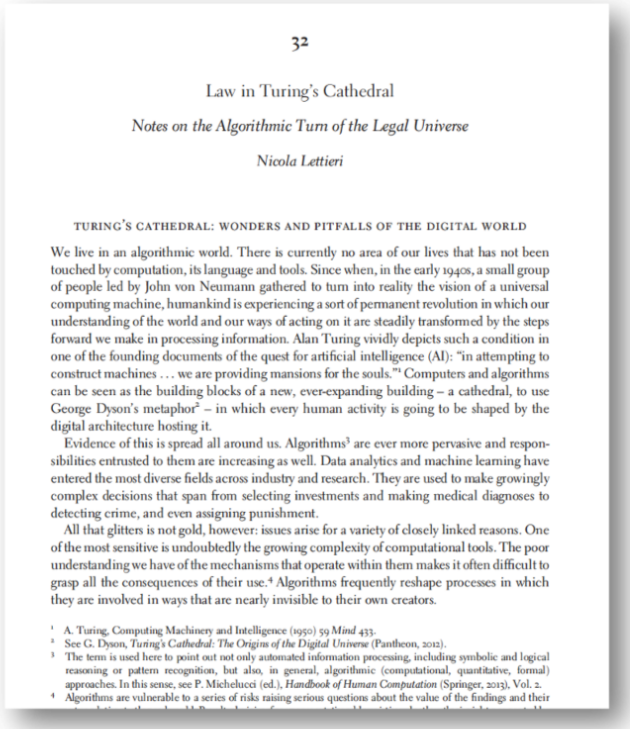
The experience has raised **issues** and **challenges**...

1. Issues arise on formal and informal norms clash, concerning factors affecting social interactions and cognitive mechanisms underlying the emergence of this phenomenon.

It seems worthy to better investigate the impact that **conformism** can exert when ***coupled*** with **misinformation** (i.e., with the existence of spaces allowing even unreliable information to be shared) on the diffusion of informal norms in contrast with formal prescriptions.

2.

Challenges lie on the methodological level and involve the need to nurture interdisciplinary and empirical approaches in the legal field and to acquire a natural "computational mental habit", by becoming familiar with new tools, languages and problem formalization processes.



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Law in Turing's Cathedral

Notes on the Algorithmic Turn of the Legal Universe

Nicola Lettieri

TURING'S CATHEDRAL: WONDERS AND PITFALLS OF THE DIGITAL WORLD

We live in an algorithmic world. There is currently no area of our lives that has not been touched by computation, its language and tools. Since when, in the early 1940s, a small group of people led by John von Neumann gathered to turn into reality the vision of a universal computing machine, humankind is experiencing a sort of permanent revolution in which our understanding of the world and our ways of acting on it are steadily transformed by the steps forward we make in processing information. Alan Turing vividly depicts such a condition in one of the founding documents of the quest for artificial intelligence (AI): "in attempting to construct machines . . . we are providing mansions for the souls."[1] Computers and algorithms can be seen as the building blocks of a new, ever-expanding building – a cathedral, to use George Dyson's metaphor[2] – in which every human activity is going to be shaped by the digital architecture hosting it.

Evidence of this is spread all around us. Algorithms[3] are ever more pervasive and responsibilities entrusted to them are increasing as well. Data analytics and machine learning have entered the most diverse fields across industry and research. They are used to make growingly complex decisions that span from selecting investments and making medical diagnoses to detecting crime, and even assigning punishment.

All that glitters is not gold, however: issues arise for a variety of closely linked reasons. One of the most sensitive is undoubtedly the growing complexity of computational tools. The poor understanding we have of the mechanisms that operate within them makes it often difficult to grasp all the consequences of their use.[4] Algorithms frequently reshape processes in which they are involved in ways that are nearly invisible to their own creators.

[1] A. Turing, Computing Machinery and Intelligence (1950) 59 *Mind* 433.
[2] See G. Dyson, *Turing's Cathedral: The Origins of the Digital Universe* (Pantheon, 2012).
[3] The term is used here to point out not only automated information processing, including symbolic and logical reasoning or pattern recognition, but also, in general, algorithmic (computational, quantitative, formal) approaches. In this sense, see P. Michelucci (ed.), *Handbook of Human Computation* (Springer, 2013), Vol. 2.
[4] Algorithms are vulnerable to a series of risks raising serious questions about the value of the findings and their

"Law must always keep searching for new ways to use algorithms and computation to better understand itself and also to more effectively carry out its ordering function. As a matter of fact, such a goal cannot be fully achieved without ever **more enhanced forms of ratiocination**, they must be achieved through an always deeper understanding of the real world of which law is a part and with which legal systems interact.

[...]

It is something in which lawyers must play an active role, fully accepting the challenge of **learning new languages**, and **adopting new categories** and **perspectives**."

We need to make **computation**
a vehicle for **knowledge**, *not confusion*.

Thank you!