Exploring the intersections between law, ABM and policy-making: on the clash between formal and informal norms

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Abstract

The work focuses on the potential intersections between ABM and policy-making from a legal perspective. After a brief introduction discussing the need for both policy-making and law to gain a better understanding of social reality, we dwell on an emerging legal research perspective, a sort of computational-enhanced legal empiricism, suggesting to use agent-based simulation to enlighten complex social dynamics behind legal phenomena. The discussion is supported by cues collected during a research experience exploiting agent-based simulation to explore an issue that heavily impacts law and policy effectiveness, i.e., the clash between formal and informal norms. In the last part of the work, we sketch some final considerations, discussing ideas and methodological issues that emerged from the research experience that can contribute to the reflection on the intersection between ABM, policy-making, and law.

Keywords

Rule-making, Computational Legal Empiricism, Informal norms, Social simulation

1. Introduction

Public policy design has always been a demanding process, oriented to identifying strategies that could decrease the uncertainty of social reality and lead the community toward desirable outcomes. The complexity of this process has increased today. From data revolution to worldwide health threats to social media misinformation, the factors that policies have to govern are numerous and ever-evolving, putting decision-makers in front of dynamics challenging to identify, predict, and control. Policies failures have thus become an even more concrete issue.

As outlined in [1], one of the "principal cause of policy failure [...] lies in the intellectual framework in which a policy is conceived", which often do not consider mental models, beliefs, societal norms, and other contextual factors that influence people's behaviour. In such a scenario, a challenge is to identify approaches that can foster better-contextualized policies enabling them to efficiently manage society non-linear dynamics.

The discussion involves the law as well. Legal norms are the instrument of choice for implementing public policies: they provide the means through which governments undertake their core functions. They prescribe behavioural standards and the connected enforcement methods, set formal institutions endowed with regulatory powers and the mechanisms through which regulatory institutions can be held accountable for their actions [2]. There is, therefore, a connection between understanding the dynamics behind legal norms and improving policy effectiveness.

The work looks in this direction, discussing some of the topics and methodological issues arising at the intersection between ABM, law, and policy-making. Specifically, Section 2 focuses on the role of agent-based simulation in the legal field by drawing attention to the ideas suggested in this sense by the emerging perspective of *computational legal empiricism.*

Section 3 extends the reflection by dwelling on a recent research experience combining behavioural experiments and agent-based simulation to explore an issue that heavily impacts law and policy effectiveness, i.e., the clash between formal and informal rules. The idea is not as much to discuss specific results as to shed light on cues and methodological issues that emerged from the research experience that can contribute to the reflection on the intersection between ABM, policy-making, and law.

2. ABM and the empirical evolution of the legal science

Widely spread in many research fields connected to public policy [3, 4, 5], ABM remains a rather unexplored frontier in the legal field [6, 7]. While interested in the intersection between law and at Computational Social Sciences (CSS) approaches [8, 9], quantitative legal research has indeed paid more attention to the idea of using computational approaches to investigate formal characteristics of law rather than its factual dimension [10].

However, interesting perspectives have arisen in recent years that rethinks the relationship between computational methods, quantitative research and legal empiricism. In particular, a view is emerging, a sort of *computational-enhanced legal empiricism*, that suggests looking at CSS methods as enabling factors for an evolution in the empirical sense of the way legal phenomena are conceptualized and studied [11,12].

Indeed, the interdisciplinary paradigm of CSS has endowed social scientists with completely new theoretical and methodological instruments allowing to gain deeper insights into the complexity of social systems [9]. *Computational-enhanced legal empiricism* looks at such an evolution of social science as an opportunity to rethink the methods and, even before, the theoretical models of legal research. The idea suggested is that of "exploiting computation not only to identify trends and correlations in case law by means of statistical regressions and machine learning, but 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" [11].

In this vein, a particular role is played by agent-based simulations, as they provide a powerful formalism to experimentally explore the complex dynamics that govern social reality, enabling researchers to generate social systems artefacts that can be observed, evaluated, and tested on a computer. Inspired by a bottom-up approach, they make it possible to see how macro-level phenomena (e.g., fundamental social structures or group behaviours) emerge from the micro-interactions taking place among individuals governed by a simple set of rules and interplaying with an artificial environment [13].

The approach helps unveil the eccentric nature of social interactions. Unlike more traditional analytical solutions and approximation techniques, agent-based simulations allow catching nonlinearity and feedback effects involved in social phenomena emergence [6, 13]. The observer is so able to see how local interactions affect collective responses and, vice versa, how these affect individual choices and local interactions.

The list of issues to analyse by this approach is long and includes mechanisms such as the cognitive processes and spontaneous collective dynamics involved in the evolution of normative behaviours, cooperation or social dilemmas. Mechanisms that are all relevant for policy and rules design and, however, have never been explored, in the legal field, by means of the agent-based approach.

3. A practical challenge: simulating the clash between formal and informal norms

Drawing inspiration from the theoretical and methodological approach suggested by *computational-enhanced legal empiricism,* we present a research experience exploiting agent-based simulation to explore a phenomenon that can heavily affect the effectiveness of public policies, i.e., the clash between formal and informal rules [15]. Along with legal norms, indeed, collective behaviours are often affected by moral, social or other informal rules that influence how individuals make decisions, build their

personal relationships or interact with groups they are part of. Typically unspoken, such norms work as shared models of action setting the cultural and structural bases of human behaviour and so contributing to the organization of social life [16, 17].

To understand the relevance of these rules we can refer to the image provided by the social philosopher Cristina Bicchieri in [16]. She metaphorically describes social norms – an instance of informal norms – as the "grammar of society": like grammar rules shaping language and allowing us to recognize it, informal norms shape communities' behaviour, making it possible to identify the inner structure of social groups.

Just think, for example, of those cultures in which families withdraw girls from schools and marry them as children. One factor in stopping girls' education is the common belief in the need to protect girls from honour threats they can receive when walking to or from the school. A social norm that prevails on policies about the school, making them unable to cope with the problem of poor feminine education effectively [18].

Even if grounded on different bases, formal and informal norms are not disconnected and, as suggested by the example, they can easily be in conflict. The inner, uncoded rules of a community can indeed hinder or completely exclude co-existing ones imposed by formal authorities, especially when not neutral or in line with them.

The topic is not new. The impact of informal norms on social behaviour is a well-known topic of investigation in social sciences [19, 20]. However, thanks to CSS approaches and, in particular, to ABM new insights have been drawn concerning the dynamics underlying the spontaneous emergence of informal norms [21].

Our reflection on these issues is supported by a recent research experience that uses agent-based simulation to explore the conflict between formal and informal norms in the scenario of railway maintenance. The contexts in which unspoken rules threaten the effectiveness of l formal ones are countless. Due to their socio-technical nature, however, railway systems offer a privileged point of view.

In recent years, indeed, innovation has strongly transformed the relationship between social, cultural, technological and organizational factors characterizing these systems. Changes concern not only the physical infrastructure but also operational rules. Such rules, as sophisticated as strategic in terms of railway safety, made staff's decisions - especially rail track maintainers – tough and increased the application of shortcuts and unofficial rules [22], unsuitable for the complexity of the task and able to fosters rail accidents [23].

Our work aims to explore the dynamics behind this phenomenon, trying to catch how different dimensions (individual, collective, and organisational) involved interact. Drawing inspiration from recent studies on group norms in the railway context [24, 25], we tried to understand whether conformism can play a role in increasing rail maintainers' use of unofficial practices.

The research takes a twofold direction. On the one hand, we attempted to understand how conformism can influence rail operators' decision-making when combined with typical conditions affecting their work, such as time pressure and misinformation (caused by non-expert narratives). On the other, we explored the macro effects of previously detected individual propensity to conformism, analysing the impact of both time pressure and misinformation on the emergence of a trend favouring informal norms.

4. Contents of the experimental activity

In order to catch the interplay between individual decision-making and collective dynamics involved in the emergence of norms conflict in railway scenario, we integrated agent-based simulation with a behavioural experiment based on real subjects. In the next sub-section, we report in detail the contents of both the experimental activities.

4.1. Behavioural experiment

To understand if and how time pressure and misinformation could impact an individual's propensity to conform to others' choices, we conducted a social experiment based on a revisitation of the protocol adopted by Asch in his experiments on conformism [26, 27]. We asked each of 28 experimental subjects (in 19-39 years old) to participate in a visual-perceptual experiment with other people (actually, actors instructed by the experimenter to provide specific answers). All subjects have been asked to perform 18 trials by comparing some lines shown on a 55-inch screen. The stated objective of the observation is to determine which one of the bars on the right side of the screen matches the comparison bar on the left side.

However, as in the original experiment, there is a non-stated objective: to observe the impact of actors' answers on the experimental subject's opinion. For this reason, the test includes 12 critical trials in which the actors unanimously provide a wrong answer, unbeknownst to the experimental subject (see Figure 1). As in Asch, the number of failed critical trials (i.e., the number of times the subject follows actors' wrong answer) describes the conformity rank of the subject, the variable to measure through the experiment. We tried to explore the course of this variable in different scenarios by alternately adding the following conditions: i) time pressure caused by time-limited (0,3') observation of trials on the screen; ii) misinformation, by the sharing of false pieces of knowledge by one of the actors who pretended to be an expert of visual experiments; iii) both time pressure and misinformation

Figure 1: Set of visual-perceptual trials. Numbers in red correspond to critical trials

4.2. Agent-based simulation

An example of the Figure 1, After we shed light on how factors such as time pressure and misinformation can affect an individual's propensity to conformism, we used agent-based simulation to grasp the impact of such factors on the emergence of a collective trend of using unofficial rules. In this vein, we develop a model in *NetLogo* including a population of agents endowed with a 30% probability to conform to the majority and no predefined preference for informal norms. Every tick of the simulation is split into two steps. During the first one, five random agents called to fix a fault have to decide if they agree about solving the problem by using informal practices rather than official rules. If all agree, the group will breach the protocols and use shortcuts; otherwise, they will comply with official rules. The agreement depends on if there are shortcuts' supporters in the group and on the probability (30%) for those at odds to conform with the majority. After they decide, they fix the fault and join the other agents.

Then, the simulation runs to the second step, where agents, back to the headquarter, discuss the value they assigned to shortcuts over the intervention with short-distance colleagues. To test the impact of

misinformation on the diffusion of informal norms, we explored different information-sharing conditions. Specifically, we observed how the use of shortcuts changes in combination with the following scenarios: i) agents with no experience in using shortcuts share information about them and their usefulness; ii) agents share information about shortcuts and their usefulness only if they have previously used them; iii) agents cannot share information about informal norms.

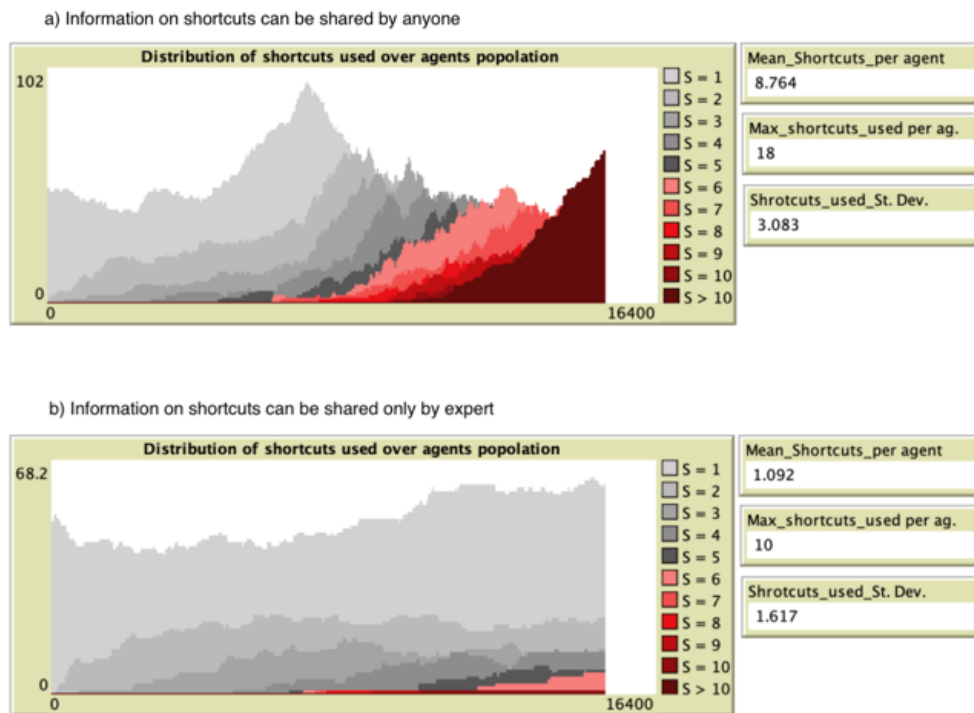An illustration of the outcomes produced by the comparison of the scenarios can be observed in Figure **2**.

a) Information on shortcuts can be shared by anyone

Distribution of shortcuts used over agents popolation				Mean_Shortcuts_per agent
	S = 1	S = 6		8.764
	S = 2	S = 7		Max_shortcuts_used per ag.
	S = 3	S = 8		18
	S = 4	S = 9		Shrotcuts_used_St. Dev.
	S = 5	S = 10		3.083
		S > 10		

b) Information on shortcuts can be shared only by expert

Distribution of shortcuts used over agents popolation				Mean_Shortcuts_per agent
68.2	S = 1	S = 6		1.092
	S = 2	S = 7		Max_shortcuts_used per ag.
	S = 3	S = 8		10
	S = 4	S = 9		Shrotcuts_used_St. Dev.
	S = 5	S = 10		1.617
0	0	16400	S > 10	

Figure 2: Distribution of informal norms among agents in the following scenarios: (a) misinformation; (b) no misinformation.

5. Discussion and conclusive remarks

The research experiment outlined in the previous section has raised issues worthy of attention for those who are interested in exploring the potential intersections of ABM, policy-making, and law. A first set of remarks concerns social dynamics implicated in the clash between formal and informal norms. We have observed the important impact that conformism can have on spreading informal norms and how this impact can be extended by misinformation. As emerged from the agent-based simulation (see Figure 2), when non-experts can share information about informal norms, the preference for these norms rises and so does the number of times in which agents use them. We would suggest that in this scenario agents have more chances for discussion exchanges about informal rules and, consequently, more opportunities to conform.

The next step of the research includes an improvement of the simulation model, both from a theoretical and technical standpoint, to extend the exploration to other cases of conflicts between formal and informal norms. The idea is to investigate if such a correlation between misinformation and informal norms' diffusion is a context-related or a class feature, i.e., if it occurs even in other kinds of formal-informal norms' conflict.

A second set of remarks is on the methodological level and relates to the need to nurture interdisciplinary and empirical approaches in the legal field by gaining a natural "computational mental habit." Computational-enhanced legal empiricism, as mentioned, is moving in this direction, suggesting to look at computation as a means that can innovate not only methods but the very culture of legal research, changing how we identify, theorize, and study legal phenomena [11].

Fiddling with ABM led us to directly experience such mutual influence between the methodological choices and the theory-making process. We observed, in fact, how changes in the model enable a different way to think of the phenomenon, a new theory, and vice-versa how different representations affect the modelling choices and the related research questions. Along with potentialities, however, we experienced also the limits caused by the lack of computational culture: basic technical skills are indeed required to grasp all the advantages agent-based simulation and other computational social science methods can bring to understanding social reality phenomena. A deep exploration of the intersections between ABM, law and policy-making thus asks legal scholars to become familiar with new tools, languages, and problem formalization processes. The knowledge we need not only to develop better models but grow new scientific interplays.

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7. References

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