

Abstract

Formal models constitute an essential part of contemporary Political Science. Their recent history is tightly tied to the developments of rational choice theory (RCT), which is considered to be the only deductive theory in the social sciences. This unique character, especially its manifestation through mathematical symbolisms, has caused profound schisms and criticisms in the discipline. Formal models have constantly been accused of being built on unrealistic assumptions of human behaviour and social structure, rendering as a result either trivial predictions or no empirical prediction at all. Nevertheless much of these charges are based on a misunderstanding about model design and the essence of explanation. Therefore, in this paper I address the philosophical and theoretical debates on rational choice modelling, drawing attention to how formal models are designed and what kind of explanations their offer. In my understanding, models produce predictions about general phenomena, and hence should not be judged on the basis of cherry-picked cases. Local triumphs by the opponents of modelling and RCT do not suffice to render models useless or false. Rather, their explanatory capacity should be judged on the terms of their general predictions and explanations.

Key words: models; methodology; explanation; rational choice theory; political theory.

Resumo

Os modelos formais constituem uma parte essencial da Ciência Política contemporânea. Sua história recente está fortemente ligada aos desenvolvimentos da teoria da escolha racional (TER), que é considerada a única teoria dedutiva nas ciências sociais. Este caráter único, especialmente a sua manifestação por meio de simbolismos matemáticos, causou profundos cismas e críticas na disciplina. Os modelos formais foram constantemente acusados de serem construídos sobre pressupostos irrealistas de comportamento humano e estrutura social, resultando em previsões triviais ou nenhuma previsão empírica. No entanto, muitas dessas acusações são baseadas em um desentendimento sobre o design do modelo e a essência da explicação. Portanto, neste artigo abordo os debates filosóficos e teóricos sobre a modelagem de escolha racional, chamando a atenção para a forma como os modelos formais são concebidos e que tipo de explicações oferecem. Na minha compreensão, os modelos produzem previsões sobre fenômenos gerais e, portanto, não devem ser julgados com base em casos finamente escolhidos. Os triunfos locais dos adversários da modelagem e do TER não são suficientes para tornar os modelos inúteis ou falsos. Em vez disso, sua capacidade explicativa deve ser julgada nos termos de suas previsões gerais e explicações.

Palavras-Chave: modelos; metodologia; explicação; teoria da escolha racional; teoria política.

Explanation as Prediction: The Raison D'être Of Formal Models In Political Science

Enzo Lenine - Universidade da Integração Internacional da Lusofonia Afro Brasileira

INTRODUCTION

Mathematics has aided a variety of sciences since the dawn of times. Ancient civilisations relied on mathematical concepts and models to describe the world around them. Models in particular constitute the essence of modern physics and chemistry, but they are also important tools in disciplines such as biology and social sciences. Political science itself has benefited extensively from models. Models of political phenomena have been designed mostly under the framework of rational choice theory (henceforth RCT), which seems plausible for RCT is the only deductive theory in the social sciences. Mathematical models are intrinsically dependant on deduction to connect assumptions, enhance logical arguments, and generate predictions. It is only natural that a deductive theory would produce such kind of models.

The first efforts in modelling political phenomena may be traced back to Borda's and Condorcet's paradoxes, or, more recently, to spatial models developed in the first half of the 20th century by Harold Hotelling (1929), Duncan Black (1958), and Anthony Downs (1957). Nevertheless, the use of models as methodological tools in political science is usually attributed to Kenneth Arrow's impossibility theorem, which relied on mathematical assumptions to advance an argument about preference aggregation. Game theory also became popular in political science around the same time, and together with spatial models, they account for the bulk of mathematical modelling in the discipline.

Since the initial developments, mathematical models have cause profound disputes within the discipline. Donald Green and Ian Shapiro's (1994) classical critique – *Pathologies of Rational Choice Theory* – summarises a great deal of the arguments against RC models, which tended to be echoed by many political scientists despite the responses given by RC theorists. In their piece, Green and Shapiro are profoundly concerned about the great importance and visibility given to RCT and formal models, mentioning the increasing share of RC articles being published in the *American Political Science Review*. Despite acknowledging the potential of RCT, they believe the theoretical enterprise failed in its mission of providing explanations and predictions of concrete political phenomena, such as voter turnout, legislative behaviour, electoral competition, and collective action. Their focus is eminently on the empirical power of RCT, which they consider limited.

The debate over the prospects of empirically testing RC models has echoed in the discipline, and has been constantly used as an argument against formal modelling. If models cannot generate predictions that are true to the real world, why should we bother designing such models in the first place? Wouldn't political science do much better with statistical tests and/or qualitative analyses? The first question is an issue of contention not only in political science, but also in philosophy. Models represent the real world, but to what extent their assumptions should be true to the world is a matter that causes profound disagreements. The second results from the historical and institutional development of the discipline. Quantitative and qualitative methods have granted political science its scientific status, and still nowadays they are the main terms under which most political scientists think about methodology and, more importantly, about explanation.

However, if one expects to judge models and modellers, at least a clear idea of what a model is has to be offered. Are models supposed to match *ipsis literis* the real world, incorporating all possible variables and its nonlinearities? Should a model be some kind of superpowerful entity that can represent and predict every single aspect of reality? Or are there other approaches to modelling and to what models can offer as explanations? And, most importantly, what is explanation and what does it have to do with models? I try to address these questions by presenting part of the philosophical and methodological debates about models and how they may enlighten our understanding of modelling in Political Science. My focus is directed towards the implications of these discussions to RCT in Political Science. The questioning of models has been pervasive in the discipline and much of the debate has revolved around the same criticisms. Nevertheless the problem seems to reside in the (mis)conceptions political scientists have about models, predictions and their explanatory capabilities, which leads to an eternal state of distrust towards models.

The paper is structured into three sections. I first present philosophical aspects of formal modelling, focusing on the debate about models as representational devices. The following section addresses the issue of models and explanation in the social sciences, and in the third section I discuss the implications of the aforementioned discussions to RCT and political science.

PHILOSOPHICAL PERSPECTIVES ON MODELS

Philosophers of science and methodologists alike have been debating the roles of models for ages. There is a general understanding that models serve different purposes, such as theory building, measurement, representation of reality (MORRISON and MORGAN, 1999). However, the central question is whether models can offer valuable explanations about reality, and how they can achieve such feat. Here lies the quintessence of this debate, spilling over to Political Science and questioning the validity of formal modelling as a means of understanding explanatory mechanisms and describing political phenomena.

Philosophers resort to a variety of analogies (some of them are very creative) to describe models: maps, objects, abstractions, fables, parables, fictions. Each of them, however, convey specific ideas about the nature of models. To begin to answer the question of what a model is, I depart from three definitions: models as “*autonomous agents*” that “function as *instruments* of investigation” (MORRISON and MORGAN, 1999, p. 10); models as “abstract objects constructed in conformity with appropriate general principles and specific conditions” (GIERE, 2004:747); models as “experiments *in thought* about what would happen in a real experiment” (CARTWRIGHT, 2010:19). All those accounts share in common the idea that models are representations of *aspects* of the world, not of its totality. As Dowding (2016:80) states: “Models are usually simplified versions of the things they represent, eliminating aspects that are not important for the use to which the model is being put”.

Models as autonomous agents is a particular understanding that provides a certain level of independence from theory and data. The literature on the philosophy of science has traditionally “portrayed [models] narrowly as a means for applying theory, and their construction was most often described in terms of ‘theory simplification’ or derivation from an existing theoretical structure” (MORRISON AND MORGAN, 1999:36). By granting independence and autonomy to models, one can envisage different modes of constructing models and assigning them functions. Evidently, the underlying premise is the representation character of models: they are supposed to represent some aspects of the world, of theories or both.

Independence from theory and data is acquired during the construction of a given model. Drawing on Marcel Boumans’ (1999) account of economic models, Morrison and Morgan conclude that models’ independence results from their being a mixture of bits of theories and data connected via mathematical formalism and a metaphor. In this sense, assigning a full theoretical or a full empirical relationship of dependence is impossible, for models could not be related to one single theory or dataset. Hence their independent status, which is essential if one expects models to perform any of their functions: theory construction and exploration of theoretical claims in concrete situations;¹ measurement; or intervention in the real world.²

Giere has a more abstract concept of models, focused primarily on representation. Models are abstract objects built on principles that act as general templates of representation. Principles themselves are abstract, such as Newton’s Laws, and the models resulting from their working together are also abstract constructs. Empirical claims can only be raised when the model is applied to a concrete context, the target situation. Therefore, “one cannot directly test principles by empirical means. One can only test the fit to the world of particular models that incorporate the principles” (GIERE, 2004:751).

Saying that models are abstract entities does not mean, however, that they fail to represent the world. Giere (2004:747) is clear in his statement that models “are designed so that elements of the model can be identified with features of the real world”. It is precisely because of this characteristic that scientists use models to represent reality: they share similarities with the real system which are essential to build explanations about real phenomena.

Yet models can also be thought as abstract representations to test theories or theoretical claims, in the veins of thought experiments. Cartwright’s (2010) approach to models as thought experiments follows this line of abstraction in dealing with representation, specifically in how we can move from falsehoods in models to truth. In the literature on modelling there is a pervasive debate about the problem of unrealistic assumptions or false premises. Models are often constructed on premises which are not observable in the real world, either because we lack empirical evidence, or because they simply contradict the aspects of reality they were supposed to represent – being, in this sense, a thought experiment. To overcome this problem, Cartwright compares models to fables, which contain a moral or a lesson about the world even

1 When mentioning this function, Morrison and Morgan allude to the ‘rational economic man’, the idealised model easily related to the RC tradition. They briefly describe the potential of this modelling for explaining real economic behaviour, but I believe that here resides a powerful understanding of models of rational choice: they are instruments to *explore* the theory, not to test or falsify it. Models mediate theory and reality via the predictions they make to explain real world phenomena, according to the purposed they were designed for. One can judge the quality of such mediation (by checking, when comparing two models of the same phenomenon, which offers better predictions or hypotheses), and if eventually a model is falsified when faced with an empirical test, theory is still preserved (it is not falsified), for models have a partial independent status from theory. In other words, independence allows for the testing of models whilst preserving theory.

2 By predicting the outcomes of specific settings, models invite us to come up with solutions for certain political problems. The literature on collective action and the tragedy of the commons is a clear example of modelling for intervention in the real world. One can focus on the tragic outcomes of collective action and claim that models only render catastrophic conclusions about human action. Or one can use the model to understand under what conditions people can overcome the tragedy of collective action. That is precisely what this literature has achieved.

if the premises of the model are unrealistic. That is what she calls “climbing up the ladder of abstraction”, a strategy to overcome the aforementioned problem. Predictions can be true of a target insofar as the conclusions derived from a model can be expressed in more abstract terms: “That is the sense in which climbing up the ladder of abstraction in describing the results of the experiment can take us from falsehood to truth: Stating the lesson of a model using more abstract concepts than those directly involved in presenting the model can generate true predictions about behaviors in a target” (2010:28).

As abstract as they may seem, the aforementioned theories of models are essential to understand how political phenomena can be represented by mathematical expressions and formal claims (DOWDING, 2016; NORTON, 1999). Evidently, they are only part of a much larger literature that deals with the implications of modelling to natural and social sciences, but they capture a great deal of the current debate in Political Science. Political theorists are profoundly concerned about the prospects of representing and predicting phenomena in a meaningful fashion, especially because the essence of explanation in the discipline lies in offering predictions about the real world. I will turn to this discussion in the end of next section. For now, it suffices to say that models of political phenomena serve a variety of purposes, but the underlying compromise of any model is still to offer an explanation or a description of the real world.

MODELS AND EXPLANATION

Much of the debate in Social Sciences revolves around the linkage between models and explanation or, better said, the explanatory power displayed by models. At the end of the day social scientists expect their models to provide explanations about mechanisms operating in the real world. The world described within a model plays a great role in building explanatory connections, and it is precisely there that methodologists display conflicting views.

Critics of modelling in social sciences generally focus their attacks on the problem of unrealistic assumptions or on the lack of empirical evidence. Models are often constructed based on premises that are not observable in the real world, at least in part. *Homo economicus*, perfect information, transitivity are just a few examples of idealizations from which models depart to construct their settings. The radical criticism of deductive-nomological perspectives of explanation would render the model completely unrealistic, even if its conclusions are derived via a logical process (CARTWRIGHT, 2010; REISS, 2013). This is so because a model’s falsehoods cannot be ignored to evaluate its explanatory capacity. But this is a radical approach that ignores the nuances of modelling. As described previously, models represent certain aspects of reality, aiming to provide predictions based on logical relationships derived from those representations. Some of the assumptions underlying the representation might be false, yet it is up to the modeller to derive conclusions that do not necessarily result from the falsehoods. As Hausman (2013:252) states: “What one needs to inspect is not the model but the application of a model in a particular explanation. Such applications typically do not make use of all the assumptions within the model and so obviously do not rely on those assumptions that they do not make use of”.

Nevertheless, this is still not an ideal answer, for some critics care about the problem of empirical evidence. Alexandrovna and Northcott (2013:263) considers it to be the fundamental problem with models, because “we have no empirical evidence for thinking that models are successful at isolating capacities”, hence their lack of success in predicting real phenomena. Assumptions would be flawed because the entities they intend to represent simply do not exist in the real world. If we are to evaluate how falsehoods affect the quality of the explanation derived from the model, one has to resort to some kind of testing of

a model's predictions. According to Hausman (2013:252): "One can examine whether the implications of models are appreciably more predictively accurate in circumstances where the assumptions are closer approximations to reality. One can consider alternative models that attempt to capture the same causal mechanism while employing different falsehoods. One can examine other applications of the model and the extent to which the falsehoods influenced the results in those other applications". However, what would that suffice to provide a full evaluation of a model's predictability? Would it comply with the idea of explanation as an approximate truth?

We know that models are simplified versions of a complex real world. That is precisely why we choose some aspects of the real world to model instead of the totality of reality. Models are constructed to provide predictions – and hence explanations – to the target system it was designed for (DOWDING, 2016). In this sense, a model is "partially isomorphic to the real world" to the extent that "some assumptions that define the model match some of the assumptions met in the real world, the target system. What we need in terms of truth values to make this happen is a claim indicating precisely which aspects of the model identify which aspects of the target system" (ROL, 2013:246). Therefore, the existence of falsehoods should not automatically doom a model as unrealistic, unsuccessful or false (MÄKI, 2013). Some falsehoods arise as a result of the efforts to translate reality into a tractable set of assumptions. It may also result from our poor understanding of new phenomena, which might be the underlying reason why we are developing a model to explore this new reality. Or it may also be that reality itself is not capable of being fully represented in order to generate a highly abstract truth, resulting in assumptions that do not necessarily correspond to high demands of truthfulness (SUGDEN, 2011).

A particular example of the complications of modelling real phenomena can be drawn from structural mechanical behaviour. In structural engineering different models are used to understand and predict the mechanical behaviour of structures, such as beams, joints, plates etc. Millions of engineers all around the world are taught Euler-Bernoulli's beam equation, as well as many other equations that allow for the calculation of deflections and stresses. A common feature of the basic models taught at the undergraduate level is that they decouple effects, making calculations simpler. At the graduate level, more sophisticated models account for the complexity of structural stresses, mapping their vectorial fields within structures, resorting to variational calculus and differential geometry. Yet however complex these models might be, however good they might be in solving for nonlinear equations via analytical procedures or computational simulations, they will never be able to state precisely how a given structure distributes and accommodates stresses within it. Even if we were to measure, we would not be able to tell the precise behaviour of the structure when subjected to a given load, for there is no method, no model, and no measurement capable of achieving such feat.³ And yet we build increasingly higher buildings such as the Burj Khalifa, and send humans to the International Space Station.

I am not implying that models are useless. On the contrary, models are successful in representing the part of the reality for which they were designed and the case in structural engineering only highlights the importance of models being isomorphic to the real world. They provide explanations and predictions about the specific settings they were tailored for, and that is all. They are isomorphic to the extent that reality is a complex thing and models only capture

³ There are many reasons why models in structural engineering cannot account for the exact mechanical behaviour of structures. Materials are not perfect and we are not able to map all their imperfections. Models are based on the theory of elasticity, whose assumptions come from the branch of continuum mechanics, which treats solids as a continuous mass instead of discrete particles (i.e. atoms and molecules), meaning that we focus our attention to macroscopic behaviour, ignoring microscopic phenomena. Measurement devices capture displacements (which are essential to calculate strains and stresses) either as a result of superficial deformation or of mechanical oscillations. Nevertheless these limitations do not render structural models useless. On the contrary, by focusing on phenomena that can be observed, measured and calculated, they provide reliable answers to the problems engineers face in their daily activities. The aforementioned uncertainties are generally treated via safety factors and probabilistic models. For further details, see Shames (1964).

parts of it (DOWDING, 2016). Representing reality in its totality – if that was possible, which I strongly doubt – is no guarantee that we would get any closer to a better understanding or explanation of it (NORTON, 1999). To be sure, there are some aspects of reality that may never be able to be represented by any model, yet this should not be seen as a flaw as long as the model is still compromised to offer predictions about some parts of the real world (SUGDEN, 2011). Total representation is unattainable and it does not lead us to the truth, for truth itself might also be unattainable.

That is why Sugden offers his credible world view of models. For Sugden (2011:733), “[t]he model is a self-contained construct, which can be interpreted as a description of an imaginary but credible world. The workings of the model generate patterns in the model world that are similar to ones that can be observed in the real world. The model provides an explanation of the world by virtue of an inductive inference: roughly, from the similarity of effects we infer a similarity of causes”. The existence of similarities offers clues about the quality of a model’s predictions and hypotheses, and hence “if a model consistently produces hypotheses that stand up to empirical scrutiny it will do so because it relies upon some mechanism that either more closely reflects reality than the structures and assumptions of rival models that produce hypotheses that do not stand up so well to empirical scrutiny, or because it relies upon some features that are correlated with such mechanisms” (DOWDING, 2016:83).

The search for similarities between the model and the real world it is supposed to represent is the essence of explanation. To be sure, scientists build their models in order to find patterns in real world phenomena, attempting to predict future events based on these patterns. Therefore, by explaining something scientists mean that their models simplify the complex real world via certain assumptions that, when put to work together, generate predictions about reality. We need models – formal or nonformal – to provide us with minimal guidance in our quest for understanding the world around us. In this quest, we might seek to explain types of phenomena, unravelling explanatory mechanisms in the macrolevel – one can think about explaining political stability using Tsebelis’ veto power framework or socioeconomic development based on Acemoglu and Robinson’s institutional account -; or specific cases, given specific actors and contexts – one could try to explain the impeachment process in Brazil by analysing former president Dilma Rousseff’s political skills. Both types of explanation – which are referred by Dowding (2016) as type and token explanations, respectively – are ways of describing the world around us, but each under its own scope. Formal models, such as RC models, are meant to provide type explanations, for their assumptions are not conceived in terms of specific individuals or contexts, but rather in terms of macrophenomena.

A clear example of how formal models provide general explanations can be found in fluid mechanics. Navier-Stokes equations are a set of complicated (so complicated that they are one of the seven millennium prize problems in Mathematics) partial differential equations that model fluid behaviour. According to the Clay Mathematics Institute: “Mathematicians and physicists believe that an explanation for and the prediction of both the breeze and the turbulence can be found through an understanding of solutions to the Navier-Stokes equations”. One can clearly see how general this model is – it models breezes and turbulence, not to mention the flow of any other fluid! Although we still lack a definitive solution in three dimensions (we are not even sure whether it exists), we apply a variety of methods to solve for specific cases, from the flow of water in a pipe to the air currents on an airplane wing. We do so by specifying concrete boundary and initial conditions and the assumptions underlying a given problem (water flowing in a pipe is not the same as crude oil flowing in a pipeline, for the latter is considered a non-Newtonian fluid, having nonlinear viscosity). But this is only possible because we have a general model that allows for an understanding of

fluid mechanics, from which we can derive less general models and predictions to specific applications.

Rational Choice models in Political Science are designed in a similar fashion. They provide explanations of macro-phenomena that allow for the understanding of specific cases.⁴ They often depart from general models to particular ones (for example, the general model of game theory and the variety of game settings are analogous to Navier-Stokes equations and modelling in fluid mechanics). The mistake made by many critics is to confuse a type explanation with a token explanation. Saying that a particular individual does not comply *ipsis literis* with the dicta of rational behaviour is a misunderstanding of the model, the prediction and the explanation it provides. Furthermore, as one cannot expect to solve for deflexions in solid beams using Navier-Stokes equations, one cannot demand that a model explains more than it was designed to. Much of the debate in Political Science has been following these lines and that is one of the reasons why, in 2017, we are still dwelling over the validity of models as a method. I will turn now to this discussion.

RATIONAL CHOICE, MODELS AND POLITICAL SCIENCE

The history of modelling in political science is tied to the development of statistical tools in the behavioural revolution. Before that, the discipline had evolved under a philosophical and historical vein, which was largely constituted of essays on Law, constitutions and philosophical thought (ALMOND, 1998). The behavioural revolution shifted the discipline to a more scientific approach to knowledge, based on statistical testing and collection of empirical data (EASTON, 1985; FARR, 1995; KIRKPATRICK, 1962). Yet formal modelling would gain its share in journals only after Kenneth Arrow probed his impossibility theorem. More importantly, by using a set of logical deductions, Arrow showed that political science could benefit profoundly by using mathematics as a means of explaining political phenomena.

The 1980s and 1990s witnessed a profusion of formal modelling in the discipline, mainly through what has become known as RCT. Evidently not all rational choice is formal (COX, 1999; SNIDAL, 2006) and not all formal models are rational choice ones (MORTON, 1999). However in some specific venues formal models of rational choice have displayed a prominent presence. One of those is clearly the *American Political Science Review*, which is the most prominent and prestigious journal of political science in the USA.⁵

This pervasive presence of formal modelling in the discipline has caused discontents to criticise the plausibility of using mathematical models to understand political phenomena. Green (an experimentalist) and Shapiro (a qualitativist) strongly doubt that RC models enhance our knowledge and their account consists of a series of attacks based on the same keywords: lack of empirical evidence, contradictory predictions (when compared to the real world) and unrealistic assumptions (HODGSON, 2012; SARTORI, 2004). These flaws would render RC useless, and modelling a pathology in itself. Other critics prefer to follow the lines of Herbert Simon's and Kahneman and Tversky's accounts of bounded

4 Dickson (2006:455) makes this point even clearer: "The epistemology of rational choice in positive political theory involves learning of a different kind. Typically, positive rational choice models seek to explain, or at least to provide a mechanism for or an account of, *macro-level* phenomena. What might be considered the microfoundations of political science (...) are generally not the objects of interest for rational choice political theorists. Instead, these aspects of human nature are stipulated by assumption, almost always in the form of standard decision theoretic axioms. Investigation of these microfoundational questions is generally left as an exercise for another field – psychology, perhaps, or the behavioural branch of political science – to the extent that rational choice theorists conceptualize it as a task at all."

5 Indeed, a large share of the articles published in the APSR were to some extent based on rational choice accounts and/or formal modelling. Norris (1997) estimates that in the 1990s (until the moment of the publication of her paper) about 30% of APSR's articles contained either a Rational Choice or deductive approach, against 16% in the 1980s. In the years 2000s, however, formal models started to fall behind quantitative and qualitative/interpretive approaches, both in terms of new submissions and papers accepted (Ishiyama, 2015).

rationality (KLEIN, 2001; GIGERENZER and SELTEN, 2001; SELTEN, 2001) in their attacks on the theory. In this line of thought, the assumption of rational agents with perfect transitive orderings is flawed, for framing effects and preferences reversals are some of the cognitive processes that invalidate the principles of dominance and invariance, which are essential to the rational actor as postulated by RCT (KAHNEMAN and TVERSKY, 2000).

Both criticisms, although enlightening in some aspects, are founded on troublesome views about modelling and the prospect of testing and falsifying theories. They tend to believe that the only way of judging a model is by empirical evidence and it should be the sole purpose of any model in Political Science.⁶ In previous sections I showed how models can play different roles. Clarke and Primo (2007) list five types of models in political science (foundational, structural, generative, explicative and predictive) and examples of their applications; Morton (1999) and Eriksson (2011) add that models may serve to generate other models; Hausman (2005) claims that models can be used to devise experiments aiming to test certain assumptions about people's preferences; Morrison and Morgan (1999) state that models of rational behaviour serve to explore certain aspects of the theory; Dickson (2006) says RC models have been devised in normative. Such a variety of applications cannot be summarised under the obvious umbrella of empirical testing, especially in the terms set by critics. They seem to seek token explanations that could be validated by empirical evidence from specific cases, ignoring the intrinsic complications in deriving a feasible test from formal models which were not initially conceived for statistical purposes. This perspective, known by some as the standard rationale (JOHNSON, 2017), requires models to be testable via empirical analysis. But then RC theorists and formal modellers are faced with the challenge of defining what a credible test should look like, for critics hardly ever specify any guidelines for conceiving and conducting a test – perhaps, because it is intrinsically complicated to translate a formal model into a test (ERIKSSON, 2011; MORTON, 1999).

One of the reasons for this eternal quarrel in the discipline is pointed out by MacDonald (2003): RCT lacks a definitive epistemological foundation that could provide guidance for its aspirations as a political theory. I am not sure whether this is the most pressing issue, as for I believe that hierarchies of knowledge in political science share also part of the explanation of these disputes.⁷ The problem with the debate in Political Science is that critics extrapolate models to serve purposes for which they were not designed. Some prefer to disqualify models' rational-theoretical assumptions on the basis of cognitive and psychological arguments. Others accuse models of not providing meaningful prediction, only trivialities. Nevertheless

6 On this matter, Clarke and Primo (2007:741) affirm: "As models in political science became more prevalent, the uses to which we put those models shifted significantly, and today, the emphasis is on using models to generate *testable* predictions that serve as hypotheses for subsequent data analysis, which in turn is interpreted as a test of the model. The field has created a hierarchy of models where those that are "tested" are valued more highly than those that are not tied to a regression analysis. While much ink has been spilled arguing for this test-the-model approach to the study of political science, little attention has been paid to justifying and rationalizing the method. On the rare occasions that justification has been attempted, the results have been maddeningly vague. Why test predictions from a deductive, and thus truth-preserving, system? What can be learned from such a test? If a prediction is not confirmed, are assumptions already known to be false to blame? These questions are never addressed in a satisfactory way."

7 Political scientists have been debating how a methodological predilection for quantitative approaches has become pervasive in the discipline. The Perestroika Movement (in the context of the American scholarship) in the beginning of the years 2000 called for more pluralism of theoretical and methodological approaches in the journals published by APSA. One decade later, the Data Access and Research Transparency (DA-RT) initiative has revived old schisms in the discipline. In this process, formal models tend to be considered as part of the quantitative tradition (Lupia and Alter, 2014), although this claim is disputable. However, editors' reports of the APSR (Ishiyama, 2015) and the American Journal of Political Science (Jacoby et al., 2017) have shown that formal models are accounting for less than 10% of total submissions and publications in these journals, whereas statistical-oriented papers account for approximately 50% (varies from year to year) of total submissions and publications. This tendency is observed in other major journals (some favouring more qualitative and interpretive methodologies), with the clear exception of the Journal of Theoretical Politics, which publishes a variety of formal models. There is a politics of science in the discipline, where formal modelling is currently disregarded as a useful approach to understanding political phenomena. Part of the debates ignore this issue, claiming without any bibliometric evidence that formal models are dominant in Political Science. The argument, however, is mobilised to criticise models and, to a great extent, RCT.

they ignore the achievements of formal modelling and RCT. Thanks to Arrow's impossibility theorem we now know that some results cannot be expected in democratic settings without imposing a dictator's will. Olson's logic of collective action allowed for the construction of theories that explained how the tragedy of collective action and free-riding could be avoided – Olstrom's works are essentially a collection of explanations and solutions to these problems. Shepsle's structured equilibrium tackled the role of institutions in decision-making. Tsebelis' theory of veto power allowed for a general understanding of political stability. These examples share in common the use of formal modelling to derive explanations about macro-phenomena (HINDMOOR and TAYLOR, 2015). To some extent, they have helped us to understand complex political phenomena without resorting to countless case studies and by tailoring type explanations that encompass a variety of token explanations (DOWDING, 2016).

Therefore, if RCT and modelling are to be judged as successful or not, one has to expand her understanding of what the theory entails, especially in terms of models' assumptions of rationality, utility maximization, transitivity etc. As Cox (2004:172-173) suggests:

“Another way to think about rational choice in social science (...) is that it focuses on the system of human interaction and black boxes the constituent parts of the system (humans). (...) The argument is about how much internal structure, how much human nature, we need to bring in to our models of social interaction. However much you decide to bring in, you can presumably always be criticized for not appreciating even richer conceptions that tap into levels even lower in the architecture of complexity (...). Moreover, however much you decide to bring in, the resulting social science is not comparable to Newtonian mechanics in precision”.

However, even among rational choice theorists and modellers there is still a sense that more should be expected from models, or at least more should be said about their explanatory capabilities. Johnson (2014 and 2017) affirms models serve conceptual purposes, a claim that is endorsed by Rubinstein's (1991) view on game theory that the former extrapolates for modelling as a whole. Indeed, models can serve this function, or rather models might be used to “explore the implications of theories in concrete situation” (Morrison and Morgan, 1999, p. 19). But even in this case they display some connection with reality, much in the sense proposed in Sugden's (2011) credible worlds. Such connection emerges in the form of hypotheses or predictions derived from the model. Yet here lies a profound disagreement among political theorists: should predictions be solely related to empirical evidence a la token explanations? In Johnson's view, “[h]ighly influential formal models often make no prediction whatsoever” (2014, p. 556), mentioning Arrow's impossibility theorem and McKelvey and Schofield's chaos theorems as examples of such models. He believes that the “standard rationale”, with its focus on empirical testing of predictions, is not suited to evaluate models, for they should be understood as conceptual tools without any compromise of predicting anything – pretty much like an object in Clarke and Primo's (2012) language. I am afraid that there is a semantic disagreement playing around the term “prediction”. Arrow's theorem indeed makes a prediction about certain political phenomena: there is no institutional procedure for aggregating individual values into collective decisions that does not violate one of his principles (collective rationality, Pareto optimality, independence of irrelevant alternatives, universal domain and non-dictatorship). This prediction does not apply to a very specific setting in country A or B, it is not a what-is-going-to-happen prediction. As Dowding (2017: 221) distinguishes between two types of

prediction, namely scientific and folk prediction: “in the philosophy of science throughout the twentieth century, the term prediction means ‘what the independent variables entail for the dependent variable’. We can call it ‘scientific prediction’ if you like. It never meant ‘what is going to happen’: we can call that ‘folk prediction’. Of course, scientific prediction enables folk prediction, but they are not identical”. Arrow’s theorem, Tsebelis’ veto power, Olson’s collective action problem share in common the feature of providing scientific predictions of political phenomena. Empirical evidence might generate folk predictions based on the scientific predictions of those models. Nevertheless this should be understood as a possibility instead of a contingency, for folk predictions might not be attainable even in face of empirical evidence: for example, one cannot predict with 100% certainty who will win the next election in the United States, or if it will rain in Canberra on August, 23rd 2018.

In my understanding, models serve different purposes, but their *raison d’être* is to generate predictions and hypotheses. Models are not Chinese porcelain dolls that we put in a shelf of political epistemologies and methodologies for display: if anything, they are Lego bricks that we use to represent reality, attempting to provide explanations about relevant phenomena. Therefore, models should be judged by their capacity for providing explanations about relevant phenomena in the real world. Empirical evidence derived from specific cases should be treated with parsimony for it is not a definitive tool to falsify a model – not to mention a theory.⁸ Furthermore, we should keep in mind Popper’s advice that one cannot dismiss a model without proposing a better one (and by “better” he meant one that could offer more accurate predictions about the real world). Explanations are replaced by more accurate explanations, not by empirical tests themselves.

CONCLUSION

Formal modelling is still a controversial issue in political science mainly due to the misconceptions about its explanatory capabilities. Much of the disagreement, however, is ungrounded and fail to see modelling as a representational endeavour that attempts to provide explanations about relevant political phenomena. Criticisms on cognitive effects, empirical testing and quasi-rational behaviour share in common the fact that these factors hardly ever constitute the building blocks of models. Should they be considered? Unless they *de facto* contribute to the understanding of the political phenomena a given model is trying to explain, I doubt that incorporating them would enhance our models.

Explanation is a model’s currency. Thus, when comparing models, we are seeking the highest value among their currencies. Explanation also happens to be the currency of Political Science, for we aim to say something meaningful about political phenomena. In this sense, models fulfil their role as explanatory devices that generate hypotheses and predictions about the real world, contributing to the advancing of the discipline. Therefore, questioning their validity based on disputable empirical tests or extra-model assumptions might not be the right way to evaluate a model’s “fitness”, because they tend to ignore valuable teachings derived from formal models. As our aim as political scientists is to explain political phenomena, then I see no reason why explanation shouldn’t be the core of our judgement about models.

In criticising models, one has also to be attentive to the hierarchies of knowledge and the politics of science.

8 Falsifying models in face of allegedly “better” explanations is a hard task because we are looking for better scientific predictions. Folk predictions or token explanations are not capable of falsifying a model in face of another. Local victories are not a good measure of a model’s fitness. As Dennett (1991:48) states: “When one wins and the other loses, it will look to the myopic observer as if one “theory” has scored a serious point against the other, but when one recognizes the possibility that both may chalk up such victories, and that there may be no pattern in the victories which permits either one to improve his theory by making adjustments, one sees that local triumphs may be insufficient to provide any ground in reality for declaring one account a closer approximation of the truth.”

The stark reality of the debate is that formal models are attacked both by quantitative and qualitative researchers, who tend to argue that models do not offer anything more than trivial predictions and explanations. Throughout this paper, I presented some examples that enlarged our understanding of important political phenomena. Many others could be mentioned, especially on the interface between political science and behavioural economics, where evolutionary models have been incorporating dynamics to the analysis of complex phenomena. Yet in order for this debate to advance, we have to shift our interpretation of models to one that accounts for their isomorphism to reality and the type explanations they generate.

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