SSOAR

Open Access Repository
www.ssoar.info

Computational and Simulation Modeling of Political Attitudes: the 'Tiger' Area of Political Culture Research

Voinea, Camelia Florela

Veröffentlichungsversion / Published Version
Zeitschriftenartikel / journal article

Empfohlene Zitierung / Suggested Citation:
Voinea, C. F. (2016). Computational and Simulation Modeling of Political Attitudes: the 'Tiger' Area of Political Culture Research. *European Quarterly of Political Attitudes and Mentalities*, *5*(1), 1-21. https://nbn-resolving.org/urn:nbn:de:0168-ssoar-459474

Nutzungsbedingungen:
Dieser Text wird unter einer CC BY-NC-ND Lizenz (Namensnennung-Nicht-kommerziell-Keine Bearbeitung) zur Verfügung gestellt. Nähere Auskünfte zu den CC-Lizenzen finden Sie hier:
https://creativecommons.org/licenses/by-nc-nd/4.0/deed.de

Terms of use:
This document is made available under a CC BY-NC-ND Licence (Attribution-Non Comercial-NoDerivatives). For more Information see:
https://creativecommons.org/licenses/by-nc-nd/4.0

gesis Leibniz-Institut für Sozialwissenschaften

Mitglied der Leibniz-Gemeinschaft

European Quarterly of Political Attitudes and Mentalities EQPAM
Volume 5, No.1, January 2016
ISSN 2285 – 4916
ISSN-L 2285 - 4916

Computational and Simulation Modeling of Political Attitudes: The "Tiger" Area of Political Culture Research[1]

Camelia Florela Voinea
Department of Political Science, International Relations and Security Studies, Faculty of Political Science
University of Bucharest
Romania

Date of submission: December 15th, 2015 *Date of acceptance: January 23rd, 2016*

Abstract

In almost one century long history, political attitudes modeling research has accumulated a critical mass of theory and method. Its characteristics and particularities have often suggested that political attitude approach to political persuasion modeling reveals a strong theoretical autonomy of concept which entitles it to become a new separate discipline of research. Though this did not actually happen, political attitudes modeling research has remained the most challenging area – the "tiger" – of political culture modeling research. This paper reviews the research literature on the conceptual, computational and simulation modeling of political attitudes developed starting with the beginning of the 20th century until the present times. Several computational and simulation modeling paradigms have provided support to political attitudes modeling research. These paradigms and the shift from one to another are briefly presented for a period of time of almost one century. The dominant paradigmatic views are those inspired by the Newtonian mechanics, and those based on the principle of methodological individualism and the emergence of macro phenomena from the individual interactions at the micro level of a society. This period of time is divided in eight ages covering the history of ideas in a wide range of political domains, going from political attitudes to polity modeling. Internal and external pressures for paradigmatic change are briefly explained.

Keywords: political attitude modeling, political culture modeling, computational modeling, simulation-based modeling.

This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

[1] Paper presented at the European Conference on Political Attitudes and Mentalities, 4the Edition, ECPAM'2015, University of Bucharest, December 2-3, 2015. MS PowerPoint Slide presentation of this paper available online on ECPAM'2015 website.

Corresponding Author: Dr. Camelia Florela Voinea, Associate Professor
Affiliation: Department of Political Science, International Relations and Security Studies, Faculty of Political Science, University of Bucharest
Address: #8, Spiru Haret Street, 010175 Bucharest, Romania
e-mail: camelia.voinea@fspub.unibuc.ro

Copyright @ 2016, Camelia Florela Voinea
European Quarterly of Political Attitudes and Mentalities - EQPAM, Volume 5, No.1, January 2016, pp. 1-21.
ISSN 2285 – 4916
ISSN–L 2285 – 4916

EQPAM Volume 5 No.1 January 2016
ISSN 2285 – 4916
ISSN-L 2285 - 4916

Introduction

There are quite few paradigms which have shaped the development of computational and simulation modeling of political attitudes. The classic model-invariant paradigm which makes intensive use of empirical data in order to identify patterns of meaningful regularities has been the dominating modeling paradigm in Social and Political Analysis as well as in Social and Political Psychology for almost one century.

Inspired by Forrester's idea of forecasting the performances of real systems by simulating them with artificial systems, Social Psychology experimental research has introduced the idea of simulation of social and political phenomena as predictions of social processes. This paradigm has been further adapted so that computer simulations could be used.

Many modeling paradigms have been in some way or another influenced by a mechanical view on society and interaction: *force, mass, acceleration* and *space* have been the most usual concepts used in defining social influence, and in modeling the dynamics of change. Social influence theories as inspired from the force field theories in Physics are still dominating the Social Psychology and Political Science experimental research. The mechanical model of *force* and *motion* has found in the modeling of behavior and attitudes, as well as in the modeling of social action, the most fertile terrain: attitudes, beliefs, and ideologies have been approached in this modeling paradigm. Social and political communication research, as well as the public opinion dynamics research has offered strong support to the ideas of the mechanics of message communication, information, and social impact.

The mechanical paradigm has been replaced by the cognitive paradigm: from congruence theory and consistency-based modeling theories of political attitude change to hot cognition and the combinations of semantic networks, neural networks and social network. Logic and semantics have been replaced by different ways of constructing and manipulating the meaning of memory-stored attitudes and beliefs. One such example is represented by Axelrod's simulation solution which uses similarity-based interaction, where the similarity is achieved by identifying the attributes shared by two or more agents (Axelrod, 1997).

However, the mechanical view on political attitude change showed that what we actually model is the *strength* and *intensity* of individual reactions to social and political stimuli. The use of semantic networks and neural networks in achieving political attitude change, like for example in the hot cognition hypothesis, are too large and become intractable when used for representation of real situations (Kim, 2009). The mechanical view has employed so far the principle of composition-decomposition, and concepts like hierarchy and structure, which make reference to the Aristotelian notions of taxonomies, empirical observation or motion.

In political attitude change, as well as in political culture change, the mechanical view becomes inapplicable due to multiple agents, and complexity of social interaction. Moreover, in social context, when there are many interacting individual agents, the problem of meaning and logical consistency makes representation based on semantic networks almost intractable.

Political attitudes, in particular, and political culture in general, assume a space which has not the same metric as the physical space. Mechanics of force is not equivalent and not even similar with the social influence or with the persuasive effect of human communication.

The necessity of approaching attitude change modeling in a new paradigm arose from the necessity to describe political attitude in terms of what is actually changed: meaning?, symbol?, affect?, value?, belief? , or perhaps all of them at once…

Traced back to the conceptual definition of attitude (Allport, 1935), the attitude modeling reveals the necessity of a new modeling approach on how attitude formation and change are operationalized.

ISSN 2285 – 4916
ISSN-L 2285 - 4916

Political attitudes modeling research has supported the burden of the computational and simulation views: more than the other elements included in Converse's definition of political culture – beliefs, and values – the political attitude change theories have provided the means to carry out and, eventually, fulfil the expectations with regard to the explanative achievements of various modeling paradigms. Taking advantage from similar or complementary aspects with either public opinion dynamics or culture drift modeling research, political attitude change research has been by far the most accessible area to theoretical and experimental modeling attempts, and also the area which has best assimilated the computational and the simulation modeling methodologies and technologies. For this reason, it is hereby considered as a reference for the entire research area of political culture in what regards the computational and simulation modeling paradigms. Right now there are very few models in which political culture modeling could cover simultaneously political belief (ideology), value, and political attitude issues. Instead, there are many separate modeling approaches for political attitudes or political ideologies, without any practical chance of unifying them into integrate models. Moreover, existing computational and simulation modeling of the emergence of political attitude phenomena, which are usually achieved by agent-based simulation modeling of the individual interactions in artificial societies, cannot explain how these macro phenomena would reach back the individual agent and influence her behavior and action decision-making.

For these reasons and several others especially concerning the internal and external pressures toward changes in the modeling paradigms, the political attitude modeling paradigms are presented in a historical ordering, emphasizing also the experiences shared by political culture modeling research. Though far behind the advances noticed in political attitude modeling, political culture could nevertheless extend the lessons learned from the political attitude and ideology modeling with the explicit goal of identifying the means and the targets in a potential paradigmatic shift toward complexity integrative modeling paradigms of political beliefs, attitudes and behaviors. This exercise could reveal the critical mass of modeling expertise which has been accumulated in various niche areas of political culture modeling, like the computational and simulation-based modeling of values and value change, political attitude change, and political beliefs (ideology) change. Moreover, it would appropriately inform the areas of policy and polity modeling, which right now could hardly cope with the complexity of their own issues.

This paper presents a brief overview of the computational and simulation modeling paradigms and the main paradigmatic changes in political attitudes modeling research.

This paper is organized as follows: *Section 1* provides a short analysis of the main paradigms which have dominated the computational and simulation modeling of political attitudes. They divide in two main classes: top-down (causal) models, and bottom-up (emergence) models. *Section 2* provides a brief history of the periods of time characterized by a particular dominant modeling paradigm. Areas of political attitudes modeling, in particular, and political culture modeling, in general, are presented in a structured view which is both chronologic and conceptual. Thus, from a historical perspective, the political attitudes modeling research has known eight major phases of development from early 1940s until the present times. From a conceptual perspective, the history is combined with major conceptual modeling approaches like: political attitudes in electoral studies, political culture, political ideology, and integrative models. *Section 3* introduces a view on the internal and external pressures toward a paradigmatic change, while in *Section 4* some research questions arise.

EQPAM Volume 5 No.1 January 2016
ISSN 2285 – 4916
ISSN-L 2285 - 4916

1. From Representation-Based to Interaction-Based Modeling

There are several levels of reviewing the modeling paradigms in political attitude change research. One interesting level is a comparative view between representation-based and interaction-based artificial systems. It defines the type of modeling approach as either top-down (causal) or bottom-up (emergence).

In the classic modeling paradigm of Artificial Intelligence theories, individual agents are represented as memory-based agents able to learn and store concepts and data, to take action decisions, develop behaviors, schedule and achieve goals (Newell, 1994). Representation-based paradigms have guided modeling research towards technologies of combining the requirements concerning the number of agents (multiple agents) with those concerning their cognitive abilities (learn and make action choices).

In the modeling paradigm of Artificial Life theories, individual agents are units of combined data acquisition (like communication and information processing), and procedural abilities (interaction). Interaction between any two agents is a process with dynamic outcomes. Agent-based systems (ABS) combine a principle of interaction, like the methodological individualism, with the operational specification of such agents. Agent-Based Models (ABM) are able to explain how macro-level phenomena emerge from the individual interactions at micro-level.

Both paradigms and their associated computational and/or simulation technologies have been employed in political attitude change modeling research. After almost eighty years of research experience achieved in both experimental, and computational and simulation modeling approaches, the limits of both paradigms could be identified and this might be a sign that new requirements are or have been already formulated so as a paradigmatic shift is ongoing. Another sign is that a critical mass of concept, theory and experimental outcomes have accumulated in the area providing for a qualitative change of the method and expectations in what regards the explanative means and power of political attitude change models.

One advantage of the agent-based models is their ability to explain the emergence of macro attitude phenomena by means of simulating the individual interactions among multiple goal-driven autonomous individual agents. One severe limitation of the interaction-based paradigm concerns its inability to explain how emergent phenomena at the macro level could reach back the individual agent and influence her beliefs, attitudes, and behaviors (Voinea, 2013).

Both paradigms – representation-based as well as interaction-based – have provided only limited support for coping with the overall integrative modeling goals and also with the complexity of managing the relationships between political attitudes, beliefs and values in each individual agent. Following the general criterion of interaction modeling, the modeling approaches on social attitude change, political attitude change and political culture change could be differentiated by roughly identifying their levels of complexity:

In social attitude change modeling, the basic interaction is operationally modeled as communication (i.e., exchange of messages between agents) and behavior accessibility. In political attitude change modeling, the basic interaction is operationally modeled as political communication and political belief (ideology) storage, accessibility and update. In political culture change modeling, the basic interaction is operationally modeled as political communication, political belief management, political behavior development and maintenance, and the management of cultural heritage, which includes value dynamics and value management. The value level of interaction concerns the initial conditions for the other types of interactions to take place. While social context links action to information, political context links action to information and belief, and finally cultural context links action to information, belief and value. Interaction dynamics as well as the outcomes of interaction depends on the inner and outer context, as well as on the cultural context. Value management means the processes which manage the values, their impact on the other contexts (Schwartz, 1992, 2006). Value may get updated so that attachment to a value could be

ISSN 2285 – 4916
ISSN-L 2285 - 4916

revisited by each individual agent, hence beliefs, actions, emotions, and attitudes, would temporarily change. However, attachment to a value could be hardly reversible or irreversible (Rokeach, 1968).

One could easily note an increasing level of complexity from social attitude change to political culture change modeling in terms of basic interactions.

Over the years, political attitude change modeling has revealed several other advantages and limitations of existing modeling methodologies and technologies. They are divided in narrow modeling areas, which again is a sign that political attitudes as well as political culture complexity is actually overwhelming the real capacity of the existing models to cope with this complexity.

2. Conceptual Backgrounds

Conceptual research on social attitudes starts by the end of the nineteenth century with the original theoretical considerations in the philosophy of mind, psychology, and sociology domains. Born at the beginning of the twentieth century at the interdisciplinary border between psychology, and sociology with strong influences from the brain and neural sciences and from the philosophy of mind, Social Psychology has the "attitude" as its fundamental concept, being often called the science about attitudes. Only later, when the discipline of Political Psychology has been founded by Howard Lasswell, the original concept of social attitude has been extended so as to cover the particular attitudinal issues defined and approached in political science research. Though initially dominated by the Freudian paradigm and also by a moral view, Political Psychology has soon embraced different views and different paradigms like Social Psychology and other social and political sciences did after the cognitive revolution. Like the research on social attitudes in Social Psychology, political attitudes research has been initially oriented toward definitional and measurement tasks. Starting with the classic work developed by the Michigan Group under the direction of Angus Campbell as well as with the Philip Converse's work on political culture in the early 1960s, political attitudes have become the preferred target of political behavior, political beliefs (ideology), and political culture modeling studies.

Strongly influenced and closely tied to Social Psychology, the development of the political attitude research area has been divided in this paper into periods of time which are characterized by a dominant modeling paradigm. Cumulating influences from the research in public opinion dynamics or group dynamics, political attitudes modeling research has often adopted the same paradigms and developed or applied similar modeling approaches. The paradigm change from one age to another has often been tied to the paradigmatic shifts toward complexity which emerged in Social Psychology.

However, its characteristics and particularities have often suggested that political attitude change approaches to political persuasion modeling reveal a strong theoretical autonomy of concept which entitles it to become a new separate discipline of research (Mutz, Sniderman and Brody, 1996). Though this did not actually happen, political attitudes modeling research has remained the most challenging area – the "tiger" – of political culture modeling research, in particular, and of political science, in general.

2.1 (Mid'1800s-1900s) Attitude Concept

By the end of the nineteenth century, some remarkable works in the philosophy of mind approaching the mind-body problem include early conceptual considerations about a new notion: the attitude (Spencer, 1867: p.4; Giddings, 1896; Wundt, 1902; James, 1918: p.241). The conceptual modifications and clarifications of the social and political attitude definitions at the beginning of the 20th century mirror the theoretical influences coming from Social Psychology, Political Psychology, and Political science. Over

EQPAM Volume 5 No.1 January 2016
ISSN 2285 – 4916
ISSN-L 2285 - 4916

more than one century the different chronological phases have often marked deep transformation of the initial collection of concept definitions by underlying the paradigm shift from one period of time to the next. At the beginning of the twentieth century, Gordon W. Allport (1935) succeeds to synthesize the social attitude research literature, and acquires a large agreement of the research community for his definition of social attitudes. Almost in the same time, Howard Lasswell (1927, 1936) writes about political attitudes.

2.2 (1940s-1950s) Empirical Modeling of Political Attitudes

From the mid' 1940s until the late 1950s, Columbia Model was the dominating model aimed at evaluating the role of social context (*small worlds paradigm*) in shaping and changing political attitudes. A decade later, the Michigan Model provides the dominant paradigm in the experimental research emphasizing and the role of political ideology in political attitude and voting choice modeling.

2.3 (1950s-1960s) Political Attitudes Modeling in Presidential Elections Studies

In spite of relevant advances in attitude theory as approached by Social Psychology, much of the political attitude research developed before the mid'1960s remained, however, anchored in the definitional and measurement approaches. As initiated in the same period, the experimental studies based on empirical and survey research integrate quite fast the nascent computer technologies. For a while, empirical modeling approaches are closely followed by computer-based models which do not go far from classic empirical data analysis. However, the potential force of computational modeling has been soon revealed even by the early computational technologies. The major argument in favor of the new computing technology was that it allows mathematical and computational methods get integrated in modeling approaches.

2.3.1 First Computer Models of Political Attitude and Voting Choice

The initial computer-based approaches are aimed at evaluating attitude formation and change phenomena in large electorates. William N. McPhee among the first to realize this huge potential for the political attitude modeling research,

The *Voting Choice Computer Model* elaborated by William McPhee and collaborators starting with the late 1940s and published much later, during the 1960s, is considered to be the first computational model of attitude change. The *Community Referendum Model* (Abelson and Bernstein, 1964) has been elaborated almost in the same time and is considered as an early model of simulation which has inspired the agent-based modeling and Social Simulation research. Based on the concepts and theories developed by Paul Lazarsfeld and his collaborators (Lazarsfeld, Berelson, and Gaudet, 1944), William McPhee elaborated the theoretical basis and the operational concept of a voting choice simulation model (Berelson, Lazarsfeld, and McPhee, 1954), which he employed in the analysis and evaluation of the presidential elections' unfolding, and moreover, in the prediction of the turnouts. Later on, together with Robert B. Smith and Jack Ferguson, McPhee worked out the operational version of the model, and formalized and described the model in technical details, which have been published in latter works (Smith, 1985; McPhee and Smith, 1962; McPhee and Ferguson, 1963). As the author makes it explicit, the model's idea is the influence of the social context on the individual's voting choice.

The role played by the social context in the individual electoral behavior is studied along with two other factors: perceptual stimuli, and internal predispositions (McPhee with Smith and Ferguson, 1963: p.75). What McPhee aims to prove with this model is a view which reinforces the idea of behavioral revolution in political science which started with the Columbia School: social context is conditioning the political behavior learning in ways which can be modeled in a Skinnerian key.

ISSN 2285 – 4916
ISSN-L 2285 - 4916

However, the most relevant achievement of McPhee's model does not reside in the behaviorist scheme of action and learning, but, surprisingly, in overrunning this limits toward achieving an interesting dynamics of attitude change in an operational construction which was essentially based on processes and mechanisms: a three-processes main loop which was meant to simulate the flow of influence from the (external) stimuli to the final choice of voting

William McPhee and James Coleman initiate and develop for the first time a project (1958) on the potential relationships between micro-level individual voting preferences and the macro-level outcomes of elections. They foresee the possibility to explain the emergence of political phenomena in mass publics by taking into consideration micro-level individual voting preferences and interactions, on the one hand, and the outcomes of electoral processes as mirrored at the aggregate data level, on the other hand.

2.3.2 Computer Simulation Models of Communication Campaigns Impact on Individual Preferences

The *Community Referendum Model* (Abelson and Bernstein, 1964) simulates how citizens' attitudes change as a result of the campaign communication in a community referendum. This artificial construction consists in a "miniature" dynamic system which is implemented as a symbolic replication of a real electoral media campaign.

2.4 (1960s-1970s) Empirical Modeling of Political Culture

Converse's empirical model (1964) of political attitude instability and political culture dominates the political science experimental research from the 1960s to the 1970s. The basic idea is that political culture could be conceptually and operationally modeled by identifying patterns of political attitudes, political beliefs (ideology), and behavior (voting choice) and their causal associations in aggregate data obtained from survey research. Along with another famous political culture modeling approach elaborated by Gabriel Almond and Sidney Verba (1963) remain influential in political culture modeling for providing a causal paradigm of research. Converse's model explains political attitude instability by weak educational and ideology backgrounds in citizens' electoral preferences. Though contradicted much later by Achen's model on the political attitude stability (1975) as the final outcome of the measurement process of subjectively perceived electoral issues, and also by Zaller's model (1992), Converse's model remains the dominant model in political culture modeling for its strong idea of explaining voting behavior by causally combined patterns of political beliefs and attitudes in survey data (Converse, 2006). Its influence is determinant also for the first empirical polity model (Erikson, Mackuen and Stimson, 2002), thus creating a new dimension of research.

Revisiting the classic political culture theory after the major political regime change phenomena in the Eastern Europe, William Mishler and Detleef Pollack (2003) introduce the idea of combining *thick* and *thin* culture concepts in a *continuum*. Though qualitatively it is the most relevant concept in the culture modeling studies during the past century, their model unfortunately fails to provide for an operational theory able to sustain the new concept.

2.5 Newtonian Mechanics-Based Modeling of Political Attitudes

2.5.1 System Dynamics Modeling Paradigm

System Dynamics (SD) is the first computational and simulation modeling paradigm used in the political attitude modeling research. It provides for the modeling of dynamic change in system's structure and behavior. This type of attitude change modeling research has been founded by John E. Hunter who elaborated mathematical models of attitude change. His attitude change models resemble the models of

EQPAM Volume 5 No.1 January 2016
ISSN 2285 – 4916
ISSN-L 2285 - 4916

Newtonian dynamics of objects which are put in motion by forces. Hunter and his collaborators have developed and/or contributed to the refinement of the basic operational models in attitude change modeling: Proportional Change Model, Belief Certainty Model, and Accumulated Information Model (Hunter, Danes and Cohen, 1984; Hunter, Levine and Sayers, 1976; Levine, Hunter and Sayers, 1972).

Hunter's work in attitude change modeling research provided for the foundation of Galileo Model (Woelfel and Saltiel, 1978) a theory about attitude change modeling in multidimensional cognitive spaces. Galileo model uses a cognitive theory to approach attitude change as an effect of the changings in the relationships between the concepts in a cognitive space.

2.5.2 Multidimensional Attitude Change Models

The idea of using a mathematical model in psychology to handle the mental representations of experience has been used by Joseph Woelfel and John Saltiel to elaborate the Galileo Model (1978). They employ the notion of "force" from the Newtonian mechanics to conceive and measure the change in attitudes as induced through (persuasive) message communication.

The Galileo Model has got a special relevance for the idea of representing the experience and for the possibility of modeling the change in attitudes, beliefs, and behaviors altogether at both individual and social level. Riemannian cognitive multidimensional spaces are defined and used in order to describe and operate the multidimensional attitude change. Galileo framework includes several classes of spatial models: spatial-linkage models, hierarchical models, and the multidimensional attitude change models.

2.6 (1970s - 1980s) Force Field Modeling

The Social Force Field Models have appeared and developed in a time dominated by the revolutionary effects of the theory about social force field (Lewin, 1951).

*Social Impact Theory (*Latané*,* 1981*)* is an empirical-based individual-level theory of social influence. The *Social Impact Theory* has both a *static* (Latané, 1981) and a *dynamic* version (Nowak et al., 1990).

Bibb Latané has formulated the social impact as a formal (mathematical) model of social influence defined as any influence on any of those attributes of an individual person which are, at least partly, socially determined. Social impact is modeled as a direct proportionality between the magnitude of the impact and a multiplicative function of the strength, ***S***, (the persuasive power of the others), immediacy, ***I***, (closeness in physical space terms), and number of others, ***N***, when the source of influence is the group, and the target of influence is the individual. When the individual is the source, and the group is the target of influence, the social impact is modeled as an inverse proportionality between the magnitude of the impact and the multiplicative function *f* described above.

In the *static* version, *Social Impact Theory* makes explicit the dependence of the social impact on the number factor only, and identifies the function *f* to be a power function, whose characteristics make it able to describe the marginal decreasing effect of an increasing number of others. As the other factors, S (strength) and I (immediacy) are kept constant the initial version is considered a static theory. As a metatheory, the *Social Impact Theory* shows how the operation of social influence processes at the individual level are moderated by factors involving (a) spatiality and geometry of the social space, (b) group size, and (c) political attitude's strength. Its implications are manifolded. It is aimed at predicting group-level phenomena by studying the individual response to group pressure. It introduces the concept of physical space in the modeling of political attitude change phenomena, with implications on the ideology and political geography research. It is aimed at studying the phenomenological connections between the micro and the macro level of a social system in scenarios of social influence (persuasion, social pressure).

ISSN 2285 – 4916
ISSN-L 2285 - 4916

2.7 (Since early 1990s) Bottom-Up Simulation and Its Impact on Political Attitudes Modeling

During the 1990s, the "*would-be worlds*" paradigm, as introduced and explained by John Casti (1996), revealed the importance of bottom-up modeling, which finally comes to dominate the political science research picture with the artificial agents-based systems and the artificial society models (Epstein and Axtell, 1996; Axelrod, 1997; Gilbert, 1995).

This shift could not diminish, however, the ever-growing interest in political cognition modeling research: motivated reasoning and hot-cognition paradigms have combined into integrated modeling approaches on political belief and attitude formation and change (Kim, Lodge and Taber, 2009; Thagard, 2010). These major developments stimulated the integrative modeling approaches as they required a shift of focus towards modalities of representation, on the one hand, and modalities of complexity simulation, on the other hand. While initially aimed at modeling human mind and thought processes in the formation and change of attitudes, it has surprisingly stimulated the social networking research and the complexity and emergence of macro political phenomena modeling which is now dominated by the artificial polity models.

2.7.1 Culture Dissemination Model

Though not directly addressing the issue of political attitude change, Axelrod's Model of Culture Dissemination (1997) is the most influential model in the area of computational and simulation modeling of social interaction. It models the social influence, culture emergence and dissemination phenomena with direct applicability to (political) attitude change. In the theory underlying the Culture Dissemination Model, Axelrod uses the term "thought experience" which has become a classic reference in the modeling based on virtual social and political experiments in artificial social systems. The model is considered to have laid the basics of agent-based simulations of social systems with multiple interacting autonomous agents. It is also considered a basic reference in Social Simulation research.

2.7.2 Diversity Survival Model

Robert Huckfeldt, Paul Johnson and John Sprague's *Model of Diversity Survival* is based on agent-based simulations and implements a constructivist (bottom-up) modeling approach to political persuasion in networks of interpersonal relations which employs an interaction mechanism based on methodological individualism.

2.7.3 Political Contagion Model

The Political Contagion Model developed by Johnson (1999) combines two theoretical approaches. One concerns the opinion formation and change during or across the election campaigns. The other one is the collective action and its emergence: political opinion and attitude change by discussions with peers in networks of interpersonal relations (dyadic networks) developed together with Huckfeldt (1995).

2.7.4 JQP Model

The Computational Model of Citizen (Kim, Taber and Lodge, 2010) uses JQP (Kim, Lodge and Taber, 2009, 2010) as a model of the common citizen exposed to electoral information: the citizen actor processes the political information in order to form evaluations of the presidential candidates. The experiments have been elaborated on the data concerning the American 2000 Presidential Elections. The model includes the most recent advances in the computational modeling of political attitudes and political behavior, political information processing and political cognition. The model covers most debated issues like the conscious and unconscious processes underlying political cognition. During the past two decades, the Stony Brook

EQPAM Volume 5 No.1 January 2016
ISSN 2285 – 4916
ISSN-L 2285 - 4916

School has developed researches on computational and agent-based modeling and simulations of the individual citizen and voter, political deliberation, and the emotional phenomenology underlying individual's evaluation of political candidates and policies. The model aims to explain how both unconscious thinking and motivated reasoning underlie the processes of formation and change of political attitudes and behaviors of common citizens.

The model is a remarkable theoretical work on the issues of implicit attitudes, automated and deliberate activation of attitudes, conscious and unconscious thinking, which have combined into a new perspective over political psychology, in general, and political attitudes, in particular. The JQP Model is based on a theory of political information processing. The theory concerns the cognitive theories of mind (Anderson et al., 2004). The two models of political information processing are: the on-line model (Lodge, Steenbergen and Brau, 1995) and the memory-based model (Zaller, 1992; Zaller and Feldman, 1992; Tourangeau, Rips, and Rasinski, 2000).

2.7.5 Political Attitude Strength and Stability Modeling

The attributes of attitude have been used to explain and predict behavior. Two main attributes have been studied: strength and stability.

PASS Model (Kottonau and Pahl-Wostl, 2004) is a computational and simulation model of political attitude change which combines several major modeling approaches on political attitudes, political cognition, and political information processing with a sophisticated procedure of revising attitude strength's measurable attributes.

2.7.6 Computational and Simulation Modeling of Ideology

The computational and simulation modeling methodologies and technologies involved in ideology modeling include multidimensional cognitive spaces, agent-based systems, and complex systems based on embedded neural and social networks. Each type of model emphasizes a different type of approach to ideology as both definition and modeling paradigm. Multidimensional spatial model of ideology (Serota et al., 1975, 1976) is a computational model which explains ideology change as an attitude change process in a multidimensional cognitive space. Ideology Polarization Model (Baldassari and Bearman, 2007) is an agent-based model of ideology polarization in networks of personal interrelations of individual agents. Clustered Ideological Landscapes Model (Lorenz, 2014) is an agent-based model which makes a comparison between empirical and generated data and evaluates the generative power of the latter by analyzing the qualitative aspects of emergent patterns of data. Complex System Model (Homer-Dixon et al., 2013) is an integrative cognitive model of ideology formation and change based on complex systems of embedded neural and social networks.

The ideological polarization model (Baldassari and Bearman, 2007) is a model of political influence which views ideology as a structure of attitudes toward political objects. The model includes the mathematical (formal) component which defines the conceptual framework, the computational component which defines the agent-based system and the operational solutions for the implementation of the conceptual model, a simulation component which describes the model runs, the case studies and the choice of parameters as well as the data generative processes, and the analytical component which includes the analysis of the generated data.

It is a bottom-up model of political influence which studies the macro-level effects of the individual interaction mechanism in a simulated social environment consisting in multiple individual agents and their interpersonal relations. The dyadic interactions are described as discussions in the network and facilitate the political ideological influence process. The outcome of this process becomes observable by means of

ISSN 2285 – 4916
ISSN-L 2285 - 4916

simulations in the emergence of dynamic configurations of the interpersonal relations network proving various polarization degrees on different issues from the issues considered initially.

The model approaches old issues with advanced computational and simulation tools and suggests new perspectives. The model aims at explaining the ideology polarization by studying the emergent effects of the interaction mechanism. Two dimensions of study indicates that the authors approach old issue – homophily and heterophily (Merton and Lazarsfeld, 1954) in local interpersonal networks – with advanced computational and simulation methods, namely agent-based system.

The model investigates the outcomes of processes of dyadic discussions characterized by the homophily-heterophily dynamics and aims at providing answers to two research issues: ideological and social polarization.

The *Ideological Landscapes Model* developed by Lorenz (2014, other) is extremely relevant for one of the latest trends in Political Science modeling research, especially in ideology modeling research: the "systemic effects" (Lorenz, 2014), that is, the meso-, and macro-level effects of the interaction mechanisms employed by the models based on artificial life technologies of generating interactions amongst multiple individual agents, like the multi-agent systems (MAS), agent-based systems (ABS), and complex adaptive systems (CAS).

The model is relevant for it defines ideology as a structure of political attitudes. By generating the same type of data patterns by means of combining an agent-based system and a bounced confidence opinion dynamics model, the Ideological Landscapes Model is aimed at achieving outcomes which replicate the shape, type and structure of aggregated ideological preferences from the empirical data provided by European Social Survey (ESS).

The comparison between the two classes of data outcomes – empirical and generated – allows for the analysis of the quality and precision of the mechanisms and processes employed by the artificial systems used in the modeling. The systematic manipulation of the parameters in the simulations provides the chance to study the details of models' design and architecture of mechanisms and processes.

The Ideological Landscapes Model is an agent-based model of ideological preference formation and change in populations of agents. Ideological landscapes are vectors of individual ideological positions in unidimensional ideological space.

From both theoretical and methodological perspectives, ideology modeling research has focused on cleavages which reflect a deep fragmentation of the domain: individual vs. social and spatial vs. non-spatial approaches (Homer-Dixon et al., 2013; Jost et al., 2009).

Cognitive Affinities Model (Homer-Dixon et al., 2013) is a computational model based on embedded neural and social networks which combines cognitive and affective aspects of political ideology. The model is aimed at applying the theory of complex systems to the modeling of ideology change. The conceptual framework approaches the dichotomies individual-group and cognitive-social such that an integrative solution is suggested. The integrative character of this solution resides in its capacity to bridge the gaps between the cleavages in modeling research on ideology formation and change phenomenology.

The theory underlying this model is based on Thagard's cognitive theory of cognition (2006). The model employs specific concepts, theories and methodologies for combining several cognitive paradigms: Eliasmith's theory on semantic pointers (2013).

2.7.7 (Since the early 1990s) Polity Modeling Research

Polity computational and simulation modeling research covers several classes of models: (1) the ethnical and nationalist insurgence polity model (Cederman and Girardin, 2007a, b), (2) the MASON RebeLand

EQPAM Volume 5 No.1 January 2016
ISSN 2285 – 4916
ISSN-L 2285 - 4916

Model (Cioffi-Revilla and Rouleau, 2010), (3) Polity Re-Construction Model (Sakamoto and Endo, 2015), and (4) Compartmental Model (Lang and DeSterck, 2012).

Open issues and concluding remarks address polity modeling in particular and political attitudes computational and simulation modeling in general. In the traditional computational modeling, polity modeling has been initially approached in the system dynamics paradigm with the aim of predicting state's resilience to stress factors defined in terms of civil conflicts (Choucri et al., 2007; Choucri et al., 2005).

Agent-based as well as the artificial society-based models have been employed in the emergence studies of civil conflicts. Latest modeling developments combine agent-based simulations with geo-referenced (GIS) data about the territorial configurations and human and material resource distributions as decisive factors in the conflict dynamics. To this aim, structured approaches model the polity as a geographically situated entity characterized by a territory with specific border and neighboring conditions.

Hierarchical polity models have been developed and used in various studies of political violence, civil unrest, uprisings and rebellions, ethnical insurgency in various geopolitical regions or countries in Asia (Afghanistan, Iraq, Iran, China), Eastern Europe (ex-Yugoslavia), Africa (Somalia, Sudan, Kenya, Eritrea, Ethiopia).

In the holistic models, polity is characterized by a territory with geography, topography, weather system and climate dynamics, resources and, eventually, with specific border and neighboring conditions. Holistic polity models allow the study of public policy emergence as governmental response to public issues. Besides traditional and current trends, ongoing polity modeling research aims in two more directions. One is the polity re-construction modeling, which addresses the post-confrontation and post-failure scenarios with the aim of building predictions over the state's stability and resilience to stress factors, conflict resolution, and sustainable development. The other direction is polity structural modeling, which addresses the structural configurations, the structural components and their relationships, and the simulation of polity behavior in various emergent structural configurations.

In both directions, political attitude modeling, especially that related to the concepts of new media and people empowering, appears as a fundamental dimension of polity modeling in both territorial and non-territorial approaches. Relevant examples are the studies of the Arab Spring revolutions. Though rarely combined so far in integrative approaches, political attitudes along with political culture and polity modeling might soon converge toward a complexity-based model of the artificial polity. It is most probably one of the main targets that both polity and political attitude computational and simulation modeling are heading to.

2.8 Political Culture Theory and Modeling: Between Old View and New Pressures

After 1989, the Eastern European overall political picture has become the subject of research in several areas of Political Methodology concerning processes and phenomena associated with major political change, post-communist transition to democracy, consolidation of democracy and democratic institutions.

The Eastern European typology of processes have been compared to other types of transition phenomena concerning post-authoritarian experience of political regimes all over the world, from South-, and Latin America, to ex-Sovietic, and African countries. Confronted, on a comparative analytical basis, with all these studies, various Eastern Europe and ex-Sovietic post-communist phenomena of transition to democracy have nevertheless raised perplexities and gave rise to paradoxes which are still expecting a comprehensive theoretical explanation. The debates concentrated on major research paradigms addressing either the economic (in materialist sense) or cultural (in idealist sense) facets of major political and social change phenomena (Kennedy, 2002; Pollack, Jacobs, Muller and Pickel, 2003; Klingemann, Fuchs and Zielonka, 2006). In particular, the (political) culture theories have been revived and reinforced by the need to approach and explain democratization and Europeanization phenomena.

ISSN 2285 – 4916
ISSN-L 2285 - 4916

It is, by all means, the complexity of the domain which prevents the students of culture to reach a consensus with respect to its definition. However, it is not the complexity only which divides the scholars in this heterogeneous community, but rather their distant, sometimes divergent, often hard-to-scale or hard-to-generalize empirical outcomes and/or theoretical conclusions drawn from different research methodologies, levels of empirical investigation, or conceptual and experimental paradigms (Johnson, 2003). In spite of strong critics, and scarce confidence in its explanative power however, political culture is periodically brought to the front by those in search for causes as well as effects whose meanings need more than economics or rational choice theory to be unraveled or which would otherwise remain hidden or poorly understood (Elkins and Simeon, 1979).

Eastern European typical transition to democracy processes revived the issue of political culture in order to find out possible explanations to puzzling phenomena like, for example, the return to authoritarian practices of the political elites in some EU-member countries, while their regimes were considered by the EU quite advanced in the process of democratic consolidation.

2.8.1 Theoretical Background

The debates on political culture addressing its explanative power are fueled by the controversies concerning the definition of culture as either a "property of collectivity", or as a property of the individual agent (Elkins and Simeon, 1979) emphasizing both a theoretical and a methodological ambiguity maintained by distinct schools of thought. The controversy comes from the different theoretical backgrounds: while the former is inspired by anthropologist and sociologic theories, the latter is a sociological perspective on culture.

Advocates of the collectivity alternative as Bourdieu (1972), Geertz (1973a; 1973b), Inglehart (1990), Putnam (1993), or Huntington (1996), much inspired by Taylor's classical definition of culture (1871), are more concerned with anthropological and sociological perspectives on culture.

A second school of thought advocates an individual-based view of culture, like Conover and Searing (1994), Norrander and Jones (1996), McFalls (2001), who are generally inspired by classical works of Almond and Verba (1965) and Converse (1964), emphasizing a concern with social-psychological perspective on culture.

Conceptual controversies based on the dichotomy between ideatic (idealist) and economic (materialist) views of culture have generated also methodological controversies mainly focused on the methods of measurement and collection of empirical data. As much as the conceptual ones, the methodological disputes are opposing different views on the modeling methodologies. As explanative conceptual tools, models have an explanative power. A model is an abstract construction, usually replicating some real situation or object and it is based on concepts and their relationships. Conceptual modeling of political culture is based on two main methodologies: model-invariant and contingency-based modeling methodologies.

The former has been developed as nomothetic approach (Hempel, 1965). The latter has been used to apply the methodological individualism onto the construction of explanative mechanisms of political processes and phenomena. Methodological individualism has been addressed as a background for theoretical approaches of culture as the complex outcome of individual agency. One of the best methodologies of modeling is represented by the agent-based systems, which implement a methodological individualism (Hedström and Svedberg, 1998; Hedström, 2005; Cederman, 2003). However, none of these methodologies have been employed for political culture modeling, especially for modeling the political phenomena characteristics to the post-communist Eastern European transition to democracy.

EQPAM Volume 5 No.1 January 2016
ISSN 2285 – 4916
ISSN-L 2285 - 4916

A third kind of approach on culture is the neo-cultural synthesis advocated by Mishler and Pollack (2003), Kubik (1994; 2012), and supported by other authors, like Sztompka (1993 a, b). This type of approach suggests that culture is a continuum between *thick* and *thin* aspects of culture, going even to "no culture" aspects. However, this modeling approach gives only a qualitative account on political culture change.

Lately, the research community, in particular, students of Eastern European post-communist political experiences seems to be divided on one more dimension: culture as a continuum advocated by the school of neo-cultural synthesis (Mishler and Pollack, 2003) challenges both the collectivity-, and the individual-based approaches by mixing them up in a continuum of cultural agency concept which associates to both societal and individual level of interactions.

Among the seven dimensions on which (political) culture is "poorly explicated" (Reisinger, 1995), the interaction between culture and polity highlights the instrumental role culture plays in the emergence and dynamics of political phenomena. Culture as a control mechanism (Geertz, 1973, p.87; Elkins and Simeon, 1979, p.129) concerns a societal perspective on how culture is defined.

2.8.2 Mechanics vs. Complexity of Political Change Mechanisms and Processes

Political change phenomena have often been described in terms of mechanisms and processes. While some authors adopt a mechanistic perspective over mechanisms and processes in politics (Tilly, 1995, 2001), others prefer a complexity-based, generative perspective (Cederman, 1997, 2003). The mechanics of contentious politics, to give but one famous example, has been defined in terms of mechanisms of three types: environmental, cognitive, and relational which are ordered in temporal sequences (temporal regularity patterns). Recurrent causal mechanisms and their temporal concatenation provide for the emergence of context-dependent, path-dependent processes (McAdam, Tarrow and Tilly, 2001).

3. Internal and External Pressures for a Modeling Paradigm Change

In this paper we denote by the term "internal pressures" the increasingly demanding influence the connected modeling research areas have on the emergence of a paradigm shift in the political attitudes computational and simulation modeling toward a unifying modeling approach. We denote by the term "external pressures" the conditioning of the political attitudes computational and simulation modeling research on the methodological and technological support developed in other research areas, like computer science, artificial intelligence or artificial life.

In their classic "A-B-C" structural definition, attitudes appear as a very complex combination of affect, beliefs, values, behaviors, information, knowledge as well as cognitive abilities. Looking almost like a "black box", the attitude conceptual and operational definition has ever since been periodically revisited so as to embed new insights into its very nature. It is precisely this "complicated" nature which has strongly stimulated internal pressures toward the development of a unifying modeling approach, at least at the operational level.

Political attitudes could hardly be modeled without including at least some of the structural elements whose presence in a model would give an account on the political attitudes' roots, like the associated political beliefs, values, norms or knowledge. Each of these elements is as complex as the political attitude itself. Research literature covers a huge list of modeling approaches developed separately[2]. Though rarely developed as empirical models, very few or no unifying perspective appears in the long run in the computational and simulation modeling of political beliefs, political attitudes and political

[2] A more detailed approach is provided in my new volume "Computational Modeling of Political Attitudes" (*forthcoming*).

ISSN 2285 – 4916
ISSN-L 2285 - 4916

behaviors. On the contrary, things seem to go toward separate narrow niche models for each such issue. It is therefore precisely this area which provides for the emergence of conceptual and methodological pressures toward unifying the separately developed computational and simulation modeling approaches on political attitudes and their structural components: affect, belief (ideology), value, behavior, norm or knowledge.

The actual and potential internal pressures for a paradigmatic change in political attitude modeling cover several dimensions.

One such dimension actually concerns basic characteristics of political attitudes. As political culture phenomena, political attitude change processes are recurrent recursive processes which affect the dynamics of the micro-macro political phenomena in a polity. As such, political attitude change phenomena provide for the missing link between macro-level and micro-level phenomena inside a polity. The modeling of this aspect is highly demanding due to the complexity of the issues. It definitely requires a new paradigm and a new technology of modeling complex systems like polities and political regime changes.

Another pressure appears from the more and more insistent comparison between Experimental Political Science and a nascent Computational Political Science: while the former has dominated Political Analysis for almost one century, achieving and consolidating a body of theory and methodology, the latter is still in search for defining appropriate concepts and methodologies. There are already in a strong position of conceptual and experimental developments the new computational disciplines like Computational Sociology, Computational economy or Computational Linguistics. Notwithstanding a strong impetus towards the emergence and development of technology-based disciplines in the humanistic, social and political science realms, Computational Political Science or at least Computational Political Culture remain as only potential evolutions in the long run.

Besides, computational political science should cover many of the other new disciplines arising from sometimes unexpected combinations of existing and desired technologies. One such example is the fast-developing Political Engineering research area (Reilly, 2003). Another one is the need to approach the issue of Big Data in politics (Tufekci, 2014), and also the issue of web technologies (Voinea and Schatten, 2015; Schatten et al., 2015; Ševa et al., 2016). This aspect points to the external pressures for a paradigm change in political attitudes computational and simulation modeling research.

External pressures address the interdisciplinary connections between political attitudes modeling and the computational and simulation modeling disciplines developed within various domains in computer sciences, in the sciences of the artificial, or in the network science, to give but few examples of those sciences which impact nowadays the development of modeling approaches in the humanities, social and political sciences. Political attitude change modeling combines theories and concepts from social and political science with concepts and theories from computer science, artificial life, and web technologies.

The external pressures develop on several dimensions: conceptual, methodology, and technology.

On the conceptual dimension, the paradigm change has been required and announced for long time already. At the end of the 1980s and the beginning of the 1990s, David Laitin (1995, 1988) reminds us about the provisions of the classic political culture theory in comparison with new context-dependent approaches on political phenomena. In the same period of time, Charles Tilly (1995, 2001) explains *why?* and *how?* a new modeling paradigm would impact Political Methodology. Making reference to the concepts of “mechanism” and “process”, he opens a hot debate in both philosophy of science and political science: causality vs. complexity. Though anchored in the causal paradigm, Tilly develops the ideas of context-dependency, initial conditions and the recurrent and often recursive character of the political phenomena,

EQPAM Volume 5 No.1 January 2016
ISSN 2285 – 4916
ISSN-L 2285 - 4916

describing a strong tendency toward modeling their dynamic and complexity-based temporal as well as spatial evolutions.

The orientation toward the complexity-based approaches is strongly supported by other branches of political science research, namely the areas of international relations, political theory, conflict theory, and polity modeling studies, which starting with the early 1990s have introduced new modeling paradigms for explaining the macro emergence of complexity from the individual interactions of agents at the micro level of society. Debates on the mechanistic paradigms based on "mechanism", and complexity concepts like "emergence" have divided the communities in several schools of thought (Cederman, 2005; Sawyer, 2002, 2004a, 2004b, 2005). Though extremely interesting and far from an end, these debates have emphasized two corresponding trends in the computational and simulation modeling of political attitudes research: one is based on classic theories of representation and provides support to artificial intelligence-based modeling approaches, while the other is based on the social simulation theories and experiments and provides support to the artificial autonomous agents-based modeling approaches, including the artificial society as well as the artificial polity issues (Voinea, 2013, 2014).

4. Research Questions to Be Answered

All these orientations, trends and developments have affected decisively the discussions on the modeling paradigm change by inducing a preference toward dynamic, complexity-based approaches. However strong they are (or promise to be), they have not produced visible effects so far in what regards the area of political culture modeling in spite of the undeniable advances in one of its sub-areas: political attitudes modeling. It is perhaps what shocks most in political culture theory: while there has not been developed a true operational theory to support it, the advances in one of its sub-areas, that is the political attitudes computational and simulation modeling research, have not been imported or assumed in any way.

Moreover, the "*thick&thin*" neo-synthesis introduced by Mishler and Pollack (2003) along with their *culture continuum* modeling approach requires a paradigm change which could bring support to this new and completely different view as it assumes a unifying modeling framework for all basic component of a (political) culture.

And this is not the only example: there are many others coming from the network developmental theories or from web-based modeling approaches of political attitudes, political culture and interaction.

The question right now is, therefore, not "*if*…", but "*when*"! How long will it take to penetrate political culture modeling research and induce a paradigm shift?

References

Abelson, R.P. and Bernstein, A. (1963) A Computer Simulation Model of Community Referendum Controversies, *Public Opinion Quarterly* Vol.27, No.1, pp. 93-122.

Achen, C.H. (1975) Mass Political Attitudes and the Survey Response, *American Political Science Review* Vol. 69, No.4, pp.1218-1231.

Allport, G. W. (1935) Attitudes, Chap. 17, (pp.798-844) in: A handbook of social psychology (Ed. by C. Murchison), Worcester: Clark Univ. Press.

Almond, G., Verba, S. (1963) The Civic Culture: Political Attitudes and Democracy in Five Nations, Sage Publications Inc.

Anderson, J.R., Bothell, D., Byrne, M., Douglass, S., Lebiere, C., and Qin, Y. (2004) An Integrated Theory of Mind, *Psychological Review Vol.* 111, No.4, pp. 1036–1060.

Axelrod, R. (1995) A Model of the Emergence of New Political Actors, in: N. Gilbert and R. Conte (Eds.), Artificial Societies: the Computer Simulation of Social Life, London: University College Press.

ISSN 2285 – 4916
ISSN-L 2285 - 4916

Axelrod, R. (1997) The Dissemination of Culture: A Model with Local Convergence and Global Polarization, *Journal of Conflict Resolution* Vol.41, Issue 2 (Apr.1997), 203-226.

Baldassarri, D., Bearman, P. (2007) Dynamics of Political Polarization, *American Sociological Review*, Vol. 72, pp.784–811.

Berelson, B., Lazarsfeld, McPhee, W.N. (1954) Voting: A Study of Opinion Formation in a Presidential Campaign, Chicago University Press.

Bourdieu, P. (1972) Esquisse d'une theorie de la pratique, Paris.

Campbell, A., Converse, P. E., Miller, W. E., Stokes, D. E. (1960) The American voter, New York, NY: Wiley.

Casti, J.L. (1996) Would-Be Worlds: How Simulation Is Changing the Frontiers of Science, John Wiley & Sons, Inc., NY.

Cederman L.-E. (1997) Emergent Actors in World Politics. How States and Nations Develop and Dissolve, Princeton Studies in Complexity, Princeton University Press.

Cederman, L.-E. (2003) Computational Models of Social Forms: Advancing Generative Macro Theory, in the Proceedings of the 8th Annual Methodology Meeting of the American Sociology Association, University of Washington, Seattle, May 8-10, 2003.

Cederman, L.-E. (2005) Computational models of social forms: Advancing generative process theory, *American Journal of Sociology Vol.* 110 , No.4, pp.864-893.

Cederman, L.-E., Girardin, L. (2007a) Beyond Fractionalization: Mapping Ethnicity on Nationalist Insurgencies. American Political Science Review No. 101, pp.173–185..

Cederman, L.-E., Girardin, L. (2007b) Toward realistic computational models of civil wars, Paper prepared for presentation at the Annual Meeting of the American Political Science Association, to be held in Chicago, August 30-September 2, 2007.Accessed on June 25, 2015.

Choucri, N., Goldsmith, D., Madnick, S.E., Mistree, D., Morrison, J.B., Siegel, M.D. (2007) Using System Dynamics to Model and Better Understand State Stability, Working Paper CISL# 2007-03 Composite Information Systems Laboratory (CISL) Sloan School of Management, M.I.T. Cambridge, MA 02142. Available in the public domain at: <http://ic3.mit.edu/ResearchSamples/2007-02.pdf>. Accessed: March 02, 2015.

Choucri, N., Madnick, S.E., Siegel, M.D. (2005) Research Initiative to Understand & Model State Stability: Exploiting System Dynamics, Working Paper CISL# 2005-02, Composite Information Systems Laboratory (CISL) Sloan School of Management, M.I.T. Cambridge, MA 02142, available in the public domain at: <http://ic3.mit.edu/ResearchSamples/2005-02.pdf>. Accessed: March 02, 2015.

Cioffi-Revilla C., Rouleau M. (2010) MASON RebeLand: An Agent-Based Model of Politics, Environment, and Insurgency, International Studies Review, No. 12, pp. 31-52.

Cioffi-Revilla, C., and Rouleau, M. (2009) MASON AfriLand: A Regional Multi-Country Agent-Based Model with Cultural and Environmental Dynamics, Proceedings of the Human Behavior-Computational Modeling and Interoperability Conference 2009, HB-CMI-09, Joint Institute for Computational Science, Oak Ridge National Laboratory, Oak Ridge, Tennessee, U.S.A., June 23–24, 2009.

Conover, P., Searing, D. (1994) Democracy, citizenship, and the study of political socialization, in: I. Budge and D. McKay (Eds.), Developing democracy, Sage Publications London, England, pp. 24–55.

Converse P.E. (2006) The nature of belief systems in mass publics (1964), Critical Review: A Journal of Politics and Society, Vol. 18, No.1-3, pp. 1-74, DOI: 10.1080/08913810608443650. Available: http://dx.doi.org/10.1080/08913810608443650 . Accessed: July 6, 2013.

Converse, P.E. (1964) The Nature of Belief Systems in Mass Publics, in: D.E. Apter (Ed.), Ideology and discontent (pp. 206-261), London: Collier- Macmillan Limited.

Eliasmith, C. (2013) How to build a brain, Oxford: Oxford University Press.

Elkins D.J., Simeon R.E.B. (1979) A Cause in Search of Its Effects, or What Does Political Culture Explain?, *Comparative Politics*, Vol.11, No.2, pp. 127-145.

Epstein J., R. Axtell. (1996) Growing Artificial Societies: Social Science from the Bottom Up, Cambridge, MA: MIT Press.

Erikson, R.S., Mackuen, M.B., Stimson, J.A. (2002) The Macro Polity, Cambridge University Press.

Forrester, J. W. (1968) Principles of Systems, (2nd Edition). Portland, OR: Productivity Press.

Geertz, C. (1973a) The Interpretation of Cultures, New York.

Geertz, C. (1973b) Thick Description: Toward an Interpretive Theory of Culture, in: The Interpretation of Cultures: Selected Essays, New York: Basic Books, pp.3-30.

EQPAM Volume 5 No.1 January 2016
ISSN 2285 – 4916
ISSN-L 2285 - 4916

Gilbert, N. (1995) Simulation: an emergent perspective, The text of a lecture first given at the conference on New Technologies in the Social Sciences, 27--29th October, 1995, Bournemouth, UK and then at LAFORIA, Paris, 22nd January 1996 online at url: http://cress.soc.surrey.ac.uk/resources/emergent.html

Hedström, P. (2005) Dissecting the Social: On the Principles of Analytical Sociology, Cambridge: Cambridge University Press.

Hedström, P., Swedberg, R. (1998) Social mechanisms: An introductory essay, pages 1-31, in: P. Hedström and R. Swedberg (Eds.), Social mechanisms: An analytical approach to social theory, Cambridge: Cambridge University Press.

Hempel, Carl G. (1965). Aspects of Scientific Explanation, New York: Free Press.

Homer–Dixon, T., Maynard, J.L., Mildenberger, M., Milkoreit, M., Mock, S.J., Quilley, S., Schröder, T. and Thagard, P. (2013) A Complex Systems Approach to the Study of Ideology: Cognitive-Affective Structures and the Dynamics of Belief Systems, *Journal of Social and Political Psychology*, Vol. 1, No.1, pp.337–363.

Huckfeldt, R., Johnson, P.E., Sprague, J. (2004) Political Disagreement: The Survival of Diverse Opinions within Communication Networks, New York: Cambridge University Press.

Hunter, J. E., Danes, J. E., Cohen, S. H. (Eds.) (1984) Mathematical Models of Attitude Change: Change in single attitudes and cognitive structure, Vol.1, Orlando, FL: Academic Press.

Hunter, J. E., Levine, R. L., Sayers, S. E. (1976) Attitude change in hierarchical belief systems and its relationships to persuasibility, dogmatism, and rigidity, *Human Communication Research* Vol.3, No.1, pp.3-28.

Hunter, J. E., Levine, R. L., Sayers, S. E. (1984) Attitude Change in Concept Hierarchies, in: J.E. Hunter, J.E. Danes and S.H. Cohen (Eds.), Mathematical Models of Attitude Change, Vol.1: Change in single attitudes and cognitive structure (pp.231-259), Orlando, FL: Academic Press.

Huntington, S.P. (1996) The Clash of Civilizations and the Remaking of World Order, New York, Simon & Schuster.

Inglehart, R. (1988) The Renaissance of Political Culture, *American Political Science Review* Vol.82, pp. 1203-1230.

James, W. ([1890] 1918) Principles of Psychology, New York, Henry Holt and Company, U.S.A. Available: <https://archive.org/details/theprinciplesofp01jameuoft> . Accessed: December 15, 2013.

Johnson, J. (2003) Conceptual Problems as Obstacles to Progress in Political Science Four Decades of Political Culture Research, *Journal of Theoretical Politics* vol. 15 no. 1, pp.87-115.

Johnson, P.E. (1999) Simulation Modeling in Political Science, *American Behavioral Scientist* No. 42, pp. 1509-1530.

Jost, J.T. (2009) "Elective Affinities": On the Psychological Bases of Left-Right Differences, *Psychological Inquiry*, Vol.20, No. 2, pp.129 — 141.

Kennedy, M. (2002) Cultural Formations of Post-communism. Emancipation, Transition, Nation, and War, Minneapolis: University of Minnesota Press.

Kim, S.-y., (2009) Online Processing, Memory-based Processing, and an Integrated Model of Candidate Evaluation: A simulation-based empirical investigation, *Korean Journal of International Relations*, Vol.49, No.6, pp.99-123.

Kim, S.-y., Taber, C.S., Lodge, M. (2009) A Computational Model of the Citizen as Motivated Reasoner: Modeling the Dynamics of the 2000 Presidential Election. Available at SSRN:http://ssrn.com/abstract=1282323 . Accessed: March 25, 2015.

Klingemann, H.-D., Fuchs, D., Zielonka, J. (Eds.) (2006) Democracy and Political Culture in Eastern Europe, London and New York: Routledge.

Kottonau, J., Pahl-Wostl, C. (2004) Simulating political attitudes and voting behavior, *JASSS* Vol. 7, No. 4 <http://jasss.soc.surrey.ac.uk/7/4/6.html>

Kubik, J. (1994) The Power of Symbols Against the Symbols of Power. The Rise of Solidarity and the Fall of State Socialism in Poland, College Park: Penn State Press.

Kubik, J. (2012) Cultural approaches, in: Raj Kollmorgen, Wolfgang Merkel and Hans-Jürgen Wagener (Eds.), The Handbook of Transformation Research, Publisher: VS-Verlag für Sozialwissenschaften.

Laitin, D. (1995) The Civic Culture at 30, *American Political Science Review* Vol.89, No.1, pp.168-173.

Laitin, D.D. (1995) The civic culture at 30, *American Political Science Review* Vol.89, No.1, pp. 168-173.

Laitin, David D. (1988), Political Culture and Political Preferences, *American Political Science Review* 82, pp. 589-593.

Lang, J., De Sterck, H. (2012) The Arab Spring: A Simple Compartmental Model for the Dynamics of a Revolution, Cornell University Library, arXiv:1210.1841 [math.DS], in the public domain at: http://arxiv.org/abs/1210.1841. Accessed: June 23, 2015.

Lang, J., De Sterck, H. (2012) The Arab Spring: A Simple Compartmental Model for the Dynamics of a Revolution, in the public domain at: arXiv:1210.1841v1 [math.DS] 5 Oct 2012. Accessed: March 17, 2015.

ISSN 2285 – 4916
ISSN-L 2285 - 4916

Lasswell, H.D. (1927) The Theory of Political Propaganda, *American Political Science Review*, Vol. 21, No. 3, pp. 627-631.

Lasswell, H.D. (1936) Politics: Who Gets What, When and How?, Free Press: Glencoe, Illinois.

Latané, B. (1981) The Psychology of Social Impact, *American Psychologist* Vol. 36, No.4 (April), pp. 343-356.

Lazarsfeld, P.F, Berelson, B., Gaudet, H. (1944) The People's Choice: How the voter makes up his mind in a presidential campaign, New York: Columbia University Press.

Levine R.L. (2003) Models of Attitude and Belief Change from the Perspective of System Dynamics, paper presented for the 2003 International System Dynamics Society Conference, available online at: <http://www.systemdynamics.org/conferences/2003/proceed/PAPERS/177.pdf> accessed on August 9th, 2011.

Lewenstein, M., Nowak, A., Latané, B. (1992) Statistical mechanics of social impact, *Physical Review A*, Vol. 45, No. 2, pp. 763-776.

Lewin, K. (1951) Field Theory in Social Science, Harper, New York.

Lodge, M., Steenbergen, M.R., and Brau, S. (1995) The Responsive Voter, *American Political Science Review* Vol. 89 No.2 pp. 309-326.

Lodge, M.,Taber, Ch.S. (2007) The Rationalizing Voter: Unconscious Thought in Political Information Processing (December 21, 2007). Available at SSRN: http://ssrn.com/abstract=1077972 or http://dx.doi.org/10.2139/ssrn.1077972 . Accessed: March 2, 2014.

Lorenz, J. (2014) How clustered ideological landscapes might emerge through opinion dynamics, Paper presented at the ECPR General Conference Sep 3-6, 2014, Glasgow in the Panel P289 "Preference Formation and Formal Models of Politics". Available: <http://ecpr.eu/Events/PaperDetails.aspx?PaperID=20737&EventID=14> . Accessed: March 18, 2015.

McAdam D., Tarrow S., Tilly Ch. (Eds.) (2001) Dynamics of Contention, Cambridge University Press.

McFalls, L. (2001) Constructing the New East German Man, 1961-2001 or Bringing Real Culture Back to Political Science, Working Papers Series of the Institute for European Studies, UC Berkeley.

McPhee, W. N. (with Smith, R. B. and Ferguson, J.) (1963) A theory of informal social influence, in: W. N. McPhee (Ed.), *Formal theories of mass behavior*, New York, NY: Free Press.

McPhee, W. N., and Smith, R. B. (1962) A model for analyzing voting systems, in: W. N. McPhee and W. A. Glaser (Eds), Public opinion and congressional elections (pp. 123–154), New York: Free Press.

McPhee, W.N. (1961) Note on a Campaign Simulator, *Public Opinion Quarterly,* Vol. 25, pp. 184-193.

McPhee, W.N., Coleman, J. (1958) A Program of Research in "Mass Dynamics", *American Behavioral Scientist*, Vol. 1, No. 4, pp. 6 – 10.

McPhee, William N. (1963) Formal Theories of Mass Behavior, New York: Free Press.

Merton, R.K., Lazarsfeld, P.F. (1954) Friendship as a Social Process: A Substantive and Methodological Analysis, in: Monroe Berger and others (Ed.), Freedom and Control in Modern Society, New York: Octagon.

Mishler W., Pollack D. (2003) Thick-and-Thin: A Neo-Cultural Synthesis (Ch.13, pp.237-256), in: Pollack D., Jacobs J., Muller O., Pickel G. (Eds.), Political Culture in Post-Communist Europe. Attitudes in New Democracies, Aldershot: Ashgate.

Mutz, D.C., Sniderman, P.M., Brody, R.A. (Eds.) (1996), Political Persuasion and Attitude Change, Ann Arbor: University of Michigan Press.

Newell, A. (1994) Unified Theories of Cognition, Harvard University Press.

Norrander, B., Jones, B.S. (1996) The Reliability of Aggregated Public Opinion Measures, *American Journal of Political Science* No. 40, pp. 295-309.

Nowak, A., Szamrej J., Latané, B. (1990) From Private Attitude to Public Opinion: A Dynamic Theory of Social Impact, *Psychological Review* Vol. 97, No.3, pp. 362-376.

Pollack, D., Jacobs, J., Muller, O., Pickel, G. (Eds.) (2003) Political Culture in Post-Communist Europe, Attitudes in New Democracies, Aldershot: Ashgate.

Putnam, R. (1993) Making Democracy Work, Princeton.

Reilly, B. (2003) Political Engineering of Parties and Party Systems, paper prepared for delivery at the 2003 Annual Meeting of the American Political Science Association, August 28 - August 31, 2003. Available: American Political Science Association website. Accessed: December 3, 2014.

Reisinger W. M. (1995) The Renaissance of a Rubric: Political Culture as Concept and Theory, *International Journal of Public Opinion Research* Vol.7 o.4, pp.328-352.

EQPAM Volume 5 No.1 January 2016
ISSN 2285 – 4916
ISSN-L 2285 - 4916

Rokeach , M. (1968) Beliefs, Attitudes, and Values, San Francisco: Jossey-Bass.

Sakamoto, T., and Endo, M. (2015) Multi-Agent Simulation of State Collapse and Reconstruction: Analyzing the Past and the Future of Somalia, Working Paper No.46. Available in the public domain at: Virtual Lab Yamakage, Exploring Artificial Societies <http://yamakage-ken.com/?p=210>. Paper accessed on June 22, 2015, with Dr. Takuto Sakamoto's agreement, which is hereby gratefully acknowledged.

Sawyer, R.K. (2002) Emergence and Downward Causation, *Principia* 6, No. 1.

Sawyer, R.K. (2004a) The mechanisms of emergence, *Philosophy of the Social Sciences* No.34, pp.260–82.

Sawyer, R.K. (2004b) Social explanation and computational simulation, *Philosophical Explorations* No. 7, pp.219–31.

Sawyer, R.K. (2005) Social Emergence. Societies as Complex Systems, Cambridge University Press.

Schatten, M., Ševa, J., Okreša Đurić, B. (2015) An Introduction to Social Semantic Web Mining & Big Data Analytics for Political Attitudes and Mentalities Research, *European Quarterly of Political Attitudes and Mentalities* Vol.4 No.1, pp. 40-62.

Schwartz, S.H. (1992) Universals in the content and structure of values: Theory and empirical tests in 20 countries, (pp.1-65), in: M. Zanna (Ed.), Advances in experimental social psychology (Vol.25), New York: Academic Press.

Schwartz, S.H. (2006) Basic human values: Theory, measurement, and applications, *Revue Française de Sociologie*, No. 47, pp.249-288.

Serota, K. B., Fink, E. L., Noell, J., Woelfel, J. (1976) Precise measures of public ideologies, Revised version of the paper presented at the April, 1975 International Communication Association conference, Chicago, IL. Available: < http://www.galileoco.com/literature/OCRpublicideology.pdf> . Accessed: July 25, 2015.

Serota, K.B., Fink, E.L., Noell, J.J., Woelfel, J. (1975) Communications Ideology, and Political Behavior: A Multidimensional Analysis, Paper presented to the Political Communication Division of the International Communication Association Convention, April 23-26, 1975, Chicago; Working Paper 75-1, Political Ideology Project. Available: <http://www.galileoco.com/literature/SerotaEtAlComIdealogyPolbehICA1975.pdf>. Accessed: June 11, 2015.

Ševa, J., Okreša-Đurić, B., Schatten, M. (2016) Visualizing Public Opinion in Croatia Based on Available Social Network Content, *European Quarterly of Political Attitudes and Mentalities*, Volume 5, No.1, July 2015, pp.1-14.

Spencer, H. (1867) First Principles, 2nd edition (London: Williams and Norgate, 1867) 7/5/2015 <http://oll.libertyfund.org/titles/1390>, Online Library of Liberty, Liberty Fund, Inc. Available online at url: <http://lf-oll.s3.amazonaws.com/titles/1390/0624_Bk.pdf> . Accessed: July 5, 2015.

Sztompka, P. (1993a) Civilizational Incompetence: The Trap of Post-Communist Societies, *Zeitschrift fur Soziologie* Vol.22, No.2, pp. 85-95.

Sztompka, P. (1993b) The Sociology of Social Change, Oxford: Blackwell.

Thagard, P. (2006) Hot thought: Mechanisms and applications of emotional cognition, Cambridge, MA: MIT Press.

Thagard, P. (2010) EMPATHICA: A computer support system with visual representations for cognitive-affective mapping, in: K. McGregor (Ed.), Proceedings of the workshop on visual reasoning and representation (pp. 79-81), Menlo Park, CA: AAAI Press.

Thagard, P. (2014) The cognitive-affective structure of political ideologies, in: B. Martinovski (Ed.), Emotion in group decision and negotiation. Berlin: Springer.

Tilly Ch. (1995) To Explain Political Processes, *American Journal of Sociology* Vol. 100, No.6, pp. 1594-1610.

Tilly Ch. (2001) Mechanisms in Political Processes, Columbia University, *Annual Review of Political Science*, Vol. 4, pp. 21-41, online at url:<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.8.3993&rep=rep1&type=pdf> accessed on February 15th, 2013.

Tourangeau, R., Rips, L.J., Rasinski, K. (2000) The Psychology of the Survey Response, Cambridge University Press.

Tufekci, Z. (2014) Engineering the Public: Big Data, Surveillance and Computational Politics, First Monday, Volume19, Number7-7, July2014.Peer-Reviewed Open Access Journal on Internet. Available in the public domain at url: http://firstmonday.org/ojs/index.php/fm/article/view/4901/4097; doi: http://dx.doi.org/10.5210/fm.v19i7.4901. Accessed: May 19, 2015.

Tylor, E.B. (1871) Primitive Culture: Researches Into the Development of Mythology, Philosophy, Religion, Art, and Custom, London: John Murray,

ISSN 2285 – 4916
ISSN-L 2285 - 4916

Voinea C.F. (2013) Why Individual Interactions Are Not Enough? Agent-Based Simulation of Polity: An Operational Concept, in: C.F. Voinea, B. Todosijević, G. Boella (Eds.), Political Attitudes and Mentalities. Eastern European Political Cultures: Modeling Studies, Ars Docendi-Bucharest University Press, pp.77-122.

Voinea, C.F. (2014) On Mechanism, Process and Polity: An Agent-Based Modeling and Simulation Approach, *European Quarterly of Political Attitudes and Mentalities*, Vol.3, No.3, pp. 15-45.

Voinea, C.F., Schatten, M. (2015) Recovering the Past. Eastern European Web Mining Platforms for Reconstructing Political Attitudes, *European Quarterly of Political Attitudes and Mentalities*, Volume4, No.1, January 2015, pp. 20 -37.

Watts, D.J. (1999) Small Worlds: The Dynamics of Networks between Order and Randomness. Princeton, NJ: Princeton University Press.

Watts, D.J., Strogatz, S.H. (1998) Collective dynamics of 'small-world' networks, *Nature* , Vol. 393 , No. 4 , pp. 440-442.

Woelfel, J., Saltiel, J. (1978) Cognitive processes as motions in a multi-dimensional space: A general linear model, in: F. Casmir (Ed.), Intercultural and international communication, (pp. 105-130), Washington, D.C.: University Press of America. Available: < http://www.galileoco.com/literature/OCRcognitiveprocess.pdf> . Accessed: October 2, 2013.

Wundt, W.M. (1902) Principles of Physiological Psychology, Translated by Edward Bradford Titchener (1904), digital version available from Classics in the History of Psychology, An internet resource developed by Christopher D. Green , York University, Toronto, Ontario, ISSN 1492-3713, online at: < http://psychclassics.yorku.ca/Wundt/Physio/chap6.htm> . Accessed: July 25, 2015.

Zaller, J., Feldman. S. (1992) A Simple Theory of the Survey Response, *American Journal of Political Science* 36 (3): 579–616.

Zaller, J.R. (1992) The Nature and Origins of Mass Opinion, Cambridge: Cambridge University Press.

Open Access
This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.