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## Political Culture and Covalent Bonding. A Conceptual Model of Political Culture Change

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### Abstract

Our class of models aims at explaining the dynamics of political attitude change by means of the dynamic changes in values, beliefs, norms and knowledge with which it is associated. The model constructs a political culture perspective over the relationship between macro and micro levels of a society and polity. The model defines the bonding mechanism as a basic mechanism of the political culture change by taking inspiration from the valence bonding theory in Chemistry, which has inspired the elaboration of the mechanisms and processes underlying the political culture emergence and the political culture control over the relationship between macro-level political entities and the micro-level individual agents. The model introduces operational definitions of the individual agent in political culture terms. The simulation model is used for the study of emergent political culture change phenomena based on individual interactions (emergent or upward causation) as well as the ways in which the macro entities and emergent phenomena influence in turn the behaviors of individual agents (downward causation). The model is used in the ongoing research concerning the quality of democracy and political participation of the citizens in the Eastern European societies after the Fall of Berlin Wall. It is particularly aimed at explaining the long-term effect of the communist legacy and of the communist polity concept and organization onto the political mentalities and behaviors of the citizens with respect to democratic institutions and political power. The model has major implications in political socialization, political involvement, political behavior, corruption and polity modeling.

**Keywords:** political culture change, c-bonding

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**Motto:**

"A molecular bipole of small molecular moment, which would scarcely attract a similar molecule, will be very appreciably attracted by a polar molecule or bipole of high moment, and may form with it a double molecule. In this process the weaker bipole stretches and its moment increases. In general, if two molecules combine, or even approach each other, each weakens the constraints which hold together the charge of the other, and the electrical moment of each is increased. This increase in the polar character of a molecule when combined with, or in the neighborhood of, other polar molecules is to a remarkable degree cumulative, for when two molecules by their approach or combination become more polar they draw other molecules more strongly towards them, but this further increases their polar character. [...] The polar character of a substance depends, therefore, not only upon the specific properties of the individual molecules, but also upon what we may call the strength of the polar environment."

Lewis, G.N. (1916) *The Atom and the Molecule*  
*Journal of the American Chemistry Society* Vol. 38, No.4, p. 765.

"Although political scientists might share rationales for experimentation with other scientists, what distinguishes their efforts is their attention to focal aspects of politically relevant contexts. His distinction parallels the use of other modes of inference by political scientists. As Druckman and Lupia (2006, 109) argue, '[c]ontext, not methodology, is what unites our discipline [...] Political science is united by the desire to understand, explain, and predict important aspects of contexts where individual and collective actions are intimately and continuously bound."

Druckman, J.N., Green, D.P., Kuklinski, J.H., and Lupia, A. (2006)  
*The Growth and Development of Experimental Research in Political Science,*  
*American Political Science Review* Vol. 100 No.4, p. 629.

## 1. Political Culture and Political Context Modeling Research

The 1989 Eastern European political phenomena known as the Fall of Berlin Wall have revived the political culture theories and stimulated the developing of qualitative models aimed to explain the major political change from communist to democratic regimes. The long-term effects and influence of the communist regimes on the political attitudes toward government, parties and policy issues are of major relevance for the ongoing research on the quality of democracy and political participation of the citizens in the Eastern European societies.

Political methodology as well as social psychology research often employ computational and simulation modeling methods in order to give an account of the complexity of political behavior. As far as it concerns the geopolitical area of Eastern Europe and, in particular, the issues concerning the quality of democracy (Voinea, 2013a), this major orientation remains however a rather tenuous preference if we take into consideration the very few computational and simulation modeling approaches which build upon political culture theory. Usually employed in electoral studies and voting behavior research, the computational and simulation modeling has been concerned more with public opinion and voting choice issues and less with political culture as a whole. The approaches are based on rather numerical combinatorial techniques, using intensively empirical data to analytical purposes. Agent-based systems have been employed to model the political attitude change with respect to the change of some other items like, for example, public opinion (Latané, 1981; Nowak, Szamrej, and Latané, 1990; Huckfeldt, Johnson and Sprague, 2004) or beliefs (Dinauer, 2009; Dinauer and Fink, 2005; Woelfel and Saltiel, 1988; Hunter et

al., 1984). However, no computational model approaches political culture dynamics in operational terms for describing and explaining the changes in values, beliefs, political attitudes and also for explaining the relationships between their associated dynamics. Nor does it model the relationship between political culture change and polity change.

Political persuasion research has approached such issues on a qualitative modeling basis by the development of analytical models which makes intensive use of empirical (survey) data (Mutz, Sniderman and Brody, 1996). Some models emphasize, for example, the role played by the communist political culture heritage in influencing the voting behavior of the citizens in Eastern European new democracies (Pollack et al., 2003; Ferić and Posavec, 2013; Barbu, 2013). Other models approach the political influence of the former communist regimes by analyzing the various degrees of attachment to materialist/post-materialist values in different countries (Inglehart, 1990, 1997; Pavlović, 2014).

In order to develop a computational and simulation modeling of political culture dynamics and how it affects the dynamics of both individual agents (citizens) and macro entities (institutions, society, polity), political culture needs an operational set of concepts to describe its basic mechanisms and processes. Political culture computational and simulation modeling needs a basis which is actually missing: a political culture operational definition and a modeling methodology.

The remainder of the paper is organized as follows:

*Section 2* describes the analytical, computational and generative modeling paradigms in political attitude change research. *Section 3* makes a comparative analysis of the existing political attitude change models and their paradigms. Advantages and difficulties in each are briefly explained. *Section 4* introduces the conceptual approach of the political culture modeling. *Section 5* describes the covalent bonding mechanism and its major implications for the study of political culture phenomena at (i) micro-, macro-, and meso-levels. *Section 6* summarizes the preliminary results obtained in experimental measurements of (i) diversity survival, (ii) emerging political conflicts, and (iii) ideological cleavages in party politics in Eastern Europe. *Section 7* briefly describes the ongoing simulation experiments on the issues of political socialization, and trust in political institutions: Government, Parliament, and the Presidential institution. *It* makes brief reference to the research project of the Eastern European Political Culture Repository as a necessary resource for the study of political culture legacy of the communist regimes over the political behavior and political involvement of Eastern European citizens. *Section 8* includes some concluding remarks: the research reported in this paper covers the conceptual and simulation modeling of political culture change in both individual agents and macro agents (polity, statal and non-statal agents, etc.), the political culture phenomena generated by the interactions between the individual agent and the polity, and the emergence of structure and order at the macro level (i.e., polity change).

## 2. Challenging Issues in Political Culture Modeling

### 2.1 Brief History

This paper addresses the area of political methodology and the modeling paradigms of political phenomena. From classic nomothetic (model-invariant) paradigm, political methodology has recently proved a systematic orientation toward context-based, path-dependent approach of the political processes modeling.

Political methodology has passed through a period of deep change with regard to its modeling paradigms. The decades between 1960s and the 1980s have been dominated by *experimentation* as a basic research approach. The birth and development of *experimental political science* as a relevant branch in political science has shaped a clear orientation toward more accurate political analysis which employs

sophisticated mathematical-statistics theories and tools (Druckman et al., 2006, 2011). Experimental political science has been defined as theoretically based on the construction and analysis of political context with empirical (survey and observational) data. Modeling based on experimentation in political science was meant to gain causal explanative power from driving the theory development and test it against empirical data.

Starting with the mid'1990s, in his writings concerned with the explanative power of modeling paradigms in political science particularly focused on the major political change phenomena, Charles Tilly (1995, 2000, 2001) has warned the political science community on the necessity of a methodological change driven by the need to develop context-, and path-dependent approaches on explaining macro-level political phenomena. Initiated in the 1990s, a dramatic shift in modeling paradigms turned the focus of research methodology from model-invariant towards contextualized approaches (Goodin and Tilly, 2006: pp. 3-32; Pye, 2006: pp.799-800).

## *2.2 Attitude and Belief Change Modeling Approaches*

The issue of attitude and belief change modeling has been approached from different perspectives. Gardenfors views belief systems as a set of propositions (Gardenfors, 1986, 1988) among which logical relationships provide for logical consistency. The Dempster-Shaffer theory defines beliefs as probabilities (Dempster, 1968; Shafer, 1976, 1990; Governatori et al., 2009; Alechina et al., 2008). Beliefs representation allowed for two kinds of approaches: semantic, in which the meaning is central, and probabilistic, in which uncertainty is central. They start from the basic idea that beliefs are stored in the human memory and are subject to update and revision processes induced by the acquisition of new knowledge. Hierarchical models of beliefs change use a spatial belief structure to describe the belief and attitude change processes (Hunter et al., 1976, 1984). Another type of models, the spatial-linkage model (Galileo Model) uses concept spaces in which concepts are the objects, and attitude change is represented as movements of the objects (Kaplowitz & Fink, 1988; Dinauer, 2003; Dinauer and Fink, 2005).

Starting with mid'1990s computational and simulation modeling methodologies have provided new modeling techniques which include multi-agent systems (MAS), like for example, the artificial political society model (Mitsutsuji, 2007), and agent-based (ABM) like, for example, the model of political contagion (Johnson, 1999), the JQP Model (Kim, Lodge and Taber, 2009) and the quantum model of attitude change (Kitto, Boschetti, Bruza, 2012). Generative modeling offers theoretical and experimental support to modeling based on agent-based and complex adaptive systems which provide support to the study of self-organizing attribute configurations (Cederman, 2001, 2005).

## *2.3 Challenging Issues*

Computational and simulation modeling research on these issues has to address several challenges.

First and foremost, the political context as a fundamental issue of political science (Druckman et al., 2006: p. 629), could hardly be re-constructed as close as possible to its real parameters without empirical data. The political context in the Eastern European totalitarian regimes cannot be constructed from survey data, which are missing with regard to the period of time between 1950 and 1990. Nor can observational data be more successfully employed in describing and/or simulating the political context of such regimes as it is of qualitative, and quite often of a speculative nature: official documents of the time are often reporting ideologically-modified observational data and provide therefore a research background of low experimental credibility. Notwithstanding its qualitative nature, the scarcity and irregularity of such

data would discourage an empirical-based computational and simulation modeling aimed at studying the political culture change on a comparative basis using data before and after 1989. Research issues like the trust in government, to take but one example which address Eastern European belief change research, cannot be studied on a comparative basis in order to emphasize either their continuity or, on the contrary, a cleavage between such beliefs during past compared to present times.

Second, the complexity of the change phenomena makes difficult the modeling of political context. Political context looks completely different before and after 1989 in terms of norms, human rights and polity architecture (to name but few major aspects): whereas the post-1989 political context can be fully described on an empirical basis, this same task could overwhelm the capacity of current modeling approaches in tackling simultaneous change in political attitudes, beliefs, norms and values, not to mention the media communication and political information. To assess the political attitude change after 1989 and to prove that current low trust in government is or is not influenced by the communist political culture heritage needs a demonstration for which a basic piece of information is missing, namely the individual political attitude before 1989 for which no public attitude survey has been developed with respect to the issue of trust in government. And even if it was done, it would not have been credible because of the ideological influence of the political structures which had almost completely penetrated the institutions as well as the private life of citizens by coercively imposing a positive attitude toward the political leadership. What the citizens did really believe about their government we could only speculate.

Least but not last, polity simulation models as well as artificial society models have to face the same challenge, namely how to define and use the structural entities which emerge at the macro level and which are supposed to interact back with the individual agents at the micro level (Cioffi-Revilla and Rouleau, 2010). In terms of political culture, that is beliefs, values, norms, and political attitudes, the downward causation is still beyond the simulation capacity of agent-based systems, the most popular and effective technology of computational and simulation modeling intensively used in social simulation and computational sociology.

Taking into consideration these difficulties could not however discourage the modeling of political culture change and its relationship with polity dynamics. On the contrary, in what regards Eastern European citizens, this challenge could only emphasize the need to understand their political behavior not only in economic, but also in political culture terms.

### 3. Goal of Approach

Our model is a thought exercise in the line shown by Axelrod in developing his culture dissemination model (1997). It aims at explaining the dynamics of political attitude change by means of the dynamic changes in values, beliefs, norms and knowledge with which it is associated. The model constructs a political culture perspective over the relationship between macro and micro levels of a society and polity.

The model defines a basic mechanism of the political culture change by taking inspiration from the valence bonding theory in chemistry, which has inspired the elaboration of the mechanisms and processes underlying the political culture emergence and the political culture control over the relationship between macro-level political entities and the micro-level individual agents.

The model introduces operational definitions of the individual agent in political culture terms. The simulation model is used for the study of emergent political culture change phenomena based on individual interactions (emergent or upward causation) as well as the ways in which the macro entities and emergent phenomena influence in turn the behaviors of individual agents (downward causation).



The model is used in the ongoing research concerning the quality of democracy and political participation of the citizens in the Eastern European societies after the Fall of Berlin Wall. It is particularly aimed at explaining the long-term effect of the communist legacy and of the communist polity concept and organization onto the political mentalities and behaviors of the citizens with respect to democratic institutions and political power. It has been therefore associated with the initiative and development of the *Eastern European Political Culture Repository* Project (Voinea and Schatten, 2014; Schatten, Ševa and Okreša Đurić, 2015, this issue) which is currently developed by the European Research Group on Political Attitudes and Mentalities (EPAM) and the Eastern European Political Culture Association (EPCA).

#### 4. Conceptual Approach

##### 4.1 The Concept of Political Culture

###### 4.1.1 Paradigms and theories in the conceptual modeling

We approach the concept of political culture as an emergent attribute of a collectivity (Elkins and Simeon, p. 129; Almond and Verba, 1963), while the individual human agents are characterized in terms of their values, beliefs, attitudes, symbols, rituals. In our conceptual class of models, political culture is defined as a complex system which dynamically adapts to norms influence and new information and which controls the individual agents' behaviors (Geertz, 1973). We adopt Mishler and Pollack's (2003) view that political culture is a continuum from thick to thin cultural forms and employ this conceptual view in modeling the political context from a political culture perspective by endowing the individual agent with a set of values, beliefs and political attitudes whose various degrees of variability influence the dynamics of political attitudes stability and political participation of the citizens. However, the approaches which have inspired ours are mostly qualitative theoretical models. Mishler and Pollack's (2003) operational definition of (political) culture provides for a quantitative cumulative model: it targets a whole population by summing up the temporal weighted expressions of individual cultural orientations. Unfortunately, no operational expression is provided for the latter term. Nor does it explain the *thick & thin* idea of a culture continuum in quantitative terms.

We elaborate a class of simulation models which are based on the conceptual views and theories mentioned above.

###### 4.1.2 Paradigms in the operational and experimental modeling

Our simulation modeling approach has been inspired by the *Sugarscape* Model (Epstein and Axtell, 1996) in what regards the different types of interacting agents/entities, the economic principles defining the individual agents and the methodological individualism in defining the role played by the individual interactions in the dynamics of a political system. Another source of inspiration is the *Culture Dissemination Model* ACM, (Axelrod, 1997). ACM defines culture by means of features and traits and employs a simple copy mechanism to describe how similarity-based interactions of individual agents result in self-organization of social units (villages) by means of culture dissemination.

This class of simulation models introduces some distinctive characteristics from ACM which concern (i) the definition of political culture, and the description of its structural components, (ii) the mechanism of constructing the political context, (ii) the mechanism of political culture transmission. Our simulation models modify ACM so as to explain political attitude change in terms of the simultaneous changes in (i) values and beliefs, in (ii) the cognitive-affective structure of human preferences and behaviors, and in (iii) political information processing and knowledge acquisition. The model assumes that

the individuals' values, beliefs and political attitudes changes are influenced by the dynamics of normative systems and by the cognitive-affective structure of the individual agents.

Finally, our modeling approaches political culture as playing a major role in the propagation of the influence of the macro level entities (institutions, polity) onto the individual agents' interactions and behaviors at the micro level of the society. This role requires a mechanism of culture transmission and our model introduces a new mechanism, inspired from the covalent bonding theory in chemistry which makes a major difference with respect to ACM's mechanism of culture dissemination: this difference arises from the idea that people assimilate in various degrees the beliefs and values which in one way or another resemble those of their own. This generic process of "assimilation" replaces the "copy" process in the ACM and implements the idea inspired by the chemical covalent bonding processes that sharing political culture individual items might be modeled as (partially or totally) overlapping of structural constituents and emerging relationships among them. Such a "covalent bonding" process of political culture basic items would heavily depend on which items are shared by the interacting individuals (i.e., values, beliefs, political attitudes, and/or political information), and on exogenous factors conditioning the bonding, like the normative systems and the knowledge and cognitive-affective structure of the individual agents.

These processes are the targets of our study: (i) how the models explain the political culture dynamics by means of the dynamic changes in values, beliefs and political attitudes of the interacting individual agents, and (ii) how individual interactions are further influenced (controlled) by political culture change emergent phenomena?

To answer these research questions let us first define the interaction unit as the individual agent, who is characterized by a set of individual political culture items (values, beliefs, political attitudes), and by individual knowledge (**Figure 1**). We assume that it is an "open end" entity, meaning that it is able to get into a relationship ("covalent bonding") with other individual's set of political culture items and provide for (a) a self-organization of values, beliefs, political attitudes, and knowledge for each interacting individual, and (b) the emergence of new political culture structures and processes at collective level, (i.e., ideologies).

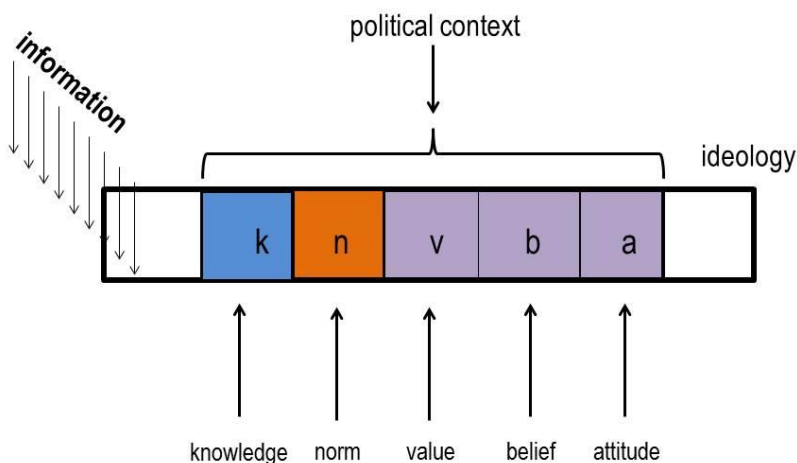


Figure 1.



Similar to the Axelrod's culture definition, our model defines a political culture in terms of features and traits. The modeling approach selects a relevant and sufficient (minimal) set of individual political culture items which include: knowledge, values, beliefs, political attitudes, and norms. These features have particular values for each individual called traits and a pre-defined number of traits. The selected features illustrate the idea that the individual-level compounds of political culture provide for the representation of different influence sources and play different roles: endogenous sources, like knowledge, values, beliefs, political attitudes, and exogenous sources, like norms or new information flow (**Figure 2**). This design is meant to illustrate the idea that the individual-level compounds of political culture, namely values, beliefs and political attitudes, are the basic ingredients of the political culture as a characteristic of the entire collectivity (group or society at large) to which the individual belongs.

One of the modeling hypothesis concerns variability, that is, each political culture basic item is characterized by variability, and the political culture as an emergent phenomena at the collectivity (macro) level has its own variability, but at a different scale. Each basic political culture constituent item, like value, belief, or political attitude, is characterized by specific variability and has its own spatio-temporal dynamics. The normative system plays a major role in influencing the dynamics of political culture on both individual and collective level. Another source of variability is represented by the cognitive-affective structure of each individual agent. Thus at the individual level, knowledge is considered to exist both as memory-based and as on-line acquired item, taking into consideration that knowledge self-organizes as a side-effect of learning/forgetting processes.

The representation introduces the issue of scale in modeling the political culture phenomena at both individual and collective level. It also introduces the requirement that the modeling space is unique regardless of the different scales of representation.

Bottom-up systems, like that used in our modeling approach allow for the construction of unique model space (Mitsutsuji, 2007), which includes entities and processes constructed at different scales and operating either synchronously or asynchronously.

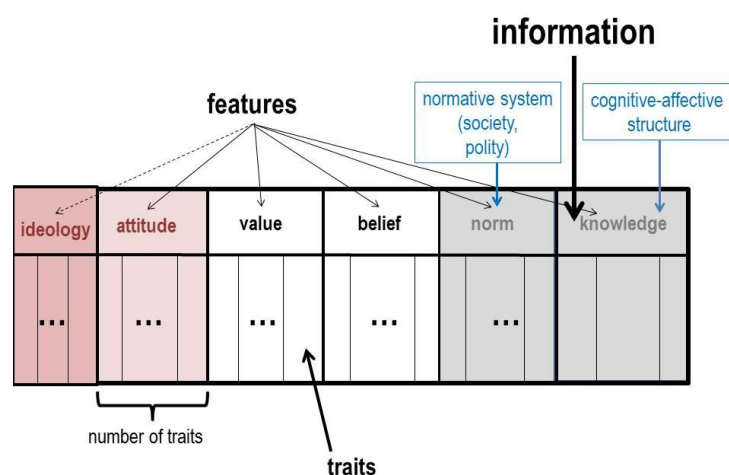


Figure 2.

#### 4.2 Political Culture Space and Agents

Two individual agents, Agent\_1 and Agent\_2 characterized by the same political culture but with different traits, interact. Interaction is described at both intra-individual and inter-individual scales in the same model space.

At the inter-individual scale, the interaction between any two agents is modeled in the methodological individualism paradigm. Political culture is described as the meso-level outcome of individual interactions. It appears as a collective-level phenomenon which further generates macro-level political change phenomena. For example, individual interactions may result in the emergence of mass political attitudes, which could further generate political change phenomena like revolutions, *coup d'état*, or political cleavages (Tilly, 1995, 2000, 2001; Laitin, 1995).

At the intra-individual scale, the interaction between any two agents is modeled as a change in each political cultural feature and also in their relationships to one another resulting in political culture individual dynamical configurations called in our approach *shadow configurations*. The shadow configurations are temporary self-organizing outcomes of dynamically changing political culture items at the individual level<sup>1</sup>. Shadow configurations may be informally described as temporal "snapshots" of the political culture structure at in each individual agent (individual shadow configurations) or at the collective level as well (collective shadow configurations).

#### 4.3 Political Culture Transmission

Several models of social influence or political persuasion have approached the issue of public opinion or political attitudes transmission through individual interaction: electoral studies and voting behavior research have been mainly concerned with the persuasive power of media in the opinion and political attitudes dynamics. Some of these approaches are based on the force field concept from Physics and have been inspired by the early work of Lewin on social field forces (Lewin, 1951). Other models are based on concepts from Quantum Physics (Kitto, Boschetti and Bruza, 2012). Still others have found inspiration also in Physics, this time in Newtonian mechanics of motion, like the spatial modeling of attitude and belief change in the Galileo Model (Kaplowitz, Fink and Bauer, 1983; Kaplowitz, Fink, Armstrong and Bauer 1986; Kaplowitz and Fink, 1988; Dinauer, 2003; Dinauer and Fink, 2005).

In Axelrod's Culture Dissemination Model (1997) the individual interaction is conditioned by previously identified feature similarities between agents (expressed as the percentage of similar/identical features from the total set of features).

In our view, individual agents look for similarity in (selecting) their interaction partners, but not to the explicit and deliberate purpose of becoming identical with their interacting partners, an idea which has been developed by Huckfeldt and his collaborators in their research on survival of diversity issues in democratic societies (Huckfeldt, Johnson and Sprague, 2004). Individual agents appear as rather looking to "assimilate", that is to "share" in various degrees the political culture items from other individuals. They seem ready or prepared (more or less) to develop cultural affinities, like preferences, predilections, leanings, or bias with respect to other identical, similar or connected political culture items (i.e., values, beliefs, political attitudes, pieces of knowledge, symbols) from other individuals.

The outcome of an interaction between individual agents is not that an attribute is "copied" from one agent to another like it happens in the Axelrod's culture dissemination model (**Figure 3a**). The outcome of such an interaction at the individual level is that each agent might identify a kind of affinity with certain

<sup>1</sup> Classic authors, in political science, sociology, social psychology, and computational and simulation modeling of political attitudes have defined it as "mind set" or "internal predispositions".

belief(s), value(s) and political attitude(s) in the other agent. This affinity can be described with a term used in theoretical Chemistry: “covalent bonding”. The change dynamics of a political culture is based on an abstract, chemistry-inspired mechanism which binds the different basic political culture items in an individual setting, thus providing for the new emergent structure: the covalent bonding (see **Figure 3b**).

The diversity of the kinds of political cultural affinities is mirrored by the diversity in the relationships between political culture sets off basic features in each individual. Such relationships are meant to characterize the type of cultural affinity or attachment developed by each individual in interaction with another individual or with supra-individual agents, like groups, communities, society at large, political institutions, statal or non-statal agents, etc.

## 5. Political Culture Change and Covalent Bonding

### 5.1 How to define “covalent bonding” in political culture interactions?

A covalent bonding (“c-bonding” from now on) is a kind of relationship between the political culture basic items of each of the individual agents which interact in the model space (i.e., society, polity).

The idea of covalent bonding in political culture change is that of complementarity: the mechanism of covalent bonding makes effective the “sharing” of a political culture basic item (value, belief, political attitude) in one agent as a complementary compound of the political culture item set in another agent.

The concept of complementarity is inspired from the valence bonding theory where two atoms could get into a relationship based on their valence: an atom of hydrogen could get into a structural combination with one other atom only (thus having a valence of 1), while other atoms could get into combinations with two or more atoms (thus having the valence of 2 or more). Their valence is therefore defined as depending on the position of the atom in the Mendeleviev table and of the necessary forces to get the combination stable.

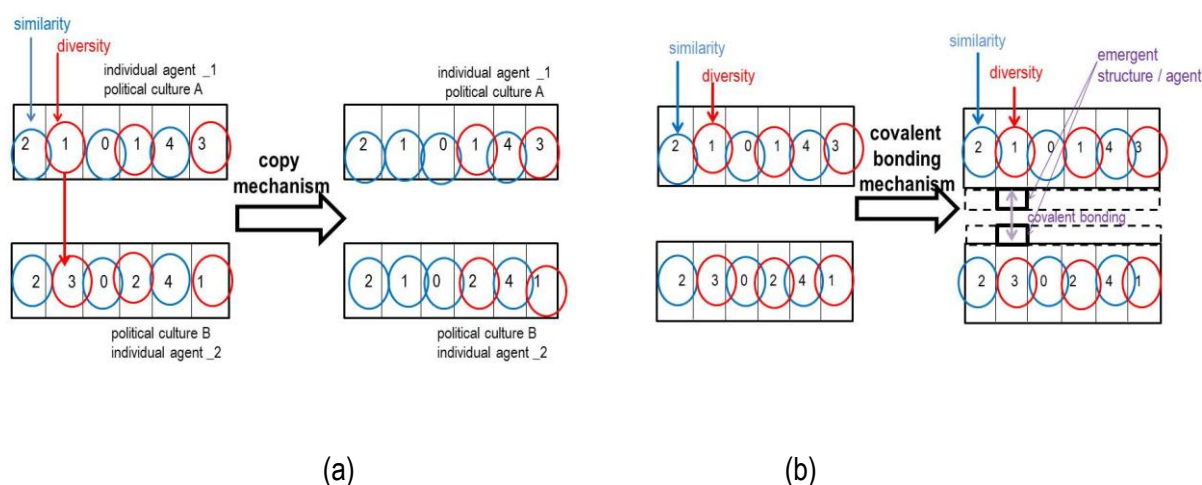


Figure 3.

In a likely manner, a political attitude, for example, could get into combination with one or more other values and/or beliefs made known to the individual agent from the interaction with another (individual

or macro) agent (**Figure 4**). The valence of each political culture basic items could thus be defined as depending on the complexity of the item, and on the forces needed to keep the emergent structure stable. In our model, it provides for the emergence of new political culture compound items and new structure (i.e., growth processes).

Similarity thus becomes a particular case of the bonding when two interacting individual agents have the same feature (**Figure 4**, up): the bonding mechanism identifies the identical features in each agent and overlaps them. As the outcome, the individual political culture items self-organize in each agent as a side-effect of the overlapping process.

Complementarity is the generic case of bonding. It identifies the feature(s) which are sought by an individual agent when interacting with another one. After identifying their type and level of complementarity, they are combined (**Figure 4**, down) so that the individual *corpus* of political culture items includes the new item(s) by self-organizing (growing).

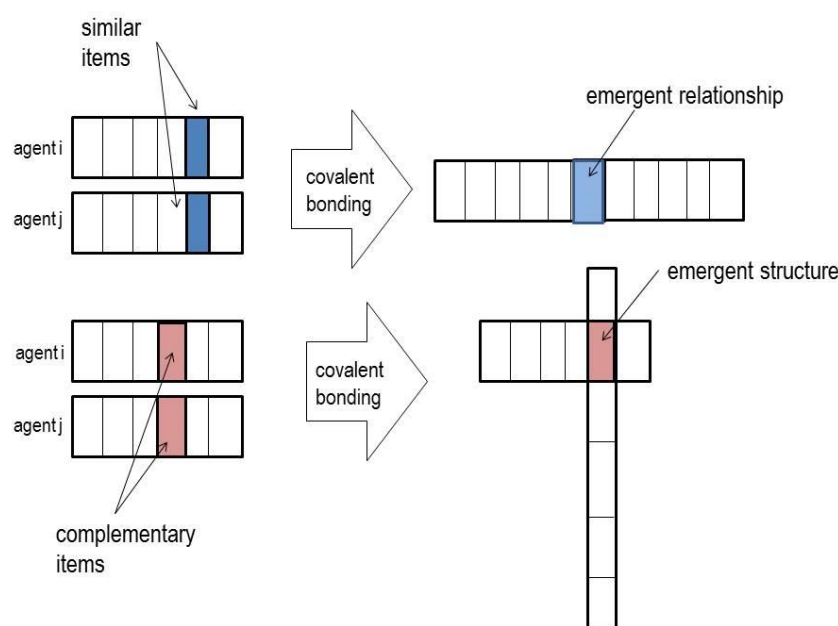


Figure 4.

There are also defined the generic cases of non-complementarity (opposition) (i.e., when the political culture individual *corpus* including values, beliefs, and political attitudes splits up) and complementarity breaking (i.e., when the political culture individual *corpus* including values, beliefs, and political attitudes shrinks).

The former case is typical for the ongoing experimental research with individual agents interacting with other individual and macro agents in a democratic political regime. The latter cases are currently under experimental testing on scenarios of individual agents interacting with other individual and macro agents in an authoritarian political regime in which coercion is used to induce certain beliefs (ideology) which are opposed to the personal beliefs of the individual agents.

We aim to prove that, beside the bounded rationality and economic thinking in terms of cost-benefit and optimal choices, the political attitudes of common people toward political power, authority, institutions and policies are regulated by their values and beliefs systems. Moreover, our goal is to model the downward causation in political culture terms without excluding the rationality assumption and the economic views from the modeling of the relationship between individual agents (citizens) and macro agents (polity).

Much of the attitude change modeling research in Social Psychology and in Political Science, ideology studies is grounded in value systems (Braithwaite, 1997, 1998; Wilson, 2004). Rokeach's research in value theory has provided the theoretical background for considering political attitudes as also being grounded in value systems. From this point of view, our approach has a background in Rokeach's Two Value Model (1973). We introduce in our model a two-value system – "liberty-equality" – whose dynamic variability conditions the belief and the political attitude change and enhances the emergence of new structure and order in each type of political regime taken into consideration (authoritarian or democratic).

### *5.2 Political Culture: Item Bonding in Dyadic Interactions*

Individual agents are described by means of their political culture basic features and traits. In a political influence scenario (usually, such a scenario addresses political persuasion through messages communicated via the electoral campaign media), at any time when two individual agents interact, their features are modified by the political culture dissemination or persuasion processes. The typical outcome of the interactions among individual agents (inter-individual interactions) is a dynamically changing political culture individual setting: knowledge, values, beliefs, political attitudes self-organize so as to include and properly connect old and new sets of basic items and combine them as new structure emerges.

The bonding mechanism results in political culture structure which is called "blossom" because of its irregular shape. A blossom includes the knowledge, values, beliefs, political attitudes and norms which an individual agent keeps as its political culture individual setting<sup>2</sup>.

The simulation modeling experimental work developed so far has provided insight into the effects of bonding operations for two types of bonding: (a) overlapping (bi-dimensional structure), and (b) complementing (tri-dimensional structure).

The overlapping structures are usually the outcome of bonding when identified features are identical or similar in the interacting agents. In this case, the feature bonding in each agent results in a structural alignment: the features are not opposite (either both positive, or both negative) and their overlapping simply makes the structure grow with new items coming from the political culture set of the individual agent whose feature has been identified. By overlapping, the new structure in the individual agent who initiated the interaction simply includes the new feature without any other relationship generated.

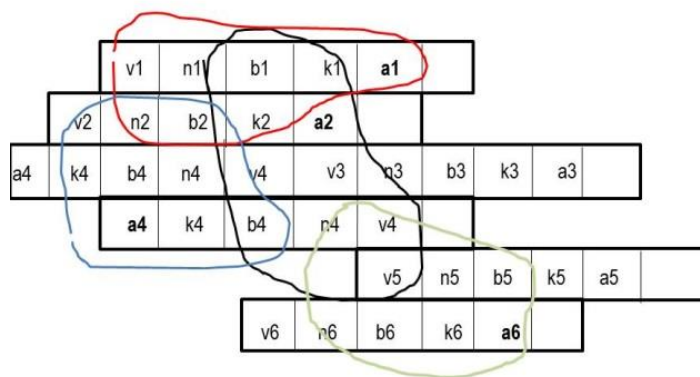
The implications of such bonding concern the local consistency of certain areas in the new structure, such that the same attitude could be grounded in different sets of value-belief-knowledge-norm. The opposite could also happen: the same individual political culture set could support different political attitudes in the same agent.

Studying a simple example with a small number of individual agents, Agent<sub>1</sub>, ... Agent<sub>k</sub> (k=7), (**Figures 5 and 6**), we can easily understand the bonding between political culture items belonging to the two individual sets as the individual agents interact with each other.

<sup>2</sup> The term "settings" aims at avoiding concepts like "mind set" or "predispositions". It has been suggested by the computational and simulation modeling experimental work undergoing on this issue in this research project.

The example in **Figure 5** shows a small population of individual agents, each agent being endowed with a political culture set which includes its own knowledge, beliefs, values, political attitudes, norms. As the individual agents interact, they search for similar or identical features in their interaction partner (i.e., the example replicates the Axelrod scenario, but replaces the "copy" mechanism in the original model with the covalent bonding mechanism introduced by our model).

If, for example, two individual agents Agent\_3 and Agent\_4 interact and identify an identical (or similar) feature in each other's political culture setting, then they will both develop an affinity toward the identified feature in the other. This is made effective by the bonding mechanism, which will modify each of their political culture settings. In this example, the two agents find that their values ( $v_3$  and  $v_4$ ) are identical. The bonding mechanism overlaps the two political culture descriptions on the identical feature ( $v_3=v_4$ ). Therefore, in each agent, the bonding results in an extended setting, so that the identical feature is now a common feature ( $v$ ) and all the rest of the structure remains unmodified.



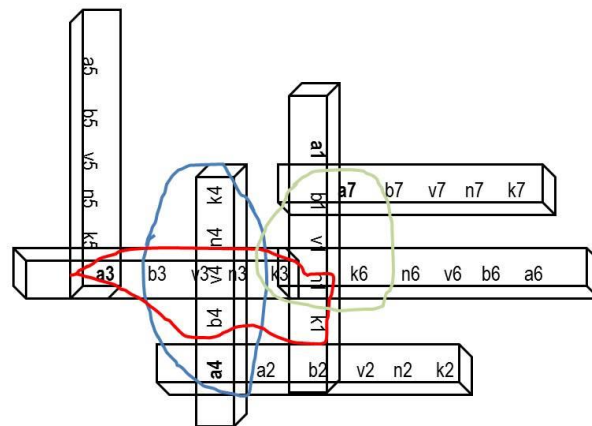
**Figure 5.**

C-Bonding: overlapping of similar/identical items.

The example in **Figure 6** shows that two individual agents Agent\_3 and Agent\_4 interact, identify a convenient but opposite feature in each other: value  $v_3$  (Agent\_3) is opposite to value  $v_4$  (Agent\_4).

As both agents or, at least, one of the agents considers the value in the other agent as convenient, regardless of being opposite to its own value, at least one of the agents updates its own political culture setting. The bonding results in a new structure in which the bonding operation brings one more dimension to the old structure. The old structure dynamically changes (self-organizes) so as to include the new (opposite) value in the old setting.





C-Bonding of opposite items: blossom growth.

Figure 6.

The outcome in this case is a collection of several locally consistent political culture shadow configurations, each being centered on a different political attitude:

c-bonding type: overlapping

$a3 \leftarrow (b3-b4) (v3-v4) (n1-n3-n4) (k1-k3-k4)$

$a7 \leftarrow (b1-b7) (v1) (n1) (k6-k3)$

$a4 \leftarrow (b4) (v3-v4) (n3-n4) (k4)$

red shadow configuration;

green shadow configuration

blue shadow configuration

where: terms like  $(v3-v4)$  show overlapping features achieved by c-bonding between the specified items; single items, like  $(v1)$  or  $(b4)$  do not have any c-bonding to other items.

If norms  $n$  are assumed identical (i.e., the agents share the same normative condition and the same social system), and the two value system is the same, then the difference between the three agents would be made by the knowledge each has with respect to a particular issue. Less knowledge would increase the generation of opposite attitudes under highly similar or identical value systems. Therefore, Agent\_3 and Agent\_7 are on the same direction of preference, while Agent\_4 generates opposite preferences (unstable political attitudes). The difference between the three agents (Agent\_3, Agent\_7 and Agent\_4) under the evidence that they share the same normative system and the same two-value system is made by the knowledge Agent\_3 has  $(k1-k3-k4)$  in comparison with Agent\_7 (who knows less than Agent\_3 about the same issue) and Agent\_4 (who knows almost nothing of what the other two agents know about the same issue):

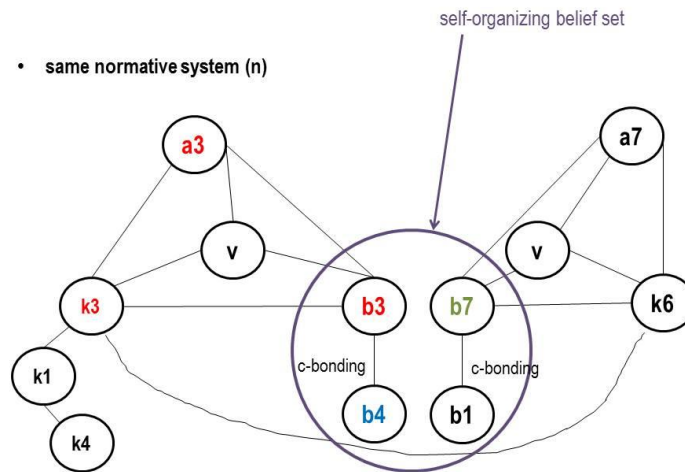


Figure 7.

c-bonding type: growth

$a3 \leftarrow (b3-b4) (v) (n) (k1-k3-k4)$

$a7 \leftarrow (b1-b7) (v) (n) (k6-k3)$

$a4 \leftarrow (b4) (v) (n) (k4)$

red shadow configuration;

green shadow configuration

blue shadow configuration

The research issue of interest here resides in the c-bonding relationships between two conflicting pairs of beliefs: (b3-b4) and (b1-b7). In both pairs, the beliefs belong to opposite views (i.e., political attitudes) with respect to the same issue (**Figure 7**). The preliminary experiments have studied the dynamics of the shadows and blossom as the belief set self-organizes while the individual agents interact. The real interesting c-bonding case studies are: (a) beliefs are associated with more beliefs in the same blossom, and (b) new belief c-bonding generates new political attitudes or a new background for the same political attitude.

### 5.3 Measures of the survival of diversity, emergent political culture conflicts and ideological cleavages

The model introduces specific measures for several classes of political phenomena which might be generated by the political culture dynamics. Our model supports diversity in a more stable manner without reaching uniformity. However, it provides for an increased level of diversity, which could often result in conflicting situations. Two such scenarios are studied: political conflict emergence, and ideological cleavages in party politics.

The preliminary set of measures which is being designed includes: (1) measures of diversity, (2) measures of polarization, (3) measures of cognitive dissonance level, and (4) measures of conflict risk level.

## 6. Preliminary results

Preliminary conclusions drawn from these simple experiments are interesting and promising:

Cognitive dissonance mechanism (political attitude change): one shadow configuration could support two different political attitudes, if it includes bonding between opposite features, so that, as new knowledge is acquired, this difference increases and the cognitive dissonance may appear.

By allowing for several locally consistent shadow configurations, the bonding mechanism supports the Dual Attitudes Model (Petty and Cacioppo, 1986). It makes possible that an individual agent holds two (or more) different attitudes toward the same object in the same blossom.

The covalent bonding (c-bonding) mechanism supports the existence and stability of the diversity of political attitudes in the same population: the affinity toward a feature of another agent makes possible that the agent remains attached to that feature without changing its other personal features which remain open to further valence bonding processes. By c-bonding, the agent might develop as much affinities as he or she interacts with other agents: diversity increases with the number of interactions. Whereas this makes the agent's own blossom grow and extend on multiple dimensions, an increasing level of diversity may often result in deep polarization or in political culture (ideology) conflicts.

## **7. Ongoing Simulation Modeling Experiments and Future Work**

### ***7.1 Political Socialization and Trust in Political Institutions***

Political socialization in Eastern European communist and post-communist regimes has been approached from various perspectives: some of them essentially combine the theory of rational choice with economic concepts and behavior, while others assume a political culture perspective, trying to relate it to beliefs, values, norms and political attitude change (Voinea, 2014a).

This modeling approach starts from the hypothesis that political attitudes of Eastern European adult citizens are influenced by their early political socialization during the former communist regimes. Their current political behavior has been marked by the communist political heritage and is characterized by low political involvement and distrust in political institutions (Csepeli, Kerl, and Stumpf (eds.), 1993; Csepeli, German, Kerl, and Stumpf (eds.), 1994). The idea that current political behavior of Eastern European adult citizens is influenced by their early formation during the communist regimes receives support from authors which have analyzed the former communist regimes in Eastern Europe and their political culture heritage (Sztompka, 1998; Inglehart 1997, 1999, 2006; Karklins, 2001, 2005; Mierina, 2011; Atanasov and Cvetanova, 2012; Srblijinović, 2012; Ferić and Lamza-Posavec, 2013; Petričušić, 2013).

The second hypothesis is that the political preferences and political behavioral tendencies learned during early life are changing over time during adulthood.

The model has been inspired from the political socialization experience in the Eastern European new democracies. While these regimes are different with respect to one another, we start from the assumption that their citizens share a low trust in government due not only to scarce economic performances of different governments, but first and foremost as a long-term effect of communist political culture heritage.

We model the political culture formation and change following the idea that the Eastern European adult and elder citizens' political culture has been formed during their early life in the former communist regimes. We try to prove that their behaviors are dependent on the political values received during the education in the totalitarian regime. The abrupt change from the communist to the democratic regime has replaced one normative system (communist) with another (democratic) in a very short time and has therefore induced a profound change in people's beliefs and values. Some authors describe this change in the value system as a dramatic deprivation process in which people experienced the roughness of the

communist regime and felt forced to give up higher values for survival ones, living in deep privation, poverty and humility (Precupețu, 2007, 2008). The harshness of this process made the change from the totalitarian to the democratic one to be critical for the political attitude toward the political leadership: the experience of the totalitarian regime in the early life has a strong influence over the later adult behavior and might have diminished the capacity of the citizens to adapt to another type of society. It is this dramatic change in the value system which makes the subject of our research. The issue is fundamental for the understanding of the low trust in the political class, in the democratic institutions (Govern, Parliament, Presidency) and in institutional authority in Eastern European societies during the past 25 years.

### 7.2 Eastern European Political Culture Repository

The investigation of the long-term effects of the communist regimes after the Fall of Berlin Wall would need collections of data. Such data exists in various forms and therefore require special techniques of collection and investigation (Voinea and Schatten, 2015 in this issue; Schatten, Ševa and Okreša Đurić, in this issue).

Political Culture Change Model offers support to the idea that such huge collections of data can be investigated in a unitary manner: in the same space are investigated items at different scales – political attitudes, individual agents' political behaviors, political institutions and polity.

## 8. Closing Remarks

The research work reported here is mainly concerned with two types of experiments: (1) individual agents and their interactions (micro level), and (2) polity as a macro-level agent, the interactions between the individual agent and the polity, and the emergence of structure and order at the macro level (i.e., polity change). The research focus has been mainly directed toward micro and macro levels of a social and political model, addressing the scale issue at the extreme levels of a social and political space: from micro to macro and from macro back to micro level. The meso levels are nevertheless the true problem in this approach. The emergence of new structure and order might be associated with the emergence of new relationship types, which might result in contextual variations at both micro and macro levels. At the meso levels a special type of emergence should be taken into account: the "scale" change. In order to study the particularity of this kind of phenomena, new entities should be taken into consideration as interacting agents in our experimental settings: some entities are of generative type, like the political parties which stimulate the ideology formation processes. Though they are micro-level agents their interactions with both macro and micro agents facilitate the emergence of ideologies by enhancing the self-organization of beliefs and values at both individual and collective levels. However, depending on the different individual political culture backgrounds, cognitive abilities and motivation, ideologies might or might not emerge. The current work does not include so far ideology-based and ideology-generative entities, like political parties (Bieber, 2008), or political beliefs systems (Homer-Dixon et al., 2013; Thagard, 2014). Nor does it include ideology-generative processes, like social movements (Greer, 1997).

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