

Study of Social Integrity Behavioral Mode based on Multi-agent System

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Abstract

Social integrity deficiency has become the main obstacle and prominent bottleneck to the construction of a harmonious society. Under this serious circumstance, paying attention to the problem and finding a solution has become an important issue we are faced with contemporarily. Former studies by some scholars have mainly centered on the basis of regime and education and some conclusions have been made. This paper, from the perspective of Multi-agent system, analyses the behavioral mode of the social integrity system and describes the process of emergence from the micro level to the macro one. Based on the Multi-agent system stimulus-response principle, it constructs the basic behavioral mode of social integrity; based on the adaptive-learning theory, it constructs the whole behavioral mode; and based on the evolution of agent, it constructs the level-emerge mode, which will provide a new point of view for the research of the social integrity system. According to this, some resolutions can be achieved to the issue mentioned above, which builds scientific reasonable policy basis and gives theoretical guidance for the central and local government in solving the widespread lack of social integrity.

Key words: multi-agent, social integrity, behavioral mode, stimulus-response, adaptive-learning

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1. Introduction

“People, without integrity, will not become established, businesses will not flourish and power will fall”. Integrity is a guide which shows you in the right direction into the society, which is also a backbone a business may depend on for big shares in the market and ensures a bright future for a nation. However, in the early years, the media disclosed to the public shoddy cotton, poison rice, poisonous milk, trench oil, “recycled” cooking oil, the tension of doctor-patient relationship; and recently plasticizer, poisonous capsule, EMU event and the like are revealed. These are challenging the bottom line of social morality and torturing social integrity as well. People lack the most basic sense of security in the aspect of basic necessities, and society is deep in a crisis of credibility.

In the light of integrity, many scholars from domestic and abroad have done a lot of useful theoretical researches. Linyan Wang [1] points out that, in regard of Chinese social phenomenon of Honesty, moral factors is the only appearance while institutional culture is the source of real problem. Shufeng Yu [2] considers that strengthening the institutional cultural construction to enhance the overall integrity of society is the core to the solution of the doctor-patient conflicts. Foreign scholars put forward the system construction of the ethics education and the relationship between moral hazard and outsourcing, and points out that the importance of the issue lies in the ethics and scientists responsibility and that to promote integrity in a proactive way will be more efficient and effective [3-5]. Such researches, based on qualitative analysis, point out that the social integrity is a macro problem, and the solution is starting from the institution and education. Those researches don't take into account micro-level elements and hence are short of specific methods to solve the problem. The application of a macro point only is difficult to solve the current issue of integrity. The evolutionary game and repeated game theories are initiated and employed by some scholars to establish an evolutionary game model of social integrity, which concludes that the cheaters' minor loss and punishment is mainly responsible for the lack of credibility. Some suggestions to solve the current credibility crisis are raised [6-8]. Certain methods of these types are practiced on the basis of a quantitative model analysis, which leads to some solutions, but for individual cases only. As mentioned above, the

social integrity is a system which concerns the vital national interests and the stability of the state. This article is accordingly based on the characteristics of Multi-Agent system and builds a social credibility system behavioral mode from micro to macro level. With the practice and application of self-organization, self-adaptation, self-evolution and the Agent of system exchanging information with the outside environment and the stimulus-response methodology, a new perspective and a framework for the study of social integrity are designed and some conclusions are made. More importantly, a theoretical basis is proposed for further study in the modeling and stimulation.

2. Agent and Multi-Agent System

The concept of the Agent was first formally proposed by Minsky in 1986 in its "The society of thinking". It is generally believed that Agent is the product of the combination of artificial intelligence and object entity, and the substance can be interactive independently in the environment which is dynamic. Agent has the following characteristics: coordination capacity, communicativeness, reasoning ability, initiative and autonomy interactivity.

The Multi-Agent system is an Agent society composed of Multiple Agents, and it is a autonomous distribution system. The Multi-Agent system performance is realized through Agent interaction, which mainly studies how multiple agents act together and seek solutions to some problems. The structure, function and the behavioral characteristics of the system are reflected in the Agents' communication, cooperation, scheduling, management and control activities.

3. The Concept of Social Integrity System based on the Perspective of Multi-Agent

3.1. The Concept of Social Integrity System

On the basis of scholars from home and abroad, this paper argues that the social integrity system refers to the relationship and the role of the collection among individuals, businesses and government, which interacts with each other and forms the organic social integrity system.

3.2. The Social Integrity System Analysis based on the Perspective of Multi-Agent

In accordance with the uniqueness of social integrity system, it is mainly manifested in the following aspects from the perspective of Multi-Agent:

(1) Multi-Agent active adaptability. In the community of nations, individuals gather to groups and the informal organization is formed, which show the coexistence of multi-agent situation. The Agent is adjusted to the internal rules according to environmental change and their own willing; thereby the system's structure and behavior can be changed.

(2) Dynamic openness. Over time, the structure, function, and behavior of the social integrity system are constantly changing; as an open system, it is appropriate intake of matter, energy and information from the environment to meet the progress of social integrity.

(3) Emergence. Emergence related to the low-level minor differences of the system will lead to huge differences of high-level. From the perspective of hierarchical structure, the emergence refers to the attributes, characteristics, behavior and function of the high level. The overall level of social integrity system is not the simple accumulation of each Agent integrity level, but the coagulation produced by interactions of various Agents.

(4) Self-organization. Social integrity system is spontaneously formed from the Agent itself needs.

3.3. The Framework of Social Integrity System

Social integrity system is composed of the multiple agents. The impact of the external environment to Agent and the reaction manifested by the Agent constitute the basic behavioral mode of social integrity system. Low-level Agents' interaction with the external environment is a self-development process, in which the Agents' ability has improved with the changes in its conduct rules, and its ongoing progress of adaptive learning constitutes the overall behavioral mode of social integrity system. The interaction between Agents forms the emergence of low-level, and the process of this level-emergence constitutes the evolution behavioral mode of social integrity system.

4. The Social Integrity System Behavioral Mode of the Multi-Agent

4.1. The Basic Behavioral Mode of Social Integrity System based on the Stimulus-Response of Multi-Agent

Either in forms or performances, these Agents of social integrity system have bounded rationality. Individual differences in social behavioral judgment are found in the pursuit of material interests. The study of behavioral game theory is carried out on how factors of various kinds affect and change the behavioral people.

Behavioral Game Theory is the standard game theory principles to correct the distortion in the description of the actual behavior by psychology achievements. The study is mainly conducted through experiment and observation of how the players act practically. The game contents analysis is extended by adding factors in emotion, reputation, limited insight and learning and showing doubts about other players' wisdom. The impact of the external environment on Agent and the reaction manifested by the Agent constitute the basic behavioral mode of social integrity system. When the Agent reaches a cognitive age, it forms a belief set through sensing environment and obtain knowledge in the behavioral game. Agent itself has a hope about the future environment as well as the impact of the reputation and institutional factors, which forms a state it wants to achieve and maintain, and we call it desire set. The desire set changes with the transformation in the external environment. Agents have their own goals and action plan because they are determined with bounded rationality and will not pursue all the goals at one time, which means they can only choose part of the goals prior to others, and consequently the intention set of the Agent is resulted. At the end, Agents produce a relatively stable outlook on life and values through accepting external education and adapt themselves to the environment changes. Figure 1 shows the development process of the basic behavioral model.

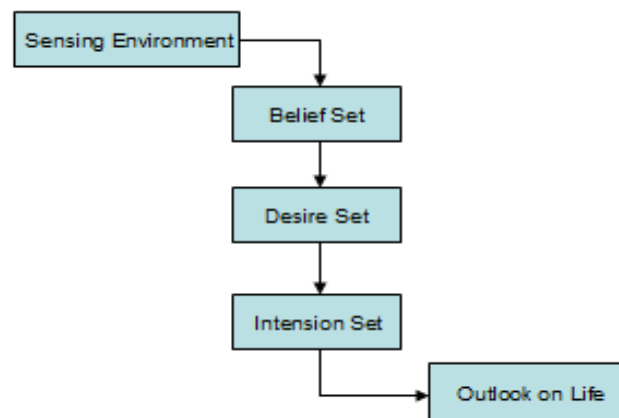


Figure 1. The Development Process of the Basic Behavioral Model

4.2. The Overall Behavioral Mode of social integrity system based on the Adaptive-learning

The Agent of social integrity system maintains its uniqueness and competitiveness through constant adaptive learning, and the overall behavioral mode of social integrity system is the process of a continuous ongoing adaptive learning.

In this stage, the Agent, relying on its adaptive learning, lives and interacts with environment in which the fittest survive. Analysis of the whole process of behavioral game leads to the conclusion that such factors as follows are responsible for the present absence of integrity:

- (1) Economic interests: transaction cost, bounded rationality, information asymmetry, contract, miscarriages of justice, and social exchange theory, etc;
- (2) Environmental factors: causal, culture, reputation system, and long-term cooperative form, etc;
- (3) Personal factors: values, personality, ethical, psychological, and neurophysiologic, etc.

In general, from the perspective of Multi-Agent system theory, Agent's adaptive learning of social integrity is the response made by Agent to the changes in the external environment. In the response process, the Agent's ability to adapt itself to the environment is improved through perceiving the outside world, accumulating experience and changing its behavioral rules of the game constantly. The figure below shows the overall behavioral mode of social integrity system.

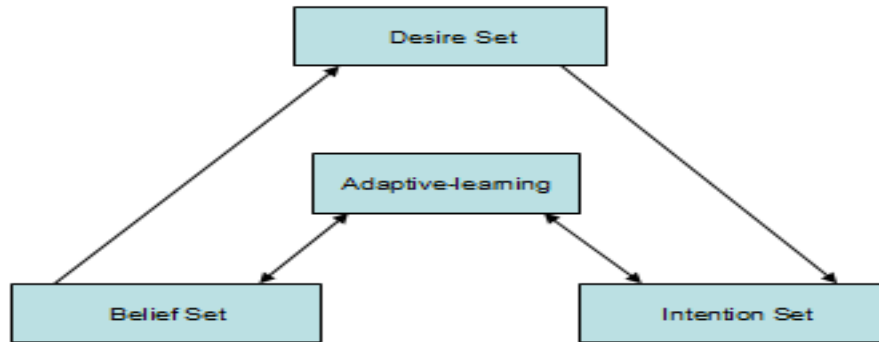


Figure 2. The Overall Behavioral Model of Social Integrity System

4.3. The Evolutionary Behavioral Mode of Social Integrity System-Complex “level-emerge” Model

As mentioned in the text above, Agents, on the basis of past experience and knowledge, have the ability to evolve and modify its behavior or rules to get adapted to the new environment, so the social integrity system is not fixed, but gradually develops from small to large, simple to complicated, low to high.

On the one hand, low-level Agents in the social integrity system communicate with others and change their behavioral mode to survive and to fit in. On the other hand, there is collaborative mechanism among Agents of all levels so that they can make adaptive-learning by exerting influence on each other, which forms emergence. After the formation of the emergence of a level, the emergence of the same level produces such synergies that the Agents interact with each other between emergences and higher level-emergence phenomena come into shape. Thus, the evolution of social integrity system is based on the emergence, and the ideal development should be a progressive one which is tiered, that is, develops from primary to advanced, from simple to complex.

According to the scope and manner of rules' search and selection in the process of evolution of social integrity system, it will be roughly through three levels of emergence [9]. 1. Self-development: Agents find and search the local effective rules and do self-replicating. 2. Dynamic imitation: Agents search global rules, and they imitate the one who owns success rules. 3. Innovation emergence: Besides 2, Agents do innovation, that they restructure their rules on the basis of dynamic imitation. The suitability and complexity of social integrity system enhance with the growth of level-emergence.

Based on the above analysis, the level-emergence mode of social integrity system evolution construction is shown in Figure 3.

4.4. The Behavioral Mode Research Ideas of Social Integrity System based on the Multi-Agent

At present integrity problems are uprising constantly and our society has been plunged into a crisis of integrity, which, to sum up, includes official corruption, food fraud, academic cheating, social injustice, the tense doctor-patient relationship, and almost every industry has its own “under-table rules” [10]. Actually, these problems have attracted attention of the relevant departments for a long time, and some measures, such as anti-corruption, health care reform, commodity crackdown etc., have already been implemented, but social integrity problem doesn't get better, but is worsening.

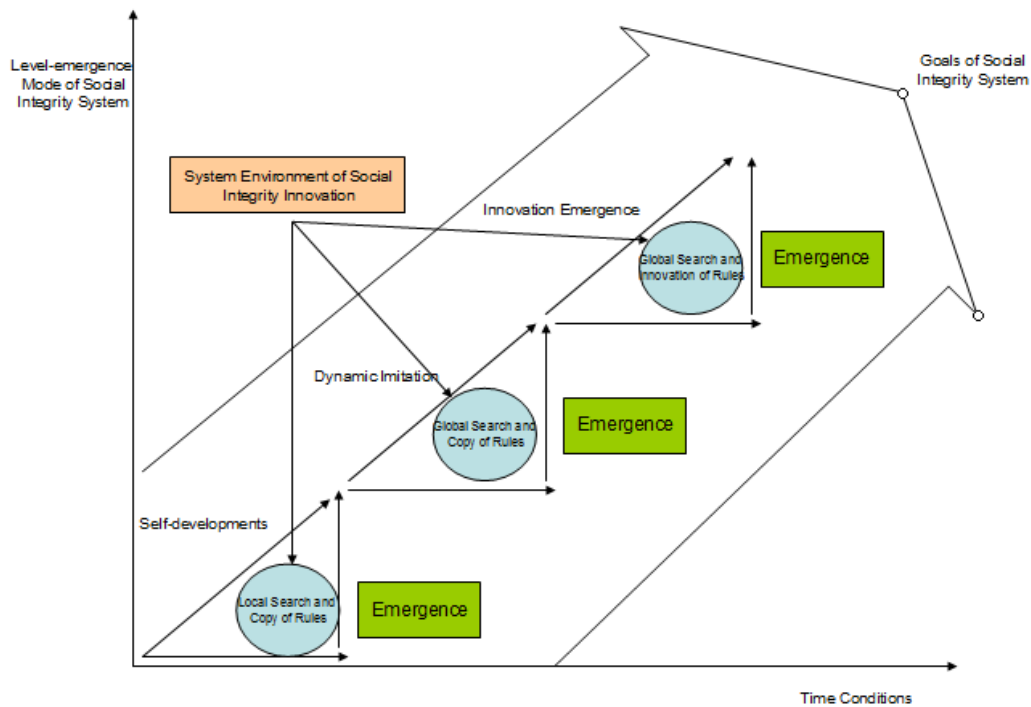


Figure 3. The Level-emergence Mode of Social Integrity System Evolution

In view of this, we establish a behavioral mode framework from the bottom to the top in the imperfect system, and the reason behind social integrity problem is that Agents of low-level interact with each other and the problem breeds and multiplies at different levels. As is known, small changes in the micro Agents will cause great contrast in the macro phenomenon, so the individual credit decline results in the loss of overall social integrity [11]. Before solving integrity loss problem facing current society, initial steps can be taken to control and reduce the happenings of discordant events from the micro-level individuals, such as assets declaration, increasing punishment level, strengthening supervision, punishing corruption, promoting social justice, judicial justice and education, and so on. These measures from the microscopic point of view can enhance the individual's integrity level, and it will form a better overall social integrity system through the evolution of levels. Then next step, model simulation analysis will be made for a comparative study of the effects and response time of countermeasures (such as the establishment of individual reputation model) through model simulation analysis. The method applied is a combination of research analysis and model simulation, which is intended to seek a more optimized solution.

5. Conclusion

Social integrity is a systematic problem which is related to personal interests and national stability and development. This paper gives an analysis of the behavioral mode and the concept of social integrity system from the perspective of Multi-Agent system theory, and it builds a basic, overall and evolutionary behavioral mode based on the stimulus-response principle, adaptive-learning theory and evolution of Agent. The responses of low-level Agents to environment constitute the basic behavioral mode; under the influence of environment, Agents change the behavioral rules constantly, and the ongoing process of adaptive learning constitutes the overall behavioral mode; it will finally develop into an emergence model of high level. At last, some measures are attained to solve the current social integrity problem through reverse analysis of the framework, which establishes a sound basis for the subsequent adoption of model simulation. Solving the problem of social integrity deficiency is not a pinch but involves a subtle, long-term process. Wise government leadership, corporate support and the

participation of the general population are of great importance to the enhancement of social integrity level and the construction of socialism and a harmonious society.

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