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Impact of information on public opinion reversal—An agent based model

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HIGHLIGHTS

- Information is introduced into the Bounded Confidence model.
- Focus on the phenomenon of public opinion reversal.
- Relationship of public opinion reversal and information is analyzed.
- Different information releasing mode are explored, such as strength, releasing time, and information countermeasure.

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ABSTRACT

Reversal of public opinion is an important phenomenon of opinion evolution besides consensus and polarization. Information released by someone often boosts others to change their opinion because the basis of their opinion decision is enriched. As an important external force, information may change the trend of opinion evolution, even reverse the state of public opinion. In order to explore the impact of information on public opinion evolution in macro level, especially reversal, this paper models information as a variable and embeds it into bounded confidence model based on agent based simulation, and then validates the model based on an empirical case. Information strength, time of releasing information and different types of information countermeasure are analyzed through a large number of simulation experiments to find out principles of public opinion reversal. The result shows that information released during the event can change and even reverse the orientation of public opinion, but different releasing mode will produce different result of public opinion evolution.

1. Introduction

With development of world wide web and social networks, net citizens can take part in and debate many kinds of social events more and more frequently. Individuals can not only communicate with others face to face, but also can chat with others online. Therefore, individuals have more chance to exchange their opinion about some topic, and they dare to say and do almost everything because they are anonymous. Usually, the results of public opinion evolution can be diversity, mutability, and emergency. But in some events, public opinion even reverse unexpectedly. This may be because some endogenous reason, for example, some extremists exist in the crowd. But exogenous reason may also lead to reversal of public opinion, especially information released by mass media or government. Furthermore, some mass media releases inaccurate information, and governments cannot do their best to monitor the public opinion and to publish important information

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timely to keep crowd calm. There are some examples about public opinion reversal in recent years, such as : "Luo Yixiao, Please stop" donation fraud, Xu Xiaodong cracking down Taiji Boxing, preferring sons to daughters within quadruplet in Shenzhen City, and so on. In these examples, frequent reversal of public opinion may leads to crisis of trust, and even crowd violence, these will be harmful to social stability.

Therefore, studying the mechanism of public opinion reversal has great significance for society. Fluctuated public opinion may mean the society is not harmonious enough. We not only need to monitor the public opinion, but also need to understand the principle of public opinion reversal. On the other hand, the existed researches mainly focus on the public opinion consensus and polarization, but not the dramatic opinion changing on the macro-level. The macro mechanism of opinion reversal driven by information has not been clear. Therefore, this paper will study the mechanism of public opinion reversal driven by external information based on simulation experiments and empirical study.

2. Literature review

Public opinion can reflect the public attitude for some policy, and it can influence behavior choosing of the common people. And the internet aggravate spreading and evolving of public opinion, and even lead to some events of crowd violence. This has attracted a lot of attention from scholars of several disciplinary. However, How do we predict and guide public opinion to prevent collapse of public trust and keep development of society? It has become a research hot in area of communication science, sociology, complex system and statistical physics.

Some empirical study are conducted to analyze the state of public opinion, route of propagation and dynamic characteristics. Tian uses ORA software to mine characteristics of public opinion information, opinion topics, and public opinion agents through a series of indicators, and quantitatively analyzed the relationships between them [1]. Nazan collects a total of 2381,297 relevant tweets and investigates the public opinions and sentiments towards the Syrian refugee crisis based on NLP [2]. Jiang analyzes the emotional state of people for news events based on sentiments computing [3]. These empirical studies show results of public opinion, but cannot depict the mechanism of public opinion evolving.

In order to analyze the dynamic process of public opinion evolution and overcome the difficult of obtaining online data, many studies explore formation of public opinion and evolution of public opinion based on computer simulation. Therefore, modeling and simulation of opinion dynamics is popular nowadays. In most of these models, opinion has to be a variable, or a set of variables, i.e., a collection of numbers. And these models can be divided into two categories according to variable type of opinion: model of discrete opinion and model of continuous opinion [4,5].

The discrete models see opinion as discrete value, such as voter model [6], Sznajd model [7,8], and so on. In daily life, people are sometimes confronted with a limited number of positions on a specific issue, which often are as few as two: right or left, Windows or Linux, buying or selling, etc. The discrete models can simulate the dynamic process of the opinion in these scenarios very well. On the contrary, continuous models see opinion as continuous value, this can depict more states of individual opinion. Therefore, bounded confidence model is very popular, which mainly includes Deffuant model [9], Hegselmann–Krause (HK) [10], and Deffuant–Weisbuch (DW) model [11]. There are cases in which the opinion of an individual can vary smoothly from one extreme of the range of possible choices to the other. As an example, one could think of the political orientation of an individual from one to a hundred. In each interaction, the focus agent communicate with others and receive opinion of its neighbors, and then update its opinion according to principle of majority, conformity or other sociological theory.

In recent years, many researches considered the influence of network structure and psychological state of agents based on these models to study the process of opinion dynamics. In each period, an agent is chosen randomly and communicate with its neighbors, therefore its opinion is mainly influenced by its neighbors and its original opinion. In other researches, influence of neighbors and influence of neighbors' neighbors are both considered [12]. Therefore, evolution of public opinion are based on some special network, such as small word network, free-scale network and so on. Meng studies the Deffuant model on various network structures (deterministic synthetic networks, random synthetic networks, and social networks constructed from Facebook data) using several interaction mechanisms, and shows that network structure and parameter values both have an effect on the convergence time, and for some network topologies, the convergence time undergoes a transition at a critical value of the confidence bound [13].

The results of public opinion in DW model and HK model are often consensus and polarization. And change of individual opinion is driven by psychology of conformity. However, reversal of public opinion is also an important phenomenon in reality. And people do not change their opinion based on conformity, they also often choose their opinion according to their knowledge and information about some topics. In phenomenon of opinion reversal, public opinion may changes to the opposite direction suddenly, it often occurs after the crowd gained some special information [14].

As a special phenomenon in evolution of public opinion, reversal of public opinion has been concerned recently. Some researcher explored this topic from different disciplines. Wang analyzed the phenomenon of stigma and identity, and concluded that the basic reason was the widespread lacking of trust and full of resentment in the society [15]. Wang took "Assaulted Chengdu Chauffeurs" as an example, and proved that Internet media's unconscious agenda setting (issues drive, media automatic depuration function), conscious agenda setting (voice competition, frame design, media resonance) and netizen agenda setting (opinion leaders, cyber-violence) were the key factors triggering the internet public opinion inversion [16]. The studies from discipline of sociology and journalism have described the definition, forming reason and