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## Analysis on the typical phenomena in the network public opinion rumor dissemination based on social network fluctuation principle

Yueyi Wang<sup>1</sup>, Congwei Xu<sup>1,2</sup><sup>1</sup>School of Economics and Management, Beihang University, Beijing, 100191, (CHINA)<sup>2</sup>Hefei University of Technology, Hefei, 230009, (CHINA)

### ABSTRACT

The continuous improvement of social network technology brings unprecedented impetuses and opportunities to the social development and provides mass communication provides a powerful media platform. Network construction by using data mining verifies the powerful dissemination and promotion effects of social network to some extent. However, on the other hand, with highly developed technology, the strong consensus dissemination capability of Internet cannot be neglected in modern times. On the basis of it, the social network fluctuation principle and the network public opinion rumor dissemination have become much-concerned issues theoretically and practically. From perspective of the dissemination of social network, this paper recognizes the reason why network could be the main method to disseminate public opinion rumor is that the network disseminators make integral connection of social network and the network. In a certain sense, network public opinion rumor dissemination conforms to the potential rules of interpersonal relationships in the social network and a comprehensive research on interaction of social network fluctuation principle and network public opinion rumor dissemination is conducted. In addition, under the Internet environment, this paper makes further discussions on network public opinion rumor dissemination of social network fluctuation principle, especially the in-depth analysis research on the enormous influence brought by socialization of the typical phenomena in the network public opinion rumor dissemination based on social network fluctuation principle. The combination of social network fluctuation principle and network public opinion rumor dissemination has great inspiration and reference effect of constructing good public acquisition, transfer, sharing, application and innovation network environment and improving the service quality of network public opinion.

### KEYWORDS

Social network; Fluctuation principle; Network public opinion; Rumor.



## INTRODUCTION

The research on sociology and social psychology conducted by academic circle promotes the escalating trend in social network analysis research since 1860s or 1870s. With mutual combination and interaction of mathematics, computer, statistics, ethics and sociology, social network field is a multidisciplinary research view-field and has become a new social science research method in the second half of the 20th century. Thus, the research on social science transfers from individual to the whole, from subjective to objective, from one-sided to system and forms a certain degree of fluctuation rules on this basis to disseminate. Such dissemination of public opinion is a network that constructed by public opinion disseminators' taking advantage of special topics and the connection of nodes and edges existing in the Internet. By using social network fluctuation to make dissemination, such network public opinion rumor occupies a significant proportion and its typical phenomena have become the entry points of this paper.

### SOCIAL NETWORK FLUCTUATION PRINCIPLE

#### Analysis on relevant theories of social network

In the emergence and development process of social network, the Cross interoperability of sociology, anthropology, psychology, statistics and probability theory makes social network has many terms with network structure in the research level and forms its unique research and analysis methods. In addition, scholars in various fields propose ideas on social network to some extent, which lays a rich theoretical support for network analysis. These applied theories expand and enrich the systematization and scientization of social network development fundamentally. These applications of social network can be summed up as shown in TABLE 1.

**TABLE 1 : Major representatives and their contributions**

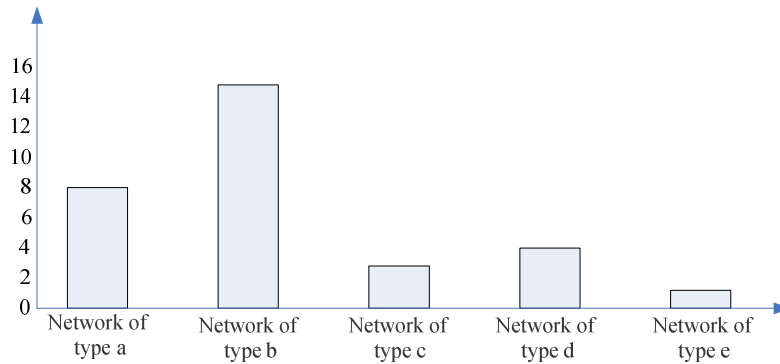
Representatives	Subject Areas	Major Contributions
Nuo LEI	Psychology	Created social metrology and social network research methodology of "community map" that uses points and lines to represent personal relationships
Wenxi LE	Psychology	Proposed social "field theory", which believes that social groups are existing in the "field" and the structural characteristics of social space can be distinguished by the topology and set theory
Hyde	Cognitive Psychology	Conducted "structural balance" research on the attitudes and perceptions of social interrelation, formed "structural equivalence", "rule of reciprocity" and other social relations theories
Barnes	Anthropology	First proposed the concept of "network" and regarded interpersonal relationships as a local area network of the social whole network
Boter	Anthropology	Conducted "Home Network" theoretical research, established various modes of kinship analysis and proposed the concept of network "correlation"
Thwaites & Harare	Mathematics	Complex social structure is composed of a number of simple structures by overlapping on each other: the "tripartite groups", it considers any balanced sub-graph is composed of 2 sub-graphs with conflict and confrontation
Harvard School	Mathematics	Made modeling process of social structure and proposed the "block model" theory

Therefore, the purpose of social network related utility theory analysis lies in starting from the interaction and influence between each structure and each sub function in social relation to explain social network structure's impacts on community function and sub function. Those social network research methods combine the static network scale, network structure features with dynamic mutual relations on the whole, which makes an analytical mode for both structure and function. According to the theory in TABLE 1, the social network research opinions can be summarized into follow parts: First, social relation formed by network rather than community. Second, the feature of social relation is the major influence factor in all social behaviors. Third, the rule of social behaviors depends on the position of the beaver in social relation structure system. Four, social network structure has an influence on social relations' operation and social resources' allocation. Five, the center of social network structure is "relation".

#### Social network analysis fluctuation principle

Social relation develops into social network analysis in some degree, while the composition of social network is more complicated which not only includes nodes but also the network edge linking these nodes. Nodes can be understood as people involved in social network in theory, while edge is the social connection between people and people. On the basis of Internet development, all kinds of network transmission technologies are also scrambling to appear, large scale network public opinion rumors disseminated through social network, forming a certain fluctuation principle according to its development. That is Social Network Fluctuation Principle. Originally, network fluctuation is a theory of computer analysis methods, called Flipping. This kind of fluctuation phenomenon typically only occurs in wide area network, which mainly refers to network sometimes unobstructed or sometimes interrupted or instantaneously interrupted due to the instability of circuit. This fluctuation principle theory applied to social network analysis means the change of social behavior should be

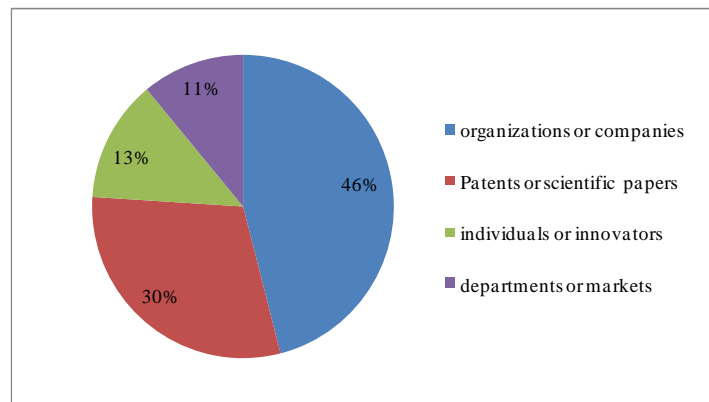
unified with the deployment of the entire social network. That means there need some time to integrate information and relation, during this period the choice of social relation is not accurate, in addition, that will make social relation unbalanced and interrupted. If this unbalance and interruption are relatively frequent, it will cause the whole social network unstable in long period, creating social network fluctuation. This problem does harm rather than good to the instability of the whole social network, therefore there needs a certain relational coordination to reduce network fluctuation in entire social network for improving the fault-tolerant ability of social network as the whole. If make relation coordination and allocation for social network, we must from the micro angle to observe and research social interaction relations. According to the mutual effects between nodes and edges in social network, the analysis methods of social network are divided into two ways, and one is based on the type of edge while another is based on what entity the nodes stand for. The classification based on network edges is shown as Figure 1.



**Figure 1 : Classification based on network edges**

As can be seen in Figure 1, there are four major types in the social network analysis categorized by edges: (1) directed and weighted network of type a; (2) directed and unweighted network of type b; (3) undirected and unweighted network of type c; (4) undirected and unweighted network of type d<sup>[5]</sup>.

In terms of social network analysis based on network node, as shown in Figure 2, 46% of network nodes come from the organizations or companies, patents or scientific papers occupy 30%, individuals or innovators occupy 13% while departments or the markets only occupy 11%.



**Figure 2 : Classification scale drawing according to the node type**

**NETWORK PUBLIC OPINION RUMOR DISSEMINATION**

The advent of mass communication age heralds unprecedented improvement and expansion of human dissemination capacity and demands. There is a tendency of globalization and informatization in human society as a result of significant transformation of social forms and economic structure in the 1980s. The network dissemination age is a product of globalization and informatization of the society and also a basic form for public opinion rumor dissemination in information society.

**Rumor dissemination**

Rumor, as a universal phenomenon in human society, was disseminated by word of mouth in the early stage. Due to rapid development of technology, there are certain changes of rumor dissemination in terms of its methods, ways and tools. In current stage, the network public opinion rumor dissemination has become the main channel for rumor dissemination in modern society along with increasing popularity of computer and Internet technology<sup>[6]</sup>. Therefore, it has become a key link

in current maintenance of a healthy network environment and social stability to conduct research on mechanism and forms of network public opinion rumor and have a command of its law and characteristics. In the field of communication sciences, it is believed that rumor, rather than being produced completely by people, is also generated naturally. There is a relatively systematic and scientific interpretation of rumor in the field of Western research as follows TABLE 2.

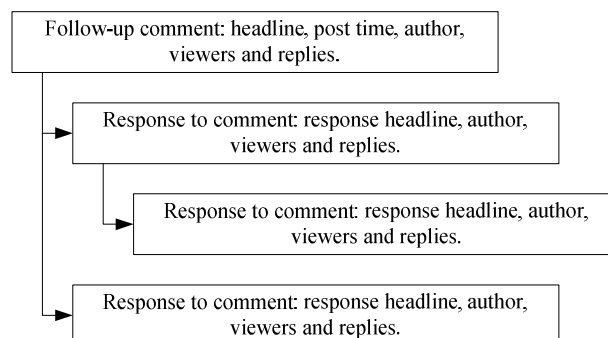
**TABLE 2 : Relevant interpretations of “rumor”**

Scholar	Definition
Allport & Postman (1947)	Rumor is a kind of statement or belief that was disseminated among people through word of mouth and it is not supported by any public evidence.
Peterson & Gist (1951)	Rumor is a kind of explanation or not-proved interpretation among the general public on various objects, time or questions interested by the public.
Berrenson (1952)	Rumor is a kind of convincing information form.
Schachter & Burdick (1955)	Rumor, being not credible, is a kind of distorted communication disseminated rapidly among people secretly by virtue of the role of contagion or diffusion.
Shibutani (1966)	Rumor is a kind of improvised news generated through the process of discussions among a group of people.
Rasnow (1988)	Rumor, as a kind of public information exchange, is a hypothesis of individual person to certain phenomenon.
Kapfere (1990)	The so-called rumor is information that has appeared and disseminated in the society but has not been proved in public by the government or has been denied in public by the government.
Huabao ZHANG (1994)	Rumor refers to certain interpretation and theory without evidence on one thing that is imagined or has happened in society through word of mouth.
Fisher (1998)	Rumor, as a kind of collective behavior, refers to information that has produced and disseminated among people for certain purpose.
Pendleton (1998)	Rumor is a kind of information communication not yet proved by any trusted sources.

Judging from the above concepts in TABLE 2, it is obvious that there are three features explained by all scholars in the academic sector in spite of their diversified interpretations on “rumor”. First, rumor is a kind of information dissemination behavior; second, rumor serves as carrier of real social relations; third, rumor is disseminated according to certain scope and time.

### Network public opinion rumor dissemination

Research on network public opinion rumor dissemination is a focus in current research field of sociology. Due to the current situation of interdisciplinary research, researchers in various academic fields including sociology, naturology, statistics, icon science and anthropology are involved in the research. Several physicists have conducted studies on and made discussions over approaches to apply basic framework of physics to explain the evolution process of public opinion under the general background of network public opinion rumor. They focus mainly on the generation and development mechanism of public opinion and go on to suggest several public opinion models on that very basis. For instance, the one-dimensional and two-dimensional lattice models of public opinion dissemination have, to certain degree, explained the mechanism of public opinion evolution<sup>[7]</sup>. As to scholars of statistics, they hold that the public opinion orientation value refers to several values between the positive and negative extremes. In their studies of network public opinion rumor dissemination, scholars of icon science have discovered the power-law characteristics concerning public opinion dissemination and proposed the BA scale-free model. In this way, they have given a more pertinent explanation of main features of public opinion dissemination in social network as well as interaction and inter-association among various individuals which is realized through the network forum<sup>[8]</sup>. It can be discovered by forum design and implementation that the network public opinion rumor forum will generally cover the following boards, shown as Figure 3.



**Figure 3 : Data structure of network forum**

It is indicated by Figure 3 that the social relation between participants and actors of network public opinion rumor is established through forum posts. There is a fixed and obvious inter-connected network established among users through such kind of relationship of posts replies. Besides, the network fluctuation law depends, to certain degree, on posts replies index and posts release. The establishment of forum serves as a link of interpersonal and network relationship among network users; hence, a kind of network public opinion rumor relationship based on social relations is established on that very basis.

**Analysis of typical phenomena in network public opinion rumor dissemination based on social network fluctuation principle**

There are certain typical phenomena of network public opinion rumor dissemination under the influence of social network fluctuation: rumor serves as the processing and transition plant of information and it can contribute to creation of some new rumor elements through its dissemination. By network public opinion rumor, it is necessary to convince the network users completely of the rumor information disseminated so that they will spread the rumor by other means. Therefore, there are two basic laws to be followed in the process of network public opinion rumor dissemination. First, the subject of rumor information is, to certain degree, significant to both disseminators and receivers; second, there is a relatively vague consistency between the public opinion rumor information and the actual facts. Scholar Allport has expressed the intensity of public opinion rumor with the formula  $R \sim i \times a$  (1), and he has held that the main focuses of dissemination media in the complicated network public opinion dissemination are the average path length and clustering coefficient demanded by public opinion rumor.  $d_{ij}$ , which is the distance between the two nodes  $i$  and  $j$  in the network, is defined as number of edges of the shortest path connecting the two nodes. The maximum of distance between any two nodes in the network is referred to as diameter of the network marked with  $D$ , and then:

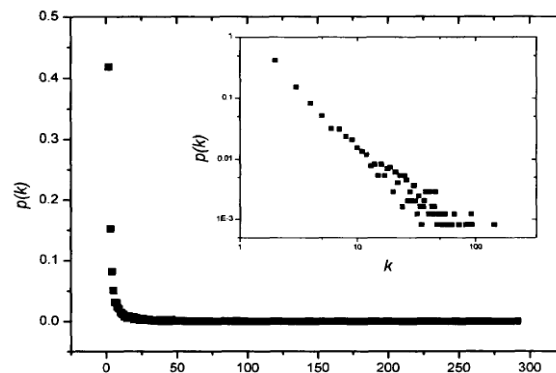
$$D = \max_{i,j} d_{ij} \tag{1}$$

The average path length of network marked with  $L$  is defined as the average value of the distance between any two nodes of public opinion rumor dissemination. If the node is regarded as  $K$ ,  $k_i$  nodes may exist on  $k_i(k_i - 1) / 2$  sides. Setting the actual number of sides for  $k_i$  nodes as  $E_i$ , the clustering coefficient between the two marked with  $C_i$  can be calculated as:

$$C_i = 2E_i / [k_i(k_i - 1)] \tag{3}$$

In the formula, the clustering coefficient of the entire network marked with  $C$  is the average value of  $C_i$  which is the clustering coefficient of all public opinion rumor nodes marked with  $i$ . When  $0 \leq C \leq 1$ ,  $C=0$  indicates that all nodes are isolated so that the public opinion rumor dissemination under social network fluctuation is interrupted; and  $C=1$  indicates that there is a connection between any two nodes in the network so that the social network coincides with public opinion network (that is, harmonious overall situation in social network).

Moreover, another typical phenomenon of network public opinion rumor is that the process of rumor dissemination is that of information homogenization. Judging from the environment for public opinion rumor dissemination, the dissemination is made under the condition that there is certain asymmetry of rumor dissemination in the process. Besides, the gap among public opinion rumor receptions will, to certain degree, lead to indiscrimination between information dissemination and reception, which is called information homogenization. The methods and levels of dissemination of network public opinion rumor have become different during the very process. There are two stages of network public opinion rumor dissemination as compared to traditional dissemination methods, and the following Figure 4 is a degree distribution of dissemination:



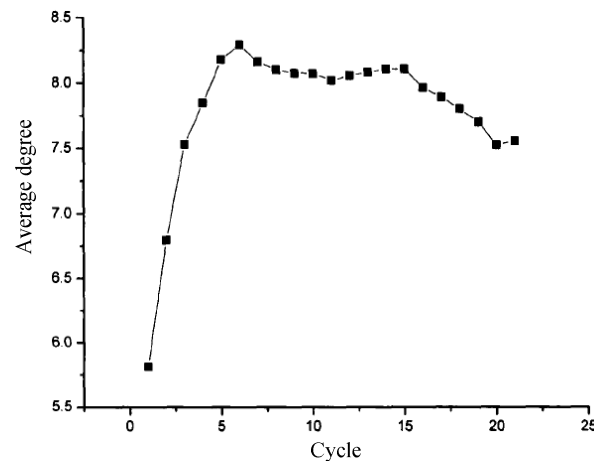
**Figure 4 : Degree distribution of network public opinion rumor dissemination**

It is indicated by the above figure that the network public opinion rumor is disseminated not as a result of network falsification and that rumor has been disseminated among individuals and groups in the social network during its

dissemination process. The rumor information, upon entering such media as network for dissemination, has been simplified, intensified and assimilated by the disseminators. According to BA scale-free model, the degree distribution of network public opinion rumor corresponds with power-law distribution, that is:

$$P(k) \propto k^{-r} \quad (3)$$

According to statistics of network forum data, the characteristics of social network is positively correlated with network public opinion rumor dissemination and the structural form of social network is different from traditional scale-free dissemination. Thus, the tendency of social network fluctuation and network public opinion rumor is shown in Figure 5. It is obvious, according to Figure 5, that the contents of public opinion rumor has been changed in the process of reposts, resulting in distorted rumor information that has deviated from actual facts.



**Figure 5 : Distribution of day-by-day number added of network public opinion rumor dissemination nodes**

## CONCLUSION

The network has become the main means for public opinion rumor dissemination because network disseminators have connected the social network with entire network so much so that the network public opinion rumor dissemination is, to certain degree, in conformity with potential laws of interpersonal relationship in social network. The fluctuations in social network are mainly originated from the authenticity and falsity of network public opinion rumor whose dissemination has accelerated the speed and expanded the scope of information dissemination by means of characters and pictures. As the individual person is the very node of social network, the theoretical basis of interpersonal relationship is also displayed in social network to make the chaotic and massive network public opinion rumor information more “convincing” to people. It is true that the network public opinion rumor has continued the interpersonal relationship in social network. In view of the network public opinion rumor dissemination mechanism and complexity of its path, however, research on network public opinion rumor should focus on more far-reaching fields with due consideration of its significant impact on social network fluctuation interruption.

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