Strategies for Spreading Information from Local to Global in Social Complex Networks, Cases from a Village in China

Weimin Liao
School of Culture communication
Zhejiang Sci-Tech University
Hangzhou, Zhejiang, China, 310018
liao_weimin@sina.com

ABSTRACT
In this paper, we discuss the strategies adopted for spreading information from local to global areas in social complex networks by studying cases from a Village named Wukan in China. After identifying the most efficient spreaders [1], the structures and features of the communication community in Wukan are revealed clearly. Although many high k-shell nodes existed, the real powerful leader of the public protest in Wukan was firmly connected with those vehicles via interpersonal communication; he is clearly knowledgeable of how to leverage the new media social network and he is the No.1 figure for public speaking at the centre of the broadcasting network in Wukan. The success in delivering information over strict censorship to a global audience relies on four important strategies combined with each other. This is confirmed by the Rogers’s theory in different manners.

Categories and Subject Descriptors
H.2.8 [Database Management]: Data Applications--data mining, statistical database; J.4 [Social and Behavioral Sciences]: Sociology.

General Terms
Measurement, Theory, Verification

Keywords
Spreading, k–shell decomposition, communication strategy, social complex network, public protest, Wukan Incident.

1. INTRODUCTION
It is well known that there are numerous public protests happening in China, however, only a few of them are ever heard of or discussed in public. This is due to the fact that most of the information regarding these events (defined as mass events or mass incidents in Chinese context[2]) are often censored or supervised [3] in mass media and through the internet by the government. It is unusual for a small village like Wukan, which is located in east of Guangdong Province in Southern China, to make its voice loud enough to be heard globally, as was the case in 2011. How did this incident get transmitted from the local level into a global prominent story reported on the front pages of international media? Basically, this paper will examine the strategies adopted by the villagers of Wukan for spreading information efficiently and smartly in social complex networks via traditional communication modes as well as new media, which is echoed with Rogers’s theory [4].

2. BACKGROUND ABOUT WUKAN
2.1 Brief Introduction of the Wukan Incident
According to the official report about the Wukan Incident posted on the People’s Daily online[5], the public opinion discussing the Wukan Incident went through three stages and over three months. In the first stage, only a few overseas media outlets reported the event while the interactive media paid little attention to it at all. Gradually, however, after the middle of November, the news media came to focus on the event and the quantity of news coverage increased rapidly after the middle of December. In the final stage, when the provincial investigation group came to Wukan in the evening of December 21, the information regarding Wukan entered the “expressway” with full transparency. Since then the Wukan case became a government media agenda topic and is now discussed freely in China. Actually, the evolution of the Wukan incident and its solution has a complex procedure involving many critical points in time[5, 6, 7]. It originated from a small group of people gathering through QQ requesting local officials to “give back our farmland”. These officials had sold the land to real estate developers and other businessmen without properly compensating the villagers. When the peaceful argument was ignored, or at best, ill-received by the administrative bureaus, the local population’s anger was agitated and it induced social conflict, street demonstrations and fierce violence which was eventually noticed by the outside world. As many scholars pointed out, the peasants in China now know to seek support from social networks when they encounter a problem. This helps ensure that their interests and rights are protected [2, 8].

2.2 Communication Modes for Villagers
The new media is frequently used by youngsters in Wukan, e.g., QQ, Microblogs, and Short Messages via their cell-phones. However, the rest of the villagers still rely on traditional communication channels such as face-to-face, frequently done while meeting at a playground. We also found that the information infrastructure in Wukan is surprisingly well constructed. The houses are connected by many small roads in the village, and there are multiple playgrounds. These are huge open spaces for people to gather and hold folk ceremony’s or village dramas to celebrate festivals. Interestingly, banging the gong is one traditional...
communication method still frequently used in this village. The entire village of over 10,000 people could be considered living under a “broadcasting network”, utilizing public speaking to deliver information and relying on a few key speakers.

3. IDENTIFYING THE MOST INFLUENTIAL SPREADERS IN THIS CASE

3.1 Method for Measuring Centrality

As for studying the mechanism to disseminate information in the Wukan incident, identifying the most influential vehicles is the key question. A number of methods or parameters have been introduced for classifying the importance or centrality of a node in complex networks based on graph theory. Examples include the following: i) Degree centrality; ii) Betweenness centrality; iii) Eigenvector centrality; iv) K-shell decomposition. K–shell decomposition is a well-established method for analyzing the structure of large–scale graphs [1, 9, 10, 11]. It has been found recently that the “most efficient spreaders are those located within the core of the network as identified by the k-shell decomposition analysis” [1].

3.2 Method for Gathering Sample Dataset

Since the Wukan incident happened in a social dynamic complex network, some nodes might be cancelled or expelled by the internet supervisors. Therefore, it is very hard to collect the reliable dataset for studying how the information is spread through the internet. For the sake of simplicity and accuracy in identifying those influential vehicles, we actually undertook a field trip to visit the village and interviewed all the newly elected committee members. By examining those key figures in this event, we tracked the information route and identified some information transmitters and receivers in Weibo, considered to be the real nodes in the complex network. Finally, we set a collection of 100 nodes as a sample at the beginning. Unfortunately two nodes were suspended when we tried to collect details of the information about their relationship one week later.

![Fig.1: Dataset contains 98 nodes, density ρ=0.414, the arrow shows the direction of message flowing from Weibo host to fan. The node size is adjusted according to degree. (Blue= Villagers)](image)

3.3 Features and Structures of the Dataset

Since the dataset contains the highest K-shell nodes for spreading information about Wukan, some statistical features and the network structure of the dataset is helpful for us to understand the mechanism of information spreading in this case. The spreading behavior and patterns between Wukan villagers and outsiders have significant differences; 100 nodes in this dataset are clustered by different dimensions. For example, most of the Wukan villagers have generally posted fewer messages, less than 1000, while the outsiders who are likely to be followed by their numerous fans have generally posted more messages, at least over 1800. The villagers posted messages mentioning “Wukan” with the average rate of 17.6% and median rate of 13.1%; for outsiders the average rate is 5.7% and the median rate is 0.8%. It indicated that only a few new activists from outside observed this event with huge enthusiasm and most outsiders were more like “passengers” for the Wukan Incident. Among the 29 outsiders, there were 4 journalists, 9 social activists and 16 intellectuals with different professional jobs, e.g., lawyers, professors, writers.

3.4 Dissemination Models and Discussion about the Nature of Information

The epidemic Susceptible-Infectious-Recovered (SIR) and Susceptible-Infectious-Susceptible (SIS) models [1, 12, 13, 14, 15] are introduced to study the information spreading mechanism and process. These models have been used to describe disease spreading as well as information and rumor spreading [16] in social complex networks. If β(t) is denoted as the probability that an infectious node will infect a susceptible neighbor in time t, in most circumstances, it is easy to be treated as a constant value for simulation [1]; however, in Wukan’s cases that β(t) are varied from time to time according to the in-time situations of the event or the importance of information delivered. As the Ref.[1] indicates that in the case of large β values, where spreading can reach a large fraction of the population, the role of individual nodes is no longer important and spreading would cover almost all the network independently of where it originated from. For some emergency circumstances, the value of β(t) is high enough that almost everyone who read the message would likely share it with their friends or fans immediately. In general, the different nature or importance of information would effect the value of β(t) [12].

<table>
<thead>
<tr>
<th>Message Nature \ Value</th>
<th>Higher β(t)</th>
<th>Lower β(t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of situation</td>
<td>emergency, severe</td>
<td>routine, dull</td>
</tr>
<tr>
<td>Expression of emotion</td>
<td>strong and fiercely</td>
<td>mild, tender</td>
</tr>
<tr>
<td>Argument of opinion</td>
<td>authority, eloquent</td>
<td>ridiculous, odd</td>
</tr>
<tr>
<td>Direction of behavior</td>
<td>show leadership</td>
<td>against, harmful</td>
</tr>
</tbody>
</table>

Table 1: The nature of information would affect the value of β(t), hence effect the mechanism and process of spreading.

3.5 Identify the Most influential Vehicles

It is very easy to evaluate the centrality of nodes by degree, betweenness and eigenvector. We can list the top ten nodes by measurement of the three methods as the following:

<table>
<thead>
<tr>
<th>Centrality</th>
<th>Top 10 nodes</th>
<th>Top 3 values</th>
</tr>
</thead>
<tbody>
<tr>
<td>degree</td>
<td>32,14,83,57,24,10,4,31,23,11</td>
<td>80, 69, 62</td>
</tr>
<tr>
<td>Betweenness</td>
<td>32,73,14,13,83,57,10,49,24,38</td>
<td>466, 332, 220</td>
</tr>
<tr>
<td>eigenvector</td>
<td>32,14,4,57,10,83,24,6,23,11</td>
<td>0.21,0.20,0.18</td>
</tr>
</tbody>
</table>

Table 2: The top 10 nodes by 3 centrality measures

The top node by all three methods is #32. Its host’s name is Zhang Jianxing, who is the photographer and closest bodyguard of Lin Zhuluan. He was in charge of the media centre for the protestors and worked as the speaker to the news media. The node #14 denotes a 16-year-old boy, usually reported by the media for his consistent performance of delivering messages continuously and thoroughly. Node #57 belonged to the daughter of a passing hero in the Wukan Incident. The only outsider among the top 10 nodes is #83, who posted the highest amount of messages about Wukan. He is a participatory observer involved deeply in Wukan’s events.
What were the results of computing using the k-shell method? First, we set up a social network graph from the sample dataset; Second, by adopting the k-shell decomposition method [1, 9, 10, 11], we assign an integer index or coreness, kS, to each node representing its location according to successive layers (k-shells) in the network. Finally, we find that the highest kS=22; there are altogether 43 nodes that have the same kS value. In other words, these nodes are all located in the same k-core with equivalent influence in terms of information spreading. By removing anyone from this k-core, their role will be replaced by other nodes and the spreading effect is not impacted in the end. The phenomenon of “absence of influential spreaders” is also verified by another study recently [17].

However, according to our fieldwork and the result of his election, Mr. Lin Zhuruan (Fig.2) was the most influential communication “vehicle” of the whole movement. He became the leader and director among this group of influential villagers after the September turmoil of Wukan. Although he is not a Weibo user, his public speech, interviews, photos and videos were spread among all the nodes through Weibo and other “new media” vehicles. He is a proactive communicator of information regarding the Wukan event.

Strategy #1: Create strong internal connections between nodes in a designated community. The promise of delivering information successfully relies on a stable information resource that can generate or provide accurate messages. If the community is strongly connected and everyone shares a common and effective broadcasting network, a message can be transmitted outside from almost any node inside. In Wukan, even the younger members of the village knew of the situation and key issues of the event and important information was sent outside by a few teenagers through the internet (Node #14 is a typical example).

Strategy #2: Create strong external connections with an open community through alternative communication channels. When the channels for ordinary connections are suspended, the alternative communication channels should be activated immediately to keep the information system working well. In the case of Wukan, the Hong Kong community acted as one alternative communication channel for information spreading after the news about the Wukan’s protest was censored.

Strategy #3: Compelling positioning of important information enhances the probability of being noticed and getting a response. The final goal of spreading information is not only generating awareness, but also ensuring the receiver responds to it positively, such as showing political support, moral empathy, emotional outreach, even finical aid or donations. There were many examples in Wukan of the issue being shared through Weibo in a compelling way which generated powerful and strong emotional responses. In terms of the SIS or SIR models, the infection rate β(t) is correlated with the rhetoric effect. The compelling expression of important information can be easily shared by the opinion leaders (Fig.3) in different domains outside the village.

Strategy #4: Keep spreading information consistently using a single voice. The success of delivering information to overcome any difficulty basically depends on two dimensions: Space and Time. For the sake of impact, the information should be consistent and positioned as a single voice by the same person. As in the case of Wukan, the message of “give back our farmland” met this criteria from the beginning to the end, culminating in the election in March, 2012.

4.2 Discussing the Combination of Strategies
Rogers defined that “Diffusion is the process by which an INNOVATION is COMMUNICATED through certain CHANNELS over TIME among members of a SOCIAL SYSTEM.”[4] These four strategies confirm the process in the critical points where the diffusion might fail in the adverse circumstances. Because the villagers are humble and less-educated, they have usually been defined as information receivers in the traditional point-of-view of Rogers’s studies [4]; however, they are information senders in our study. The direction of information flow in our study is reversed as the diffusion of innovation. These peasants in Wukan, considered typically as a vulnerable group by urban dwellers, eventually conquered all barriers to ensure their voice was heard, enduring much suffering and taking an arduous journey along the way.

Let’s take a look from a case to study on how the combined strategies were effective and complimented each other. On December 13th 2011, the officials announced that a protestors called Xue Jinbo had died just two days after being arrested. The villagers held a vigil for Xue at his home and local officials began to set up barricades around the village for “safety’s sake”.

Strategy #1 worked when most villagers took part in the resistance activities and mourning ceremony. We can see in this case how information sharing in the community filled the gaps between those with and those without internet access. In the Wukan Incident, many youngsters wanted to send messages by
internet regarding what happened but the internet was blocked and the electrical power and water supply systems were shut down by local government officials. **Strategy #2**: journalists from Hong Kong walked via the country roads to cross the barricades set outside the village. The journalists will generally get a warm-hearted welcome by the villagers in Wukan, because they know they can send accurate information outside via news media. Also, **Strategy #2** worked when Hong Kong residents who were originally from Wukan sent information through alternative channels when the usual routes were blocked or sealed from the origin. Qingdong cited reports from Hong Kong’s media when he sent a message about the emergency in Wukan.

**Strategy #3** was effective when this message was transferred over 16,000 times in one week. Why did it spread? Because he told the story with strong emotion and with conviction using just 140 words in Chinese during prime time. The pattern of this information diffusing looks like an explosion in the first several hours (Fig.4), because the host has over 1 million fans. **Strategy #2** became effective again when many fans transferred it by @friends or other opinion leaders. For example, only after 3 minutes the message was transferred to @Lichengpeng, who is a famous writer with over 5 million fans. By examining the transferring speed (Fig.5), we find that the explosive point at peak roughly happened around 17:00 on December 18th, promptly after Mr. Li Chengpeng transferred this message at 16:51. In general, **Strategy #3** is the mechanism to compel people to respond to your information. If delivered in such a way, with significant emotion and conviction, it will make the jump from local to global. Only when the local event is labeled with a unifying issue, will it become a global agenda. **Strategy #4** can guarantee the communication effect will keep extending in geographical and timing dimensions.

**Fig.4**: A message posed by Prof. Kong Qingdong spreading in the first 6 hours on December 16th 2011.

**Fig.5**: Variation of times/min for this message transferred and commented in 1416 minutes on December 18th.

The combination of the 4 strategies put Wukan Village on the global map. Hopefully this incident will have educated and enlightened all local Chinese government officials to not resort to censorship but rather, to respect fundamental rights and real public opinion. Sit, meet with, and talk to the people in a sincere manner and you will earn their respect.

**5. ACKNOWLEDGMENTS**

This research is supported by the “Humanities and Social Science Research Youth Project Grant” (No. 10YJCZH084) and the “Philosophy and Social Sciences Major Project Grant” (No. 09ZJD0010) by the Ministry of Education and China Postdoctoral Science Foundation (No.2012M510501). I am grateful for the helpful comments by three anonymous reviewers and for the cooperation with Prof. Zhu Xiaojun, Zhejiang Sci-Tech University in our field trip to Wukan. I would like to thank Prof. Ke Huixin and Prof. Shen Hao in Survey & Statistics Institute, Communication University of China.

**6. REFERENCES**


