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Dissemination patterns, opinion leaders and news commentary on Weibo: A medium-sized data approach to studying social networking sites[1]

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The New Information Environment

Launched in 2006, Twitter kick-started the microblogging revolution, helping create, along with other similar platforms, a new type of information environment. This environment breaks the one-to-many dissemination model of traditional mass media and allows individual users to act both as information senders and receivers, as both content consumers and producers (Hermida, 2010). Sullivan (2014) marks a breakthrough moment for this new information environment in China in February 2009; an illegal firework display in Beijing caused a fire that threatened the new headquarters of the state television system, with traditional media slow to report on the issue many witnesses on the streets broke the story on their microblogs.

Compared to the large amount of research that has been conducted concerning news dissemination and provision on Twitter and related to Western news organizations and events, much less is known about these issues in China, the world's largest Internet using population. However, there is evidence that the use of the Internet and social media for accessing news may be even more prevalent in China than in the West; 78 percent of Chinese Internet users access online news and 56 percent use microblogging platforms (CNNIC, 2013). In contrast, only 18 percent of U.S. Internet users use Twitter (Smith, 2013).

This lack of research into Internet use in the world's largest Internet population is symptomatic of a significant imbalance in the topics and methods of research into information sharing on social networking sites (SNSs). A review of research on SNSs in communications journals between 2006 and 2011 found that only 8.3% of articles examined these platforms in an Asian context, of which none concerned Chinese SNSs; additionally 75% of articles used a quantitative approach and only 7.1% a mixed methods approach, with very few (2.3%) discussing the networking features of these sites rather

than focusing on the individual user as the unit of analysis (Zhang and Leung, 2015). However, since the cut-off point of this review, research on Chinese SNSs has blossomed, with research into Weibo, the leading Chinese microblogging service, becoming a hot topic in recent years.

Weibo was launched in China in 2009 as the domestic version of Twitter, in line with government policy of restricting access to internationally popular Internet platforms and fostering domestic alternatives. This policy enables more easy control and monitoring of the online actions of these sites' millions of users and also means that these sites develop affordances specific to the Chinese context. However, the basic affordances of Weibo[2] are similar to that of Twitter.

On Weibo, users can choose to follow a variety of other accounts; posts from these accounts plus other popular and sponsored content appear on a user's "news feed." Users are given the option to like, retweet/forward, favourite, or comment on each individual post (Figure One). The retweet functionality is the most important means by which information is disseminated throughout the system because it allows information to flow between users based on the recommendation and endorsement of that information by those in the user's social network, capitalizing on the networking functions build into the structure of these online platforms. The potential to disseminate information online through a multitude of individual network connections was seen as potentially a very important change to information flows within China, in which the government maintains tight controls on the publication of information (Reporters Without Borders, 2015).

Research into information dissemination on Weibo focusing on particular social issues has found that the platform helped grassroots leaders challenge the agenda setting

[2] There are several weibo (meaning microblog in Chinese) services in China of which Sina Weibo is by far the largest and most popular. This article follows the general convention of speech in China in which Weibo is assumed to refer to the Sina Weibo platform, unless otherwise stated.

power of established leaders (Fu and Chau, 2014) and enabled the building of issue-networks across geographic boundaries (Huang and Sun, 2014). However, these research efforts have focused on case studies of particular issues, using select keywords or groups of users. In contrast, studies of popular topics on Weibo have found that the majority of trending topics on Weibo are concerned with "frivolous content… unlike Twitter where the trends are mainly news-driven" (Yu et al., 2013: 2) and that many of these trends are artificially generated based on the retweeting activity of robot or spam accounts (Yu et al., 2012).

A call for a more nuanced understanding of information dissemination on Weibo has come from research based on a random sample of users, which found that more than 80 percent of posts were created by a small minority (4.8%) of users with the remaining users mainly retweeting the content created by others (Fu and Chau, 2013). These findings underscore the importance of studying retweeting and information dissemination on Weibo to understanding the social effects of this platform.

Ideas about online information dissemination often draw from the work of media theorists Katz and Lazarsfeld (1970), who proposed the idea that news information disseminates via a two-step flow in which opinion leaders act as intermediaries between the mass media and the general public. Previous research concerning opinion leaders on the Chinese Internet has tended to focus on qualitative description in isolated case studies of extraordinary events rather than a quantitative analysis of a random sample. These studies have highlighted celebrities (Fu and Chau, 2014; Liu, 2011), government officials (Zhang, 2011), individual journalists and other media professionals (Fu and Chau, 2014; M Wang, 2011) and academics (Zong, 2011) as influential opinion leaders.

However, big data studies of Weibo, which form the majority of work in this area, do not tell us are great deal about who these online opinion leaders and the size of the datasets often are seen to preclude an analysis of the context of its production and

reading. The work of Fu and Chau, who noted the identities of several of the top ten accounts by betweenness centrality (a measure of the importance of an individual node to the dissemination network based on the number of shortest paths in the network that pass through the node) in the dissemination of information in two cases of grassroots-initiated social issues on Weibo is an exception to this rule; however, much more work is necessary to bridge the gap in knowledge between research that focuses on individual case studies but thus lack generalizability and big data efforts that can describe the texture of the whole platform but are so large that they have difficulty speaking to the nature of individual users and cases.

To do this, this study is based on a medium-sized data approach that first utilizes digital social research methodologies and a quantitative social networking approach to collect, compare, analyze and categorize data on dissemination networks of randomly selected news stories from top information providers on Weibo; it then undertakes an a qualitative analysis of key opinion leaders, stories and comments identified as important by the quantitative analysis, which provides the description and context necessary to evaluate and extend existing knowledge about this important and understudied area.

Research Questions and Operationalizations

1. What role does retweeting play in the dissemination of mass media information on Weibo? How do these dissemination patterns contrast with those found on Twitter?

Previous research has found that news forwarding (retweeting) plays an important role in disseminating news stories on microblogs, with almost half the mass media information Twitter users received coming through an intermediary (Wu et al., 2011). However, other researchers have been more sceptical about the potential of microblogs to diffuse information to new eyes. In analyzing trending topics on Twitter, Kwak et al. (2010) found that tweets were generally seen by an additional 1000 people who did not

follow the original source; however, information was unlikely to spread far from the source; more than 95.8 percent of tweet trees (the length of the path of a series of retweets) had a height (length) of one, 97.6 percent had a height of five or less and no tree went beyond 11 (Kwak et al., 2010). Similarly in analyzing URL sharing on Twitter, Bakshy et al. (2011) found that, although information spread up to nine steps from the source, the average retweet tree height was only 1.14. Although a lot of retweeting took place, few messages were carried far from their source and, given the likelihood of high homophily within follower networks, this suggests microblogging plays a limited role in increasing the diversity of available information. However, Chinese microblog users live in a distinctly different media environment than most Twitter users, which has led some to suggest that patterns of information dissemination discovered on Twitter might not be applicable to Weibo (Yu et al., 2012).

2. How is mass media information disseminated on Weibo?

Previous research on Twitter that divided users into three categories, mass media, regular users and evangelists (opinion leaders, politicians, celebrities, local businesses), found that mass media organizations could reach a majority of Twitter users and that the remaining audience could be almost entirely reached by evangelists; they concluded that regular users accounted for a "negligible fraction" of the information spread for different news events (Cha et al., 2012).

Qualitative research in China has similarly concluded that online discourse is dominated by a select group of opinion leaders (Kang, 2012) and that a small proportion of users generate the vast majority of information (Fu and Chau, 2013). However, little quantitative research has been devoted to identifying who these opinion leaders might be and whether the differences of the Chinese context, such as greater distrust of government information sources and traditional news providers compared to blogs and

other forms of online communication, might lead to different types of opinion leaders being prominent on Weibo.

Additionally, some scholars have questioned the applicability of the two-step flow model online that focuses on a select few opinion leaders. In examining discussion surrounding several politically orientated trending topics on Twitter, Bastos et al. (2013) proposed an alternative to the dominant view that regular uses play little role in the dissemination of political topics on microblogs, finding instead that "the intense activity of individuals with relatively few connections is capable of generating highly replicated messages that contributed to trending topics".

3. What is the extent and nature of user commentary on Weibo?

While comparable research on news dissemination and opinion leaders exists for Twitter, which can be used to generate hypothesis and comparisons, Weibo's commentary and discussion platform is far more developed than Twitter's. As such very little research, mostly focusing on selected, extraordinary news events, exists regarding commentary on Weibo. However, it is these commenting functions that lead some to label Weibo an emerging Chinese public sphere and, as such, it is important to investigate the use of the comment function on Weibo and its relationship with forwarding.

Methods

Rather than examining specific social issues or case studies of extraordinary events, this research focuses dissemination of and interaction with mass media information on Weibo. Although the calculation of this statistic is not transparent, Weibo publishes a list of the most influential accounts each week in particular domains such as news, entertainment and travel. The top five most influential news providers for the week

of February 11 to 17, 2013[3] were chosen for study as the largest providers of mass media information on Weibo during that time period.

These providers were the Weibo Breaking News and Entertainment News channels, information sources provided by Sina Weibo itself; the People's Daily newspaper, a mouthpiece for the Central Committee of the Communist Party; CCTV, the state broadcaster; and Caijing, an independent, bi-weekly current affairs magazine.

These news providers were selected to represent the dominant voices in providing news information on Weibo. While the top providers on the platform (according to Weibo's statistics) fluctuate each week, these news providers represent the most influential during the period under study. The selection of random stories from within the publications of these providers during the time period and the collection of retweet and commenting data for these stories thus creates a dataset that is designed to speak to patterns of interaction with the most popular and dominant news stories on Weibo.

These five providers published 1276 posts during the study period, with little variation in volume (the most frequent poster was the Breaking News channel that published 279 posts during the week and the least frequent poster was the People's Daily

[3] Weibo enjoyed an unparalleled position as the leading Chinese web platform between mid-2011 and mid-2013; however, use dropped precipitously in the late summer of 2013 after the government crackdown on rumors and subsequent series of arrests (Moore, 2014). The results of this study thus speak to the patterns of information dissemination on Weibo at the height of its popularity and, although the online-environment moves much faster than the publication cycle of social science research, the contributions of this study to understanding how news information is shared online in China and to methodological practices for working with online data can provide useful insights into the study of online environments even if usage has shifted from Weibo to other platforms such as Weixin. More research would be necessary to evaluate patterns of news dissemination on the post-crackdown Weibo or on Weixin; however, restrictions in access to Weibo's API mean that network data of the type used in this study can no longer be collected.

with 233 posts). From within this sample of 1276 posts, ten were selected at random from each of the five news providers to constitute a total of 50 posts.

Using Python scripts to query the Weibo API, networks of post retweets and comments were reconstructed for each of the 50 stories, using a timeline of user interactions and lists of users' follower networks. This data was collected at least five days after the original story was posted to allow the stories to fully disseminate through the microblog network. The collected information was used to construct the networks of retweets and comments each of the stories. The dissemination networks were visualized and analysed using both Pajek and Gephi. The dataset comprised, across the 50 stories, 68,490 retweets and 29,428 comments, resulting in 36,382 retweet trees and 88,077 directed replies.

Following quantitative analysis of this data, key nodes, stories, comments and outliers were analysed qualitatively. Accounts identified as opinion leaders in the dissemination of the selected stories (based on their outdegree centrality, i.e. the number of their followers to retweeted the information) were coded to ascertain their social positions. The content and dissemination patterns of stories that had wide dissemination networks were analysed and the comments on a particularly popular story from within the sample were examined as a case study.

The Importance of Forwarding as a Dissemination Tool

The first research question of this study asks what role retweeting plays in the dissemination of mass media information on Weibo and how these dissemination patterns contrast with those found on Twitter. In order to address this question, repost networks for each of the selected news stories were reconstructed and analyzed. The average height of the retweet trees was 1.23 (Table 1). This means that these posts travelled, on average, 1.23 hops from their source. Three quarters of these retweet trees

had a height of one, meaning that they were retweeted by one follower of the original information provider but none of the followers of these individuals who were not also followers of the original provider retweeted that story. Eighteen percent of the retweet trees analysed had a height of two, meaning that information could be seen by users separated by two following connections from the original poster, i.e. this information could be seen by someone who followed someone who followed the original news provider.

These dissemination networks are, on average, larger than those found in previous research on Twitter, with retweet trees having an average height of 1.23 in this sample on Weibo compared to 1.14 in (Bakshy et al., 2011) work on URL sharing on Twitter. More powerfully since one might expect random news stories even from the top providers to be retweeted less than trending topics, 74.9 percent of trees had a height of one in this sample compared to 95.8 percent found by Kwak et al. (2010) in analyzing trending topics on Twitter.

This finding suggests news information may travel further from its source (i.e. it may be disseminated more widely) on Weibo than on Twitter, in line with the hypothesis that information sharing practices might be different on Weibo due to the social, cultural and political context. The difference in sampling frames between this and previous research on Twitter means that this is only a tentative conclusion and more direct comparisons would be necessary to further work in this area. However, there are several potential explanations for the apparent difference noted in the dissemination networks in this sample compared to previous research on Twitter.

Firstly, the differences found here could be simply a function of different sampling frames. It has previously been found that information on different topics disseminates in a different way on Twitter; in particular that many individuals often need more exposure to politically controversial topics before they forward them to others,

compared to other topics where the effects of repeated exposure falls off more quickly (Romero et al., 2011).

However, it could also be the case that the Chinese users of Weibo are more likely than the predominantly Western users of Twitter to forward news information. This could be attributed to the more homophilous, closely linked user population on Weibo; a more collectively orientated culture in which sharing a piece of information that others have shared is a marker of in-group conformity; the more controlled situation of offline news information that increases interest in the online sharing or news; or a social situation that places more emphasis on the construction of personal networks in which sharing potentially new and useful information to one's social contacts increases one's desirability as a connection.

Clearly more research would be necessary to investigate whether and why information seems to travel further from it's source on Weibo than on Twitter; however, one way to investigate this issue in the current dataset is to examine in more detail those stories that had higher than average retweet tree heights. This is an example of the medium-sized data approach adopted by this study. Large amounts of quantitative data on dissemination networks were collected, comprising 68,490 retweets of 50 randomly selected stories from Weibo's top news information providers. This data was analysed quantitatively using Pajek and statistical analysis to generate insights into the data that are comparable to previous research on information dissemination on microblogs. This analysis raised questions such as why information might appear to have a wider dissemination network on Weibo than Twitter and why some stories have wider dissemination networks than others. These kinds of questions need to be answered in reference to the content and context of the specific data points under question and using a medium-sized data approach key cases are selected based on the quantitative data for further analysis.

Within the 50 randomly selected news stories several had much wider than average dissemination networks. The average retweet tree height of most of the stories clustered between 1.1 and 1.3; however, seven of the stories were disseminated much more widely, having average retweet trees heights of 1.5 of greater. Unsurprisingly, these stories concerned some of the biggest news events of the period: the Pope's resignation, the Chinese Spring Festival TV show, North Korean nuclear tests and the Grammy Music Awards. A qualitative analysis of the participants in particularly high retweet trees for these seven messages showed several distinctly different patterns of news dissemination across these cases, with some stories exhibiting a top-down, some a bottom-up and some a peer-to-peer/lateral distribution pattern (Figure Two).

Following two step flow theory, top-down distributions are thought of as the standard in news dissemination networks (Cha et al., 2012). However, some have argued that in the online environment opinion leaders are not necessary for the wide distribution of political messages and that the retweeting actions of ordinary users with few following connections can be enough to generate trending topics (Bastos et al., 2013); this type of distribution pattern can be though of as a lateral or peer-to-peer network. An analysis of the individuals who were nodes in the retweet trees that allowed these seven stories to achieve wider than average dissemination, which included considerations such as the number and identity of followers and friends of the account and the personal information and self-presentation choices of the account user, demonstrated that information can be disseminated to a large number of users on microblogs via a variety of different dissemination patterns.

Out of the seven news stories within the sample that achieved wide distributions, only three stories exhibited the top-down pattern that is traditionally understood as the main method by which information disseminates. For instance, news of Pope Benedict's resignation was originally posted on the Weibo channel Weitianxia, which posts

breaking, international news, and was then retweeted by the Weibo Breaking News channel and several other major media organizations. The followers of these other organizations then retweeted the message, leading to a much higher average retweet tree height, with 52 percent of trees having a height of two and 19 percent a height of three. The wider dissemination of news in this case was due to the fact that the original story was retweeted by other major media organizations and bloggers.

In contrast to the top-down pattern that relies on retweeting by elite users, two of the entertainment stories clearly followed a very different bottom-up pattern. Rather than being disseminated by elite users with many followers, they were initially retweeted by regular individuals with an average number of followers, only a handful of whose followers retweeted the message. However, these messages sometimes worked their way up fan networks, arriving after one or two retweets at localized opinion leaders, such as fan club organizers. In these two cases, involving many users whose profiles were dedicated to the star in question, individuals played a crucial role in the initial stages of disseminating a message that achieved wider than average distributions, in a way that is contrary to the prevailing, top-down understanding of how news stories disseminate on microblogs.

Another widely disseminated story, covering China's condemnation of North Korean missile tests, which reached individuals up to seven steps removed from the original source, was disseminated not by large users but a wide variety of smaller bloggers, writers, academics and business people, following a peer-to-peer or lateral distribution network that is, again, at odds with the prevailing top-down understanding of dissemination networks.

This analysis of the important individuals the retweet trees of seven news stories that had much wider dissemination networks from within the random sample of 50 news stories demonstrates that messages can reach wide networks via different types of

dissemination mechanisms: the traditional top-down networks advanced by (Cha et al., 2012), the lateral/peer-to-peer networks found by (Bastos et al., 2013) or bottom-up networks, in which mass media published information finds its way to localized opinion leaders. However, it should be remembered that the findings presented here are based on a small sample of "successfully" disseminated mass media stories; more research would be necessary to demonstrate the relative frequencies of these different types of distribution pattern or to test the applicability of these models in differnet contexts.

Opinion Leaders in News Forwarding and the Role of Robot Accounts

There are several ways of evaluating news distribution networks; retweet trees, as analyzed above, focuses on how far a message travels from its source and the individuals who are important in disseminating the message out from the center. However, another way to evaluate dissemination is to analyze which users caused the message to be further distributed by the most others. These individuals can be seen as important opinion leaders, occupying a position closer to news sources, and acting as receiver, evaluator and distributor for their followers. Successful opinion leaders in news dissemination are those for whom many of their followers choose to retweet a message that they have retweeted.

Of the 68,540 nodes across the 50 distribution networks, 10,579 (15.4%) had at least one of their followers retweet the message after they had retweeted it. Of these 6,476 (61.2%) were retweeted by only one of the account's followers and 1,693 (16.0%) by two of that account's followers. A small proportion of these accounts stood out as opinion leaders, for whom many of their followers retweeted the message after they did; 81 nodes (0.1% of the dataset) had an outdegree centrality of more than 100 (i.e. 100 of their followers retweeted the message after they did) and 520 (0.7% of the dataset) had an outdegree centrality of more than 10.

Following Chen et al. (2012) who, studying information dissemination on Weibo, singled out those individuals with an outdegree centrality of more than 10 as critical users, accounts within the dataset which had an outdegree of more than 10 were considered to be opinion leaders. The number of opinion leaders varied widely by channel, with Breaking News, the largest channel, yielding 165; CCTV, 174 and Entertainment News, 108. In contrast, the two print media channels, People's Daily and Caijing, had only 35 and 34 opinion leaders respectively.

While the lower number of opinion leaders for the People's Daily can be explained due to a lower number of average retweets for this channel (Table Three), Caijing's stories had a comparable number of retweets to the other three channels but a drastically lower number of opinion leaders. This means the average number of followers of a user retweeting a particular Caijing message was much lower than for the Breaking News, Entertainment News and CCTV channels. Many of those who retweeted Caijing's stories had only two, one or none of their followers retweet the message, and Caijing's message dissemination, generally, followed a peer-to-peer/lateral distribution pattern rather than a top-down pattern. These actions by more numerous but less influential individuals resulted in a lower average retweet tree length, despite having a similar number of overall retweets. One potential reason for this difference could be Caijing's more niche readership (Caijing is bi-weekly magazine that reports current affairs from an economic and political standpoint) and it's independent status, compared to the other four channels, which may mean that it's publications are less likely to be reposted by other major news providers and elite users.

Following a medium-sized data methodology, these user accounts noted as playing an important role in disseminating mass media information were examined qualitatively to contextualize and extend these findings. Based on the content of their profiles and posts, all 520 opinion leaders were categorized into one of twelve types:

academic, BBS/forum, blogger, bot, businessman/woman, business/organization, celebrity, individual, journalist, media outlet, official/government department, and Weibo itself. These categories were not decided a priori but rather emerged from the data as a logical way of structuring the types of accounts that were found to exist within the set of opinion leaders.

Within this project's sample it was found that robot accounts were highly active in three of the 50 news stories and that, out of the accounts classified as opinion leaders based on the number of their followers who retweeted the story after they did, 30 percent were fake accounts. Two of the news stories in which robot accounts were prominent concerned entertainment news, one from the Entertainment News channel reporting fashion at the Grammy Awards and one from CCTV announcing the winner of Best Single at the Grammy Awards; however the third story in which robot accounts were active was a Breaking News channel story announcing the resignation of Pope Benedict.

These findings echo the work of Yu et al., who concluded that a large percentage of trends on Weibo were the result of the artificial inflation of fake accounts (which they, assuming that Weibo is efficient in deleting spam accounts and that spam accounts account for the vast majority of deletions, define as an account that was active one month previously, when their data was collected, but has subsequently been deleted). However, this analysis, based on a medium-sized data approach that examines the qualitative context of key cases identified with quantitative approaches, extends this work on the role of spam accoutns on Weibo in several ways.

Firstly, while it was found that three of the accounts identified as opinion leaders in the Breaking News story on the Pope's resignation and six in the Entertainment News story on fashion at the Grammys were deleted, 33 accounts that were classified as robots based on a qualitative analysis of their profile and post information remained undeleted out of the accounts identified as opinion leaders in the Breaking News story on the

Pope's resignation and 45 remained in the Entertainment News story about the Grammys when the accounts were analyzed over a month after the posting of the orignal news story. None of the 79 accounts identified as opinion leaders in the CCTV story on the Grammys Best Single award (of with 77 were classified as robots) had been deleted.

This finding demonstrates that many robot accounts on Webio are deleted in a timley fashion and relying on deletion as a proxy for robot accounts may lead their number to be drastically understated. The qualitative analysis of the commonalities of robot accounts in this research showed that accounts appear to work in groups with a set of accounts who were active in a particular message interlinked as mutual friends and having similar or the same profile pictures; the accounts classified as robots also stood out as having no orignal posts, no user interaction on their timelines, an ideosyncratic spread of post topics and nonsencial posts. These groups appeared to be working together in flurries of activity, with an individaul account reposting several messages a few seconds apart and all the accounts in a group reposting the same message within minutes of each other.

While qualitative analysis will likely be more exact at identifying robot accounts, these findings demonstrate that the method proposed by Chen et al. (2013) based on a combination of factors such as the average time interval between posts, the percentage of replies and the number of active days may be a more effective mechanism for identifying robot accounts on Weibo quantitatively in large datasets than relying on deletion. The apparent existence of robot groups also suggests that an analysis of clusters within disseminaion networks, which has also been noted in studies of criminal accounts on Twitter (Yang et al., 2012), might be a profitable venue for further research in this area.

Secondly, this finding contributes to a more nuanced understing of the use and effects of robot accounts. Robot accounts were found to be prominent in three of the 50 randomly selected news stories from the most infleuntial infromation providers on Webio

during the time period under study. These three stories all achieved wider than average distribution networks (with average retweet tree heights of 1.33, 1.42 and 2.25 compared to an average of 1.23 in the dataset). However, the widest distribution network (with a average retweet tree height of 2.5) was achieved by an Entertainment News story about a pop singer's award at the Grammys, which appears to have been propogated via a peer-to-peer/lateral distribution based on the forwarding of numerous regular users for whom one or two of their followers retweeted the message after they did. Similarly, the story with the most retweets in the dataset, concerning an accusation of police brutality, was disesminated, in particular, by bloggers and academics and contained no evidence of bot activity (Figure Three).. This indicates cause for hope, therefore, that while artificially inflated topics do exist on Weibo networks of individuals and localized opinion leaders can also achieve similar or even larger networks of dissemantion for popular news stories.

Different Opinions Leaders, Different Types of Influence

Since the data sample focused on posts from the top five news providers on Weibo, the original poster was removed from calculations of the influence of different categories of opinion leaders to avoid overstating these individuals via oversampling. However, even after the original publisher was removed Weibo accounts were the most influential type of opinion leaders in distributing news messages, with an average of 136 of their followers retweeting the message after they had retweeted it. This is compared to 107 for other types of media organization. Academic research on Weibo generally focuses on the company as a platform and tool for others to distribute information, but, unlike Twitter, Weibo is, itself, a highly influential provider of news information, republishing stories from other news organizations, government departments and press releases.

The large number of Weibo channels dedicated to both general interest and niche topics have a huge number of followers, since Weibo promotes itself aggressively on its own platform. Weibo also cross promotes its stories, with messages initially posted by one channel, often retweeted by other Weibo channels, vastly increasing message dissemination and readership. Weibo's status as an information portal as well as platform is a major difference from Twitter's market position, and future research on Weibo should consider both the company's technological platform as well as its information provision services and realize both these functions work together to increase Weibo's power.

After Weibo and other mass media organizations, bloggers were the third most influential group in increasing message dissemination. Bloggers were defined as such, and particularly in contrast to individuals, based on their number of followers, the content of their profiles and posts and the interactions of other user's with these posts. Within the sample, bloggers had an average of 66 of their followers retweeting a message they retweeted. However, this average obscures the actual nature of influence within the blogger group. Out of 35 bloggers who were classified as opinion leaders, 31 had fewer than 66 of their followers retweet the message after they did; however, four bloggers had a very large number of secondary retweets (195, 255, 558 and 564). Out of these four highly influential blogs, three were topic blogs, focusing on local news, selected YouTube videos and educational news. The fourth was the blog of a famous celebrity stylist. These four bloggers had two main things in common. Firstly, they had more followers, on average, than the other 31 bloggers, and secondly, their blogs also focused on a particular topic with no or little mention of their authors' personal lives, which appeared to solidify the blog's image and increase their authority on the topic in question.

Similarly, Chinese government officials and departments were also highly skewed with a low median (13 follower forwards) but several high outliers. Overall, government officials had the a very low level of influence, but on three stories on the police and military and one story about an official government TV program official sources had a much higher level of influence, suggesting again that the extent of user influence depends on expertise in the topic in question.

This finding, however, contradicts the conclusions of researchers such as Cha, Haddadi, Benevenuto, and Gummadi who, in their analysis of user influence on Twitter, conclude "local opinion leaders and highly popular figures (can) be used to spread information outside their area of expertise" (2010, p. 15). While the influence of celebrities, who could rarely be argued to have great expertise on the new stories they retweeted, support Cha et al.'s (2010) conclusions, an analysis of the individuals who acted as influential opinion leaders within this sample supports the idea that local opinion leaders are most powerful in disseminating information that fits with their area of expertise.

Individual opinion leaders had an average of 35 secondary retweets; however, this relatively high number (higher than for academics, journalists, officials and businesspeople) obscures the fact that most of these individuals were local opinion leaders on the topic of the message in question. In the case of stories concerning particular celebrities, influential individuals tended to be explicit fans of the celebrity, with that star's photos, quotes and news prominently featured on their profile. In the story about the Pope's resignation, influential individuals were overwhelmingly overtly Christian, displaying abundant religious imagery and Biblical quotations on their profiles. Thus, while celebrities are, perhaps, able to act as opinion leaders on topics outside their expertise, bloggers, officials and regular users tend to be more powerful when focused on a particular topic. Further research into opinion leaders online should be

aware there is unlikely to be a single class of opinion leader, but rather different sets influential opinion leaders for different topics and pay attention to contextual factors such as the users offline social position and the way in which they present themselves online through their images, biographical information and post content that are obscured in large scale quantitative analysis.

Comments and Discussions

Microblogs are seen as important not only because they allow users to disseminate information but also because they allow users to comment on one another's posts, increasing opportunities for discussion and interaction. While both Weibo and Twitter allow users to respond to existing tweets, with the @ symbol used on both platforms to denote a response to a particular individual, either generated automatically using the reply function or manually typed by the user, Weibo's structure is more conducive to discussion with an inline, threaded comment system for each message. Levels of user commentary on Weibo are much larger than on Twitter, with news stories within the sample receiving an average of 589 comments each.

This discursive potential has led many commentators to see Weibo as a nascent public sphere, offering a freer platform to discuss social issues and easier path to reach critical mass on an issue. However, because in this area, user interactions on Weibo are significantly different from those on Twitter, relatively little research exists regarding the commenting and discussion that takes place on microblogs.

In order to understand the relation between retweets and comments on Weibo, the levels of each were compared (Figure Four). In general, stories that had the most retweets also had the most comments, with stories generally receiving about twice as many retweets as comments. However, one story, from the Breaking News Channel reporting the Sanya Public Security Department's official response to an online video accusing

them of brutality, received almost twice as many comments as retweets (while also receiving the most retweets of any story in the sample). In contrast, stories covering celebrity or entertainment news, or distributing quotes or videos received many more retweets than comments.

Both commenting and retweeting on Weibo indicate audience interest in a message and allow the user to add their own 140-character message to the original post. However, while retweeting disseminates the story to the users' followers, reposting the story and the new message to the user's profile feed, commenting on Weibo is used to participate in a discussion located at the site of the original message. Thus, retweeting appears to be used relatively more frequently for entertainment stories, quotes and videos that a user wishes to disseminate without comment, and commenting is used more frequently in contentious news stories where a users wishes to enter a discussion with other interested parties without necessarily broadcasting their opinions on the subject to their followers.

In their analysis of 720,000 random Twitter tweets, boyd, Golder, and Lotan (2010) found that 36 percent specifically referenced other users, using the form @username. Comparing Weibo and Twitter, Gao et al. (2012) found Weibo posts were about as likely to include a person as Twitter posts; however, their analysis was conducted on a set of general, snowball sampled posts rather than focusing on news information and only noted whether another person was mentioned without addressing issues of interaction and discussion.

Within the sampled news stories, it was found that 31.5 percent of comments contained an @ symbol, denoting a directed response to a previous commentator, a similar result to that which boyd, Golder, and Lotan found on Twitter.[4] However, the

[4] It should be noted that previous research by the author has cautioned that the use of the @ symbol in big data techniques is a poor proxy for levels of user interaction on social

Sanya story, which had more than twice as many comments as retweets, had a very high number of direct responses, with 58 percent of the comments containing a directed reply.

Given that this story stands out from within the sample of 50 randomly selected stories from Weibo's most influential news providers as having generated much more audience interaction and in particular more comments from Weibo users that could possibly be seen as evidence of an online public sphere that commentators like J Wang (2011) and Zhou et al. (2008) see potentially emerging online, the medium-sized data approach picks this outlier case for further qualitative analysis.

The message refers to a video posted the previous day on Weibo in which a young woman tearfully tells the story of her visit to the southern tourist town of Sanya some months earlier. She says her and her husband, returning to their car after dinner, got into a disagreement with the parking attendant; a group of men in suits then arrived and begun beating the woman and her husband. When the police arrived they also began to beat the couple without attempting to ascertain the situation. The video ends with photos of the woman's injuries and audience footage of the event shot on cellphone cameras by bystanders. The woman says her husband is still in jail, will face trial soon, and implores netizens and the media to publicize her case and help her achieve justice. The video was removed from Weibo within 90 minutes of its posting; however, during this short time it was widely distributed and became a popular topic.

The examined message, from the Weibo Breaking News channel, reported the official response to the accusations, stating the tourists were angry because their car had been scratched, one of the suspects attempted to snatch a police officer's gun and linked

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media platforms and that the differences between the use of the @ symbol and actual levels of user interaction identified using content analysis were significantly different in discussions on mass media news stories on Weibo and Facebook (Author, 2014). This consideration again supports the use of a medium-sized data approach that, rather than relying solely on operationalized quantitative measures, qualitatively probes the contextual factors identified as potentially important by big data techniques.

to new surveillance video footage of the incident. Particularly because the original video had been removed from the Internet, this official response became an airing ground for interested individuals to discuss the case (Figure Five). Over 4000 individual users commented on this message, expressing their disbelief in the department's version of events, their opinions on what can be seen in the video, their opinions of Sanya and its police department, their opinions on Northern tourists visiting the South, and their reactions to other comments. Among the commentators, the average number of comments per account was 2.6; however, a small minority of commentators were highly active, with 62 posting more than 20 comments, 21 posting more than 50 comments and seven posting more than 100 comments on the message.

The most active commentator was a young man from Macau, who posted 250 comments on the message. Many of his comments were replies to others, agreeing or disagreeing with their point of view, or carrying on the conversation; he also posted general comments, criticizing the Communist Party, its brainwashing and social control. He was involved in a long, heated exchange with the second most active commentator, a young woman from Beijing who supported the police's actions in this incident. In this case (one of a random sample of 50 stories from among those published by Weibo's leading news providers), thousands commentators participated in a heated debate posting their opinions of who was at fault in the incident and the evidence presented in the video. This type of discussion, which does not have a parallel comparison on Twitter both due to the site's structure and the ability to convey a much greater amount of meaning in 140 characters in Chinese than in English, shows that Weibo does have the potential to provide a type of public forum for discussion of current affairs as well as to facilitate the distribution of information (even if this discussion is often hidden under the huge number of frivolous, entertainment, and trivial content). It is notable that within this sample the high outlier in terms of retweeting and commenting was an attempt by networked

individuals to raise awareness and garner public support for a social justice issue rather than the frivolous or diversionary content that has been found to be prevalent in the examination of trending topics on Weibo. However, this sample is based on 50 news stories from the top providers on Weibo published during a week long period and further research of a greater number of stories over a longer time period would be needed to extend this finding and shed more light on the frequency and nature of the public issues that might rise to popularity based on the dissemination and commenting affordances of microblogs.

This analysis also showed that these online forums are dominated by a minority of users and contain quite a number of angry and flaming comments. In analyzing discussion of current affairs online, whether using big data, medium-sized data or qualitative approaches, we must also be careful not to discount other types of interaction with news that do not leave a digital trace and cannot be so easily measured and quantified.

Limitations, Conclusions and Further Directions for Research Policy and Practice

All research makes a trade-off between granularity and scope in constructing its research design. A literature review concerning information sharing practices on microblogs highlighted two limitations of current understanding. Firstly, comparatively little is known about Weibo and other Chinese social networking sites, despite their huge user base, compared to the popular U.S.-based platforms whose market niche they fill. Secondly, the majority of work on information sharing practices in the Chinese context is either based on isolated case studies of extraordinary events or on studies of extremely large datasets that tend to present their analysis divorced of context.

Consequently this research project had two main objectives: firstly, to collect data on news sharing practices on Weibo and to compare these to conclusions drawn from

research on Twitter to assess the applicability of these findings in the Chinese context and, secondly, to follow a medium-sized data approach that begins by collecting and analysing quantitative data and then examines key cases identified through quantitative analysis in order to illuminate the nature and context of the case and help explain the research findings.

In examining a random sample of fifty microblog posts from the five most influential news providers on Weibo during the study period, it was found that dissemination networks for these stories appeared to be wider than those found in previous research on Weibo that focused on trending topics and URL sharing. This provides tentative support for the hypothesis that information travels further from its source on the Chinese microblogging platform. Those who believe the existence of "guanxi" in Chinese culture might attribute this finding to the greater emphasis that Chinese users place on establishing and strengthening their digitized social connexions to navigate the increasingly more open but still uncertain social environment. However, those take the perspective of innovation diffusion might argue that this difference is simply due to the time period understudy and that Chinese Weibo users represent only a small segment of society (i.e. early adopters) who are more excited about exploiting the microblogs' features for the affordances they provide than their more blasé Western counterparts.

However, these findings are based on the posts of a very small number of the largest news providers on Weibo over a very short time period. Much has changed on Weibo since the data was collected and, indeed, changes in permissions mean that network data can no longer be collected from the API; it appears that there has been a large drop in tweeting activity on Weibo since the crackdown on Weibo content in the spring and summer of 2013. Further research is thus necessary to assess whether these

findings are applicable across different types of stories, from different types of providers, on different platforms and/or under the current climate on Weibo.

It remains to be seen whether these findings represent a snapshot of user interaction with mass media information during a particular period when Chinese microblogs enjoyed popular support or whether the differences found here represent a qualitative difference in Chinese online public discussion practice compared to Western ones. However, these findings contribute to the on-going comparative work on Weibo and Twitter and efforts to extend academic understandings of social media use to account for increasingly large non-Western populations of users. In illuminating differences between social media use in the Chinese and Western contexts, these findings can also help craft better policies to approach both research about and support of information dissemination on the Chinese Internet, understanding where approaches that worked for Twitter in the West might need to be modified to be effective in China's different political, social and economic context.

Where many previous studies have focused primarily on the content of Weibo posts, this research examined the key user-level practice of retweeting. In modelling the information distribution patterns of seven stories that achieved wider than average dissemination, it was shown that both the top-down distribution pattern observed by Cha et al. (2010) and the peer-to-peer/lateral pattern found by Bastos et al., (2013), as well as a third bottom-up pattern, were present in the dataset. While these insights are based on a small number of observations and thus can say little about the relative frequencies of these different patterns, this research contributes to existing knowledge by showing that at least three different types of distribution patterns exist on Weibo. Further research should examine the relationship between distribution patterns and types of information being distributed, for instance whether grassroots and political mobilization information

might be more likely to follow a lateral pattern while entertainment information might be more likely to follow a bottom-up pattern.

Among opinion leaders, while academics, journalists, officials and businesspeople were shown influential, bloggers and individuals can sometimes play a greater role. Bloggers and individuals were generally found to be most influential when they were retweeting information concerning a subject around which the identity of their online presence was constructed. This suggests that, at least in the case of mass media information on Weibo, the apparent expertise of the user in question may be taken into account by the others who choose to engage with information that that user has forwarded, a finding which supports the idea that social media often performative and is used for building and managing particular impressions of the user in front of their audience of followers. However, these findings were based on a relatively small sample (520 individuals) who were active in retweeting mass media stories from some of the largest providers on Weibo. More research would be necessary, perhaps using quantitative methods to categorize opinion leaders and thus enabling the use of a larger sample, to paint a better picture of the relative influence of different opinion leaders across different topics.

This analysis also highlighted the importance of Weibo, itself, as both a distributor of information and as the provider of the platform via which information is distributed and the prevalence of robot accounts in widely distributed stories. A lack of engagement in questions of ownership, power and economic considerations marks much data-based research into microblogs; however, an understanding of Sina Weibo's structural position is important in evaluating the social effects of the platform. For instance, Weibo, which has close ties with the government, can aggressively promote its own content through its own platform.

The prevalence of robot accounts also speaks to the importance of considering the social conditions and economics associated with microblog distribution, as well as the structure of the site that produces conditions that favour the use of robot accounts to drive a topic onto the trending toplists as a means of generating publicity. These findings highlight the importance for further research into the social effects of microblogs, particularly big data approaches, to engage with questions of economics and power, rather than viewing the technological platform and the data it provides as a neutral given.

Overall, these findings illustrate some of the advantages of a mixed-method, medium-sized data approach; the quantitative analysis of dissemination networks highlighted key accounts, cases and mechanisms in distributing information on the platform and the qualitative aspect provided the context that helped to understand and explain the functioning of these mechanisms. In order to adequately understand the nature of online information dissemination, it is important to construct research designs that can include both relevant statistical and contextual information, selecting appropriate samples based on both quantitative and qualitative concerns and combining the analysis of the data, as done here.

Current policies related to the funding of academic research into online phenomenon have recently been heavily skewed toward big data approaches. This study demonstrates the importance of thinking critically about making trade offs between granularity and scope in constructing research designs and demonstrates the way in which a mixed-methods design for researching online phenomenon can yield insights that would be impossible if a solely quantitative or solely qualitative method was employed.

Building from this study, future research efforts should take an overtly comparative approach, collecting similar data on comparable platforms, and following mixed-method and medium-sized data research designs in order to investigate the online

environment in China, which it increasingly appears has a significantly different social role than Western platforms and thus is in need of study and theorization in its own right.

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Tables

Table 1. Average height of retweet trees from the original publisher of each news story

Post	Breaking News	Entertainment News	People's Daily	CCTV	Caijing
1	1. 051948052	1. 098765432	1. 16027088	1. 154103853	1. 094871795
2	1. 184818482	1. 619601329	1. 116724739	1. 067873303	1. 11036036
3	1. 00	1. 162689805	1. 043478261	1. 718083462	1. 173280423

4	1. 361702128	1. 223826715	1. 070626003	1. 088235294	1. 095571096
5	1. 03030303	1. 018404908	1. 189376443	1. 076011846	1. 534201954
6	1. 065502183	1. 336772983	1. 100694444	1. 06097561	1. 120512821
7	1. 24929972	1. 017857143	1. 091836735	1. 203007519	1. 085201794
8	2. 254948162	2. 5	1. 545201669	1. 054621849	1. 073469388
9	1. 083333333	2. 252566735	1. 101736973	1. 058823529	1. 066964286
10	1. 013333333	1. 204545455	1. 046099291	1. 425632911	1. 067385445
AVE	1.229518842	1.443503051	1.146604544	1.190736918	1.142181936

n = 36,382 retweet trees

Table 2. Average number of retweets per message for examined news channels

News Provider	Average number of retweets per post
Breaking News	1241. 1
Entertainment News	1734. 3
People's Daily	844. 8
CCTV	1548. 9
Caijing	1479. 9