



Measuring international relations in social media conversations



George A. Barnett^a, Weiai Wayne Xu^b, Jianxun Chu^c, Ke Jiang^a, Catherine Huh^a,
Ji Young Park^d, Han Woo Park^{d,*}

^a University of California, Davis, United States

^b University of Massachusetts, Amherst, United States

^c University of Science and Technology of China, Hefei, China

^d Yeungnam University, Gyeong-San, South Korea

ARTICLE INFO

Article history:

Received 9 February 2016

Received in revised form 18 December 2016

Accepted 20 December 2016

Available online 29 December 2016

Keywords:

Social media

Facebook

Weibo

Network analysis

International relations

Webometrics

ABSTRACT

This paper examines international relations as perceived by the public in their social media conversations. It examines over 1.8 billion Facebook postings in English and 51 million Chinese posts on Weibo, to reveal the relations among nations as expressed in social media conversations. It argues that social media represent a transnational electronic public sphere, in which public discussions reveal characteristics of international relations as perceived by a foreign public. The findings show that the international relations in social media postings match the core-peripheral structure proposed in the World Systems Theory. Additionally, the relations are associated with the amount of news coverage and public attention a country receives. Overall, the study demonstrates the value of webometric data in revealing how international relations are perceived by average citizens.

© 2016 Elsevier Inc. All rights reserved.

1. Introduction

The idea of *public sphere*, first proposed by Habermas (1989), states that there is “a constellation of communication spaces in society that permit the circulation of information, ideas that facilitate debate leading to the formation of public opinion” (Dahlgren, 2005, p.148). Increasingly, the public sphere has taken a virtual format in various Internet forums and social media outlets. Scholars use “electronic public sphere” or “global social media sphere” to describe its resemblance to a transnational public sphere for socio-political-cultural discourse (Castells, 2008; Volkmer, 2003). The public sphere is a rich ground for studying public opinion. In particular, the word-of-mouth within the public sphere helps researchers understand how opinions spreads (Haralabopoulos & Anagnostopoulos, 2015; Golan & Himelboim, 2015; Jalilvand, 2012; Jansen, Zhang, Sobel, & Chowdury, 2009; Xu, Park, & Park, 2015; Xu, Park, Kim, & Park, 2016), and how shared narratives and identities connect the public (Papacharissi & de Fatima Oliveira, 2012). In this paper, we turn to discourses on the public sphere for another type of insight. That is, the importance of and the interlinkage among various countries/regions. Using network analysis, this kind of

insights can be inferred from how different countries are mentioned in public conversations. This approach provides a new angle in studies of international relations. To introduce the new approach, the paper is organized as follows: It first reviews prior studies to link public diplomacy to social media. It then introduces how network analysis can be applied to study international relations. Next, the value of network analysis in revealing international relations is demonstrated to form the basis of the research questions explored in the study.

2. Literature review

2.1. Mining social media conversations for public diplomacy

Public diplomacy is the establishment and maintenance of international ties through citizen-to-citizen communication (Signitzer & Coombs, 1992). Castells (2008) discussed public diplomacy in terms of global communication networks and the development of shared meanings. The goal of public diplomacy is to generate favorable ties with foreign public through dialog and collaborations, emphasizing two-way communications of ideas, values and opinions. National governments can strategically use global trade, tourism and cultural exchange to promote national images. Social media provide a new frontier for carrying out such strategic operation. National governments and diplomats have adopted digital media to facilitate outreach (Fisher, 2010; Mergel, 2013; Slaughter, 2009). For example, U.S. embassies and consulates use Twitter tweets to connect with foreign nationals (Zhong & Lu,

* Corresponding author.

E-mail addresses: gabarnett@ucdavis.edu (G.A. Barnett), weiai.wayne.xu@gmail.com (W.W. Xu), chujx@ustc.edu.cn (J. Chu), kejiang@ucdavis.edu (K. Jiang), cuhuh@ucdavis.edu (C. Huh), heytree@gmail.com (J.Y. Park), hanpark@ynu.ac.kr (H.W. Park).

2013). In recent years, public diplomacy efforts increasingly involve the use of digital data. For example, the U.S. Department of State has been promoting the use of crowdsourced mapping to help humanitarian aids in foreign countries (Campbell, 2014). This is a part of the open data initiative in which governments provide public access to large datasets to facilitate crowdsourcing solutions to community-wide problems (Kassen, 2013). Like other government branches and public institutions that use social media data to predict public opinion (Sobkowitz, Kaschesky, & Bouchard, 2012), public diplomacy also involves opinion mining: The State Department's US Digital Outreach Team, for example, disseminates bi-weekly brief summarizing what people talk about online (Khatib, Dutton, & Thelwall, 2012).

Opinion mining is based on the premise that social media and other internet platforms provide an extra-societal, transnational public sphere where dialog and collective actions shape a global narrative on politics (Castells, 2008; van Dijk, 2012; Volkmer, 2003). In the everyday topics of social media conversations, names of foreign countries are expected to be mentioned in different contexts, from discussions related to regional conflicts, global economy to topics of travel destinations and movie releases. How the public discusses foreign countries reveals important insights about public perception of foreign countries. In this paper, we argue that social media conversations provide fruitful ground for understanding the structure of international relations. Such understanding can enhance public diplomacy efforts.

Previous studies of public diplomacy mostly focus on examining institutions' use of social media for public diplomatic outreach (Burns & Eltham, 2009; Zhong & Lu, 2013). But, such a perspective is one-sided. Public diplomacy is as much about outreach as understanding what citizens are talking about, in particular, how foreign countries are perceived to be connected. Therefore, the current paper provides a new direction to the literature by using social media data to understand how citizens perceive the importance and relevancy of various foreign countries. Specifically, this research direction requires examining the structure of international relations as they reveal important power dynamics in geopolitics (Lake, 2009).

The use of such data for understanding society and human behavior is increasingly prevalent in the social sciences (Borgman, 2015; Mayer-Schomberger & Cukier, 2013; Park & Leydesdorff, 2013) and policy-making processes (Struijs, Braaksm, & Dass, 2014). The field of webometrics, which is the quantitative measure of internet communication, is emerging and provides critical online behavior insights for decision-making and management (Jung & Park, 2016). This kind of investigation is also facilitated by the availability of open tools such as the Google's Trends, Location History, Correlate services, and NodeXL that can easily access online presence data and map out structure in online content (Meier, 2016; Smith, 2015).

2.2. Applying network analysis to international relations

International relations can be expressed in network linkages. In mapping the network of nations, a country is represented by a *node* and its *links* with other countries. The linkages may be based on commodity trade, diplomatic ties, military intervention, treaty membership, telecommunications, airline traffics, monetary flows, and student exchanges. The structure of the network reveals the current geopolitical power dynamics. For example, using Internet bandwidth capacity, hyper-link connections, website use, and website ownership as proxy measures, Barnett and his colleagues showed a core-peripheral structure (Barnett, 2001; Kim & Barnett, 1996; Barnett & Park, 2014; Ruiz & Barnett, 2014; Barnett, Ruiz, Xu, Park, & Park, 2016). They concluded that the globalized cyberspace is characterized by an unequal exchange between powerful information rich and information poor countries, which has led researchers to question whether cyberspace is truly boundary-less and independent from the geopolitical reality on the ground.

We use a similar approach to reveal the geopolitical structure based on citizens' perception of foreign countries. Specifically, we can picture

different nations woven into a network. Two nations are connected when they appear in the same social media posts. The basis for such network ties is called co-occurrence. Examples of co-occurrence include mutual membership in groups, such as international governmental organizations (Kim & Barnett, 2000), co-participating in events (international conferences), proximity in physical distances, and similarities in attributes (e.g., political views) (Borgatti, Everett, & Johnson, 2013). Co-occurrence is also widely observed in webometric data. For example, prior studies examine semantic networks based on co-occurrence of words in various social media posts (Kim, Heo, Choi, & Park, 2014; Shapiro & Park, 2015; Xu et al., 2015, 2016; Park, Lim, & Park, 2015). Co-occurrence of words can reveal thematic/topic similarity and variation in online public discussions of issues (Heo, Park, Kim, & Park, 2016), or the media's framing of international events (Jiang, Barnett, & Taylor, 2016). In the current study, a network of nations based on co-occurrence reflects how the public perceives the connection between two given countries in a semantic context.

With the network of nations based on co-occurrence, we can analyze its structural features using network analysis, which is a set of research methods for identifying structures and patterns in communication and associations among connected actors (Wasserman & Faust, 1994). Network analysis has been widely used in academic studies of international relations and cross-cultural communication (see Barnett & Park, 2005, 2014; Chang, Himelboim, & Dong, 2009; Kim & Barnett, 2000; Kim & Barnett, 2007; Rosen, Barnett, & Kim, 2011; Segev, Sheaffer, & Shenhav, 2013; Park, Barnett, & Chung, 2011). In addition, network analysis has been used in the public sector to bridge the gap between practice and planning (Guhua & Chakrabartib, 2014).

Broadly speaking, network analysis produces two levels of insights. The first, concerns the nodes' positions in a network. Centrality is an indication of how central a node is in a network (Freeman, 1979). Accordingly, centrality is a proxy measure for popularity, salience and influence (Freeman, 1979). In a network based on co-occurrence, high centrality means a high degree of salience and visibility of a semantic concept or entity in conversations (Doerfel & Connaughton, 2009). Various prior studies have used this approach to identify import themes in public discussions online (Oh, Kwon, & Rao, 2010; Veltri, 2012). Accordingly, in a network based on co-occurrence of country names, countries with a high degree of centrality are considered highly salient and visible. Therefore, the first research question asks what countries are the most salient and visible based on network centrality.

RQ1: What countries are the most salient in the network based on co-occurrence of country name in social media?

The second level of insights concerns the general structure of a network. For example, clustering is one such structural characteristics. It indicates divisions and separation among entities (Watts & Strogatz, 1998). In prior studies, clustering is used to identify political and ideological divides (Kim, Barnett, & Kwon, 2010; Himelboim, McCreery, & Smith, 2013; Gruzd & Roy, 2014). Too much clustering can create blockages in the free flow of information, limiting the scope and variety of influence (Granovetter, 1983). In a network based on co-occurrence of words, clustering indicates convergence and divergence of concepts and topics. By the same token, in a network comprised of different nations based on co-occurrence of their names, clustering shows what countries tend to be mentioned together in the same context. Therefore, the second research question addresses this network characteristic in the co-occurrence network investigated in the study.

RQ2: What is the structure of international relations reflected in the clustering in the network based on co-occurrence of country name in social media?

Since the kind of international relations investigated in the study are based on perception of citizens, such perceptions arguably are shaped by multiple forces. In this globalized world, many of our perception

about the outside world are being shaped by global news coverage (Zhang & Meadows, 2012). News coverage drives public attention given to a particular issue and region (McCombs & Shaw, 1972). The classic agenda-setting theory posits that issues (and related regions) that receive more news coverage will be perceived as more salient by audience (McCombs & Shaw, 1972). Consequently, more intensive media coverage can correlate with a greater amount of online discussions (Roberts, Wanta, & Dzwo, 2002). Thus, RQ3 and RQ4 explore the potential correlation of the structure of international relations with news coverage and public attention.

RQ3: How is the pattern in the current co-occurrence network related to news coverage?

RQ4: How is the pattern in the current co-occurrence network related to broad public attention?

International relations can also be shaped by public diplomacy through citizen-to-citizen interaction (Park & Lim, 2014). So RQ5 examines the role of international friendship in the structure of international relations.

RQ5: How is the pattern in the current co-occurrence network related to international friendship?

Relating co-occurrence patterns to various phenomena also serves the purpose of validity check. Ackland (2013) suggested that empirically or theoretically testing the relationships between webometric outcomes and other constructs. Ample evidences have suggested that co-occurrence networks display structural characteristics that are consistent with phenomenon observed in the real-world. For example, the global Internet is centralized in a few economically and politically dominating nations (Park et al., 2011; Ruiz & Barnett, 2014). Similarly, Facebook friendships and Twitter followings display homophily along similar cultural and socioeconomic attributes—similar patterns are also manifested in the offline world (Barnett & Benefield, 2015; Colleoni, Rozza, & Arvidsson, 2014).

3. Methods

The social media data used to examine the research questions in the current study were collected from Facebook and Weibo. Facebook was selected because it is the most visited social networking site worldwide with over one billion visitors from 218 countries (Barnett & Benefield, 2015). At the time of the data collection (Fall 2014), 23.5% of Facebook users were from the United States, 8.7% from India, 4.1% from Brazil, 3.5% Germany, and 3.4% United Kingdom. On average users spent 20 min per day on the site and viewed 12 pages per visit (www.alexa.com/topsites). Weibo was selected because it represents the dominating social media site in China for citizens' public discussions. Weibo played a critical role in China's online public sphere, in particular, considering that Facebook is blocked in China, and consequentially most online conversations by Chinese users take place in local social media outlets such as Weibo. Weibo is the fifth most visited site in China and ranked 16th globally in term of traffic. The majority of Weibo users are from Mainland China (94.8%) and only 2.2% are from the U.S., followed by 1.1% from Taiwan and 0.6% from Hong Kong. Worth noting is that another well-known Chinese social media site, Renren was not selected for data collection. Although Renren is considered a Chinese equivalent of Facebook, its popularity and traffic has been declining—as of December 15, 2016, it is the 1656 most visited site worldwide, and ranked 166 in China. With the selection of Facebook and Weibo, we can reasonably assume that the data in the current study represent two major social media-based public sphere, the English-speaking and Chinese-speaking one respectively.

Recall that the network under investigation in this study is based on co-occurrence of country names in social media posts. The co-occurrence

of all pairs of 225 country names were obtained in two steps through the paid access to Google Custom Search Engine. The first step uses English-language search queries to obtain the co-occurrence data from Facebook. For example, to get the co-occurrence of United Kingdom and America, we used the following query: “United Kingdom” “America” site:Facebook.com. The next step uses Chinese search queries to get co-occurrence from Weibo: For example, for the co-occurrence of United Kingdom and America, we used 英国 (United Kingdom) 美国 (America) site:weibo.com. Notice that this collection method excludes private Facebook posts not indexed by the search engine. Additionally, the collection is restricted by API limitations—only 10,000 search queries per day are allowed, therefore, the queries were evenly split across collection days. Facebook data were collected from September 26 to October 13, 2014, and Weibo data from December 21, 2014 to January 10, 2015.

Data cleaning was performed to delete mentions of country names in trivial and irrelevant context. For example, 多哥 (Togo) frequently appeared in Weibo posts, but a further examination shows that the phrase was not used to refer to the country Togo, but rather, the concepts “cousins” or “many brothers”. To avoid confusion, all Weibo posts mentioning Togo were excluded.

For data-cleaning purposes, some variants of country names were checked and merged into one single name. For example, USA was the sum of mentions of “United States”, “U.S.” and “U.S.A.” “America” was not included because its Chinese term also refer to countries in Central and South America. “United Kingdom”, “U.K.” and “Great Britain” were combined under the term UK. “England” and “Britain” were excluded because the former excludes Scotland, Wales and Northern Ireland, and “Britain” as a stand-alone term was used infrequently. The final data output was two, 218 by 218, symmetrical relationship matrices, where x_{ij} was the number of times two countries were mentioned in the same posts on either Facebook or Weibo.

RQ1 about network centrality was examined with three network centrality indicators, degree centrality, betweenness centrality and eigenvector centrality, each of which addresses different aspects of a central network position. Degree deals with the general salience and popularity of a node, betweenness deals with a central node's strategic position to connect dislocated clusters in a network (Freeman, 1979). Eigenvector centrality is a measure of a node's overall centrality taking into account the connectivity of a node's neighboring nodes (Ruhnau, 2000). These centrality measures were obtained through UCINET, a network analysis program (Borgatti, Everett, & Freeman, 2002). The study uses Gephi (Bastian, Heymann, & Jacomy, 2009) to visualize the networks. Infographics of networks helps readers better make sense of the data from network analysis (Kavanaugh et al., 2012).

RQ2 was addressed through the hierarchical cluster analysis in UCINET. Cluster analysis identifies sub-groups of nodes sharing similar or structurally equivalent characteristics (Borgatti et al., 2002). To address RQ3 and RQ4, countries were ranked by various centrality measures. The ranking was then correlated with the ranking of countries based on search volumes on Google, Google News and LexisNexis, respectively. The number of searches on Google are a proxy measure of general public interest. Search volumes on Google News and on LexisNexis were used to approximate the amount of media attention. Lastly, the network in the study is correlated with the international Facebook friendship network obtained from an early study. The significance level of the correlation between the two networks was determined using Quadratic Assignment Procedures (QAP)—which is a standard correlation measure of two network variables (Dekker, Krackhardt, & Snijders, 2007).

4. Results

In term of the Facebook data, over 1.8 billion (1,833,629,678) posts with mentions of two or more nations were collected. The mean of mention count was 34,283 (s.d. = 349,601). On average, each country was mentioned 7.2 million times (s.d. = 22.0 million). RQ1 deals with the

centrality of various countries in the social media conversations. The most central country based on the Facebook conversations, using degree centrality, was the United States with over 302 million mentions (19.1% of the total). It was followed by the United Kingdom, (74.3 million), Australia (53.8 million), France (40.7 million), and India (40.2 million). Based on betweenness centrality (Freeman, 1979), the United States was the most central country—more than three times the centrality of U.K., which is the second most central country by this measure. Based on eigenvector centrality (Bonacich, 1972), the United States is more than twice as central as the United Kingdom, three times more central than Australia, and four times more central than France, India and Canada.

RQ2 addresses the clustering in the network, namely, how various countries are lumped together based on their structural attributes in the network. A hierarchical cluster analysis revealed two groups, a core group of nations and a peripheral group. Countries in the peripheral group are connected to only a single country of the core group. A graphic illustration of the structure of the co-occurrence network of different nations is presented in Fig. 1.

In the Weibo data, there were >51 million (51,139,896) co-occurrence of countries, which is about one eighth of the amount of co-occurrences on Facebook. The mean of the mention count was 953.2 (s.d. = 13,701). Each country on average was mentioned 230,268 times (s.d. = 775,019). Hong Kong (a semiautonomous special administrative region in China) was the most frequently mentioned country/region with 7.4 million mentions (representing 14.8% of the total mentions). It was followed by China with 5.1 million mentions (10.3%), Japan (6.6%), U.S. (6.4%), and U.K. (4.7%). By betweenness centrality, Hong Kong connected with the most countries mentioned in Weibo conversations. It is almost three times more central than China (Mainland China) by this measure, and about 15 times more central than the U.S. and

Japan. The ranking of nations by eigenvector centrality shows a similar order. The hierarchical cluster analysis revealed four groups differentiated by centrality. The four groups ranged from central to peripheral by centrality. Fig. 2 shows a visualization of the international co-occurrence network from Weibo data.

To compare the networks from Facebook and Weibo, the two networks were correlated. The QAP correlation between the Facebook and Weibo networks was 0.230 ($p < 0.001$). This indicates that the conversations on the two social media outlets were somewhat similar but not entirely overlap.

Recall that the network of co-occurrence could be shaped by several factors in the current cultural and socio-economic environment. Specifically, these factors include news coverage, public interest and interpersonal friendships. Therefore, RQ3 through RQ5 is an attempt to relate the webometric measure of co-occurrence to measures indicating these broad trends. These RQs were addressed by correlating the centrality measures in the co-occurrence data with (1) the number of searches about the country reported by Google Trends (<https://www.google.com/trends/>), (2) the number of stories in Google News (<https://news.google.com/>) and (3) the number of searches on LexisNexis (<http://www.lexisnexis.com>) and (4) Facebook friendship. Because of the length of time required to collect the network data, the timeframe of the data from Google Trends, Google News and LexisNexis were limited to three weeks prior, three weeks during, and six weeks after the collection of the network data from Facebook. The international Facebook friendship network was obtained from Barnett and Benefield (2015).

The correlations between Google Trends data and the co-occurrence network data by frequency of mention (degree) ranged from 0.639 to 0.681, with the first week data being the most highly correlated. The correlations between Google Trends and betweenness in the co-

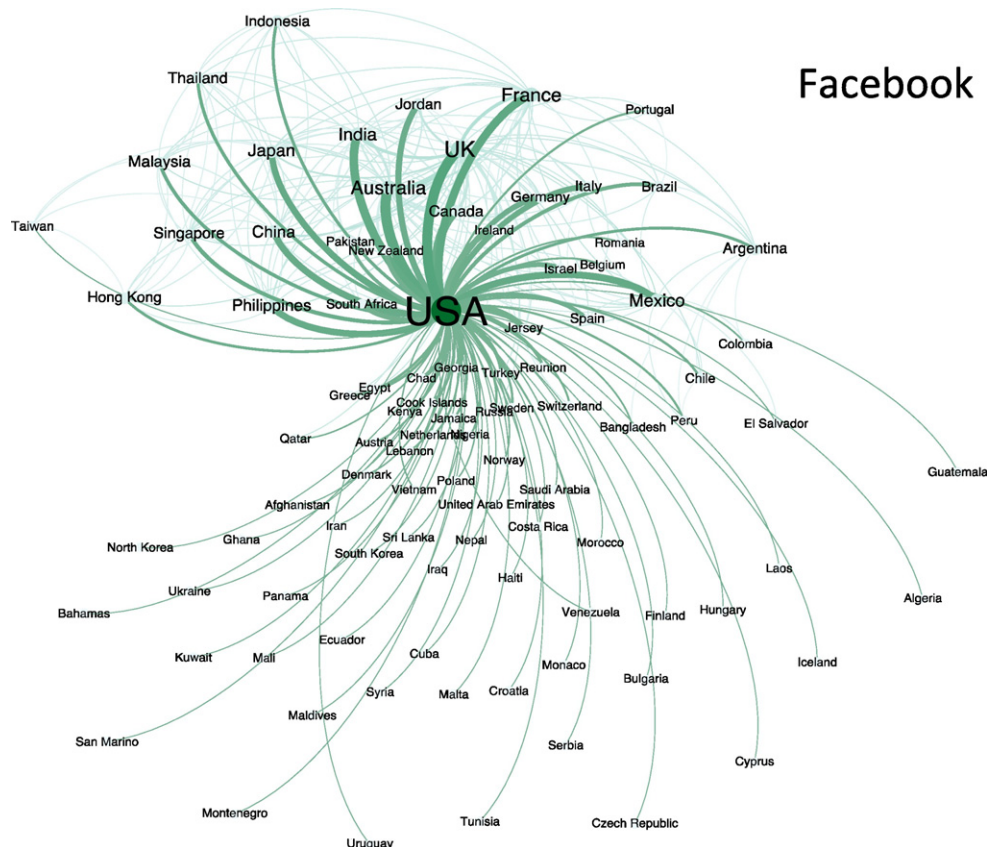


Fig. 1. Co-occurrence network based on Facebook data. Note: Node size varies by centrality. Line width indicates the frequency of co-occurrence.

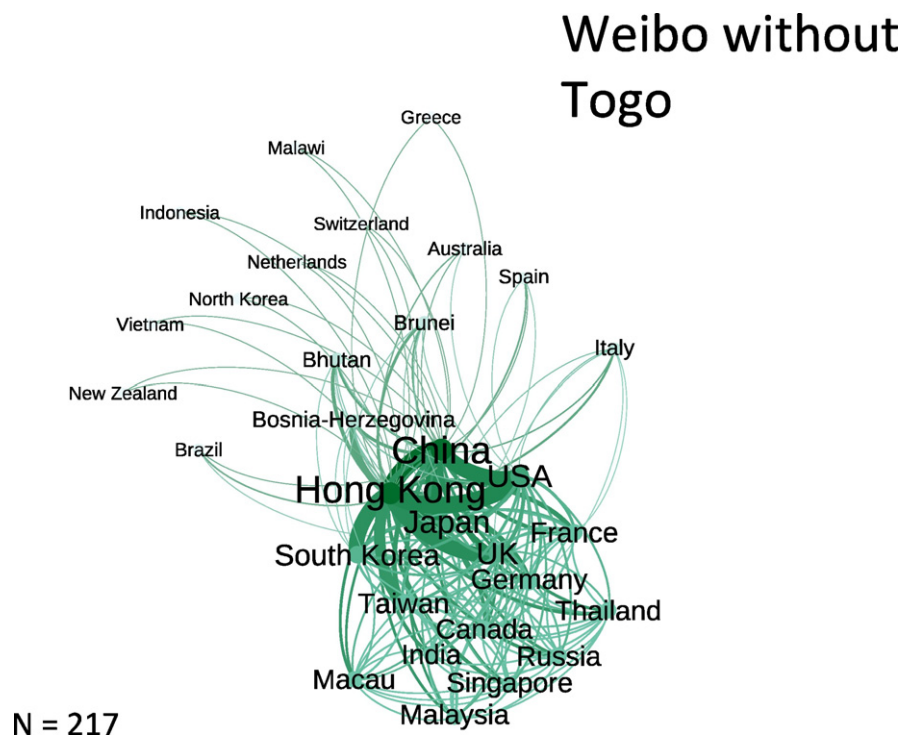


Fig. 2. Co-occurrence network based on Weibo. Note: Node size varies by centrality. Line width indicates the frequency of co-occurrence.

occurrence network data ranged from 0.542 to 0.573, with the first week data showing the strongest correlation. For eigenvector centrality of co-occurrence network, the correlations ranged from 0.772 to 0.800. Again, the strongest correlation was found in the first week data.

The correlations between the Google News data and the frequency of mentions (degree) in the co-occurrence network ranged between 0.445 and 0.560 with the greatest correlation in the third week. For betweenness centrality, the correlations ranged from 0.355 to 0.438, with the strongest correlation reported in the third week. For eigenvector centrality, the correlations ranged from 0.500 to 0.637, again the third week had the strongest correlation.

The correlation between the co-occurrence network by the frequency measure and the number of LexisNexis searches ranged from 0.585 to 0.679, with the strongest correlation occurring three weeks after the data collection. For betweenness, the correlations ranged from 0.493 to 0.597, with the strongest correlation is reported three weeks after the data collection. And for eigenvalue centrality, the correlations ranged between 0.711 and 0.784, with the strongest correlation reported three weeks after the data collection. The proceeding results are summarized in Table 1.

The correlation between the co-occurrence network and the international Facebook friendship network shows that the two networks are significantly correlated ($r = 0.087$, $p < 0.001$).

5. Discussion

The current study suggests a new direction in using webometric data to reveal international relations. The basic premise of the study is this: people talk about different countries on various social media outlets. Such data can be mined for inferring about international relations perceived by the general public. In this study, over 1.8 billion Facebook posts mentioned at least two different nations during the three-week study period in the fall of 2014. There were over 51 million such posts on Weibo produced during three weeks in the early winter that follow. The active conversation about foreign countries is in line with Castells'

(2008) notion of Web 2.0-based virtual space being representative of the global public sphere.

The results from the study are in line with the World System theory (Wallerstein, 1974; Chase-Dunn & Grimes, 1995; Barnett, Jacobson, Choi, & Sun, 1996) and Galtung's (1971) Structural Theory of Imperialism. These theories suggest that the world order is manifested in a central-peripheral pattern. The network analysis in the study shows a similar pattern in social media-based co-mentions of nations. That is, developed nations such as the U.S., U.K., France, Australia, and Canada possess central network locations, whereas smaller and less wealthy countries are at the periphery. A potential explanation for this pattern is this: the dominant countries more likely appear in world affairs and thus incite more discussions—this is in line with the later finding that the centrality of a foreign country is related to the amount of news coverage it receives.

It is not surprising to see discernible differences between Facebook and Weibo conversation. Being a global site, Facebook conversations

Table 1

Correlations between country ranking by centrality in the co-occurrence network and country ranking by search volume o Google Trends, Google News and LexisNexis.

	Time of maximum	Range
Google Trends		
Degree	$r = 0.681$ (1st week during)	0.639–0.681
Eigenvector	0.800 (1st week during)	0.772–0.800
Betweenness	0.573 (1st week during)	0.542–0.573
Google News		
Degree	$r = 0.560$ (3rd week during)	0.445–0.560
Eigenvector	0.637 (3rd week during)	0.500–0.637
Betweenness	0.438 (3rd week during)	0.355–0.438
Nexis Articles		
Degree	$r = 0.679$ (3 weeks later)	0.585–0.679
Eigenvector	0.784 (3 weeks later)	0.711–0.784
Betweenness	0.597 (3 weeks later)	0.493–0.597

take a global perspective while the conversation on Weibo focuses on East Asia. The emphasis on Hong Kong and China was possibly due to the timing of the data collection, which coincided with the pro-democracy movement in Hong Kong. Again, this indicates the close connection between perceived international relations and events on the ground. The result also indicates the role of locality, which is consistent with recent findings that the WWW is composed of a separate set of websites that use Chinese (Barnett & Park, 2014; Barnett, Ruiz, & Park, 2015).

Most importantly, the study shows that the structure of international relations in social media conversations correlates with various indicators of media/public attention and international friendship. This points to the necessity of studying how public diplomacy is related to global friendship and news coverage.

There are numerous shortcomings with this study that should be mentioned. First, Facebook is a diverse platform including actors such as news media, government agencies and international organizations, in addition to average citizens. It is not clear from the data who actually produced the content—whether the conversations were by average citizens or established organizations. Making such distinction is important because established organizations such as traditional media and government agencies actively use Facebook to conduct public diplomacy (Park & Lim, 2014). Their content should be treated differently from citizen-generated content.

Second, the Facebook data were collected only in English and not in other widely used international languages. Therefore, we do not know how many times the United States was referred to as “États Unis”, “Vereinigtes Staaten” “Estados Unidos” or “Соединенные Штаты”. Thus, non-English-speaking countries might be underrepresented in the dataset, which may explain why the U.S., U.K., Australia, Canada and India are central in the network. Future research should gather comparable Facebook data in various different languages to determine the validity of the reported findings.

Third, future research should gather network data on the co-mentions of countries using other social media websites, including Twitter, YouTube and Renren to determine if these sites also serve the role of electronic public forums for the discussion of international issues. Further, given the increased use of short instant message services, such as Wechat and WhatsApp at the expense of social networking sites, it may be beneficial to examine their role in the electronic public sphere.

Fourth, one of the interesting findings in the research was the relationship between Facebook discussions and media coverage both online and in print. This raises the question of which comes first, reporting of news events by the mass media or conversations in social media? Or, is this relationship more complex, with the use of one media providing feedback to another? In order to investigate inter-media agenda setting, future research should be conducted. Given the limited number of search queries that are allowed per day, only a few relationships among countries can be collected to provide longitudinal data sufficient enough to draw precise conclusions.

Fifth, social media data on the relations among countries should be gathered overtime to determine if the structure of the network changes in response to world events (Barnett & Jiang, 2016). In this way, we will be able to determine if a network does represent the global electronic public sphere in which people discuss current transnational issues and how social media responds to these events.

Finally, and perhaps most importantly, one should examine the content of the postings on various social media to determine precisely what is being said about international events. Do they represent forums for the public to freely and openly discuss important international issues of the day or something less significant, such as news about celebrities and international sporting events? The meanings of the various postings may be determined through the use of semantic network analysis (Cho, Choi, & Park, 2012; Hsu, Park, & Park, 2013; Danowski & Park, 2014; Jiang et al., 2016), which has been shown to facilitate the interpretation of media messages.

6. Policy implications

Although this paper focused on the co-mentions of nations in social media, there are a number of policy implications for government, local, regional (state or provincial) and national. Perhaps the most important implication is that governments of all levels should, at a minimum, monitor social media conversations that mention their individual governmental entity, especially when critical events take place. This was seen in the results from Weibo that showed that Hong Kong occupied a central role in the international discussion network during the democracy movement in the fall of 2014. Careful monitoring of online dialog is essential for the development of effective responses by governments that address the concerns raised by the public. This may require the creation of a new governmental agency or the modification of an entity's mandate to deal specifically with social media.

In a more active capacity, governments should also consider using social media to their advantage to set the agenda for the discussion in the electronic public sphere (Park & Lim, 2014). As reported in this paper, the discussions on Facebook are strongly related to the nations' coverage in the mass media and the general public's search activities, suggesting that social media can set the agenda across different media. By having their public officials, agencies and followers initiating dialog through their online posts, governments can alter discussion and modify diverse public perceptions and opinions to gain consensus about the issues of concern.

Specifically regarding international relations, the research reported in this article suggests that governments can reposition themselves closer to their allies and other more powerful nations central in the network, such as the United States and the United Kingdom, through public diplomacy discourse expressed in the electronic public sphere. This may be accomplished by associating one country with another. For example, “Korea and the U.S. are both liberal democracies.” Dialog of this type is especially important because as World Systems Theory suggests, changing public perceptions may lead to behaviors that can have impact on international aid, tourism, trade and investments, which have long-term impact on national economies and quality of life.

References

- Ackland, R. (2013). *Web social science: Concepts, data and tools for social scientists in the digital age*. Sage.
- Barnett, G. A. (2001). A longitudinal analysis of the international telecommunications network: 1978–1996. *American Behavioral Scientist*, 44(10), 1638–1655.
- Barnett, G. A., & Benefield, G. A. (2015). Predicting international Facebook ties through cultural homophily and other factors. *New Media & Society*. <http://dx.doi.org/10.1177/1461444815604421>.
- Barnett, G. A., & Jiang, K. (2016). Resilience of the World Wide Web: A longitudinal two-mode network analysis. *Social Network Analysis and Mining*, 6(1), 1–15. <http://dx.doi.org/10.1007/s13278-016-0415-0>.
- Barnett, G. A., & Park, H. W. (2005). The structure of international Internet hyperlinks and bilateral bandwidth. *Annals of Telecommunications*, 60, 1115–1132.
- Barnett, G. A., & Park, H. W. (2014). Examining the international Internet using multiple measures: New methods for measuring the communication base of globalized cyberspace. *Quality and Quantity*, 48, 563–575.
- Barnett, G. A., Jacobson, T., Choi, Y., & Sun, S. (1996). An examination of the international telecommunications network. *Journal of International Communication*, 3, 19–43.
- Barnett, G. A., Ruiz, J. B., & Park, H. W. (2015). *Globalization or decentralization of hyperlinked content among websites: An examination of website co-citations*. *Proceedings of Hawaii International Conferences on System Science (HICSS-48)*. (pp. 1779–1787), 1779–1787.
- Barnett, G. A., Ruiz, J. B., Xu, W., Park, N., & Park, H. W. (2016). *The world is not flat: Evaluating the inequality in global web structure through website co-mentions*. (Submitted to *Technological Forecasting & Social Change*).
- Bastian, M., Heymann, S., & Jacomy, M. (2009). Gephi: An open source software for exploring and manipulating networks. *ICWSM*, 8, 361–362.
- Bonacich, P. (1972). Factoring and weighting approaches to status scores and clique identification. *Journal of Mathematical Sociology*, 2, 113–120.
- Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2002). *UCINET for windows: Software for social network*. Harvard, MA: Analytic Technologies.
- Borgatti, S. P., Everett, M. G., & Johnson, J. C. (2013). *Analyzing social networks*. London: SAGE.
- Borgman, C. (2015). *Big Data, Little Data, No Data. Scholarship in the networked world*. Cambridge, MA: The MIT Press.

- Burns, A., & Eltham, B. (2009). *Twitter free Iran: An evaluation of Twitter's role in public diplomacy and information operations in Iran's 2009 election crisis*.
- Campbell, J. (2014, March 7). OpenStreetMap for Diplomacy: MapGive and Presidential Innovation Fellow. Retrieved October 13, 2016, from <https://blogs.state.gov/stories/2014/03/07/openstreetmap-diplomacy-mappgive-and-presidential-innovation-fellow>
- Castells, M. (2008). The new public sphere: Global civil society, communication networks, and global governance. *Annals of AAPSS*, 616, 77–93.
- Chang, T. K., Himelboim, I., & Dong, D. (2009). Open global networks, closed international flows world system and political economy of hyperlinks in cyberspace. *International Communication Gazette*, 71(3), 137–159.
- Chase-Dunn, C., & Grimes, P. (1995). World systems analysis. *Annual Review of Sociology*, 21, 387–417.
- Cho, S. E., Choi, M. G., & Park, H. W. (2012). Government-civic group conflicts and communication strategies: A text analysis of TV debates on Korea's import of U.S. beef. *Journal of Contemporary Eastern Asia*, 11(1), 1–20.
- Colleoni, E., Rozza, A., & Arvidsson, A. (2014). Echo chamber or public sphere? Predicting political orientation and measuring political homophily in Twitter using big data. *Journal of Communication*, 64(2), 317–332.
- Dahlgren, P. (2005). The Internet, public spheres, and political communication: Dispersion and deliberation. *Political Communication*, 22(2), 147–162.
- Danowski, J. A., & Park, H. W. (2014). Arab Spring effects on meanings for Islamism web terms and on web hyperlink networks among Muslim-majority nations: A naturalistic field experiment. *Journal of Contemporary Eastern Asia*, 13(2), 15–39.
- Dekker, D., Krackhardt, D., & Snijders, T. A. B. (2007). Sensitivity of MRQAP test to collinearity and autocorrelation conditions. *Psychometrika*, 72, 563–581.
- Doerfel, M. L., & Connaughton, S. L. (2009). Semantic networks and competition: Election year winners and losers in US televised presidential debates, 1960–2004. *Journal of the American Society for Information Science and Technology*, 60(1), 201–218.
- Fisher, A. (2010). Mapping the great beyond: Identifying meaningful networks in public diplomacy. *CPD Perspectives on Public Diplomacy*, 2, 1–87.
- Freeman, L. C. (1979). Centrality in social networks: Conceptual clarification. *Social Networks*, 1, 215–239.
- Galtung, J. (1971). A structural theory of imperialism. *Journal of Peace Research*, 8, 81–118.
- Golan, G. J., & Himelboim, I. (2015). Can World System Theory predict news flow on Twitter? The case of government-sponsored broadcasting. *Information, Communication & Society* (doi: 0.1080/13691 Making e-government work: Adopting the network approach 18X.2015.1106572, Online First).
- Granovetter, M. (1983). The strength of weak ties: A network theory revisited. *Sociological Theory*, 1(1), 201–233.
- Gruzd, A., & Roy, J. (2014). Investigating political polarization on Twitter: A Canadian perspective. *Policy & Internet*, 6(1), 28–45.
- Guhua, J., & Chakrabarti, B. (2014). Making e-government work: Adopting the network approach. *Government Information Quarterly*, 31(2), 327–336.
- Habermas, J. (1989). *The structural transformation of the public sphere*. Boston: MIT Press.
- Haralabopoulos, G., & Anagnostopoulos, I. (2015). *On the information diffusion between web-based social networks*. *Web Information Systems Engineering – WISE 2014 Workshops Volume 9051 of the series Lecture Notes in Computer Science*, 14–26.
- Heo, Y. C., Park, J. Y., Kim, J. Y., & Park, H. W. (2016). The Emerging Viewertariat in South Korea: The Seoul Mayoral TV Debate on Twitter, Facebook, and Blogs. *Telematics and Informatics*, 33, 570–583.
- Himelboim, I., McCreery, S., & Smith, M. (2013). Birds of a feather tweet together: Integrating network and content analyses to examine cross-ideology exposure on Twitter. *Journal of Computer-Mediated Communication*, 18(2), 40–60.
- Hsu, C. L., Park, S. J., & Park, H. W. (2013). Political discourse among key Twitter users: The case of Sejong city in South Korea. *Journal of Contemporary Eastern Asia*, 12(1), 65–79.
- Jalilvand, M. R. (2012). The effect of electronic word of mouth on brand image and purchase intention. *Marketing Intelligence & Planning*, 30(4), 5.
- Jansen, B. J., Zhang, M., Sobel, K., & Chowdury, A. (2009). Twitter power: Tweets as electronic word of mouth. *Journal of the American Society for Information Science and Technology*, 60(11), 2169–2188.
- Jiang, K., Barnett, G. A., & Taylor, L. D. (2016). News framing in an international context: A semantic network analysis. *International Journal of Communication*, 10, 3710–3736.
- Jung, K., & Park, H. W. (2016). Tracing interorganizational information networks during emergency response period: A webometric approach to the 2012 Gumi chemical spill in South Korea. *Government Information Quarterly*, 33(1), 133–141.
- Kassen, M. (2013). A promising phenomenon of open data: A case study of the Chicago open data project. *Government Information Quarterly*, 30(4), 508–513.
- Kavanaugh, A. L., Fox, E. L., Sheetz, S. D., Yang, S., Li, L. T., Shoemaker, D. J., ... Xie, L. (2012). Social media use by government: From the routine to the critical. *Government Information Quarterly*, 29(4), 480–491.
- Khatib, L., Dutton, W., & Thelwall, M. (2012). Public diplomacy 2.0: A case study of the US digital outreach team. *The Middle East Journal*, 66(3), 453–472.
- Kim, K., & Barnett, G. A. (1996). The determinants of international news flow: A network analysis. *Communication Research*, 23, 323–352.
- Kim, K., & Barnett, G. A. (2000). The structure of the international telecommunications regime in transition: A network analysis of international organizations. *International Interactions*, 26(1), 91–127.
- Kim, J. H., & Barnett, G. A. (2007). The effect of global communication on international conflict: A network analysis. *International Interactions*, 33, 135–165.
- Kim, J. H., Barnett, G. A., & Kwon, K. (2010). The influence of social networks on the U.S. Senate roll-call voting. *International Journal of E-Politics*, 1(4), 22–42.
- Kim, M., Heo, Y. C., Choi, S. C., & Park, H. W. (2014). Comparative trends in global communication networks of #Kpop tweets. *Quality and Quantity*, 48(5), 2687–2702.
- Lake, D. A. (2009). *Hierarchy in international relations*. Cornell University Press.
- Mayer-Schomberger, V., & Cukier, K. (2013). *Big data: A revolution that will transform how we live, work, and think*. Boston, MA: Houghton Mifflin Harcourt.
- McCombs, M. E., & Shaw, D. L. (1972). The agenda-setting function of mass media. *Public Opinion Quarterly*, 36(2), 176–187.
- Meier, H. (2016). Global civil society from hyperlink perspective: Exploring the website net-works of international NGOs. *Journal of Contemporary Eastern Asia*, 15(1).
- Mergel, I. (2013). Social media adoption and resulting tactics in the U.S. federal government. *Government Information Quarterly*, 30(2), 123–130.
- Oh, O., Kwon, K. H., & Rao, H. R. (2010, August). An exploration of social media in extreme events: Rumor theory and Twitter during the Haiti earthquake 2010. *ICIS* (pp. 231).
- Papacharissi, Z., & de Fatima Oliveira, M. (2012). Affective news and networked publics: The rhythms of news storytelling on #Egypt. *Journal of Communication*, 62(2), 266–282.
- Park, H. W., & Leydesdorff, L. (2013). Decomposing social and semantic networks in emerging "big data" research. *Journal of Informetrics*, 7(3), 756–765.
- Park, S. J., & Lim, Y. S. (2014). Information networks and social media use in public diplomacy: A comparative analysis of South Korea and Japan. *Asian Journal of Communication*, 24(1), 79–98.
- Park, H. W., Barnett, G. A., & Chung, C. (2011). Structural changes in the global hyperlink network 2003–2009. *Global Networks*, 11(4), 522–544.
- Park, S. J., Lim, Y. S., & Park, H. W. (2015). Comparing Twitter and YouTube Networks in Information Diffusion: The Case of the "Occupy Wall Street" Movement. *Technological Forecasting & Social Change*, 95, 208–217.
- Roberts, M., Wanta, W., & Dzwon, T. H. D. (2002). Agenda setting and issue salience online. *Communication Research*, 29(4), 452–465.
- Rosen, D., Barnett, G. A., & Kim, J. H. (2011). Social networks and online environments: When science and practice co-evolve. *Social Networks and Mining*, 1, 27–42.
- Ruhnau, B. (2000). Eigenvector-centrality—A node-centrality? *Social Networks*, 22(4), 357–365.
- Ruiz, J. B., & Barnett, G. A. (2014). Who owns the international Internet networks? *Journal of International Communication*, 21(1), 38–57.
- Segev, E., Sheaffer, T., & Shenhav, S. R. (2013). Is the world getting flatter? A new method for examining structural trends in the news. *Journal of the American Society for Information Science and Technology*. <http://dx.doi.org/10.1002/asi.22932>.
- Shapiro, M. A., & Park, H. W. (2015). More than entertainment: YouTube and public responses to the science of global warming and climate change. *Social Science Information*, 54(1), 115–145.
- Signitzer, B. H., & Coombs, T. (1992). Public relations and public diplomacy: Conceptual convergences. *Public Relations Review*, 18(2), 137–147.
- Slaughter, A. M. (2009). America's edge: Power in the networked century. *Foreign Affairs*, 88, 94–113.
- Smith, M. A. (2015). Catalyzing social media scholarship with open tools and data. *Journal of Contemporary Eastern Asia*, 14(2), 87–96.
- Sobkowicz, P., Kascheky, M., & Bouchard, G. (2012). Opinion mining in social media: Modeling, simulating, and forecasting political opinions in the web. *Government Information Quarterly*, 29(4), 470–479.
- Struijs, P., Braaksma, B., & Dass, P. J. H. (2014). Official statistics and big data. *Big Data & Society*, 1(1), 1–6 (Online First) 10.1177/2053951714538417
- Van Dijk, J. (2012). *The Network Society* (2nd ed.). London: Sage.
- Veltri, G. A. (2012). Microblogging and nanotweets: Nanotechnology on Twitter. *Public Understanding of Science*, 0963662512463510.
- Volkmer, I. (2003). The global network society and the global public sphere. *Development*, 46(1), 9–16.
- Wallerstein, I. (1974). *The modern world system*. New York: Academic Press.
- Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge: Cambridge University Press.
- Watts, D. J., & Strogatz, S. H. (1998). Collective dynamics of 'small-world' networks. *Nature*, 393(6684), 440–442.
- Xu, W. W., Park, J. Y., & Park, H. W. (2015). The networked cultural diffusion of Korean wave. *Online Information Review*, 39(1), 43–60.
- Xu, W. W., Park, J. Y., Kim, J. Y., & Park, H. W. (2016). Networked cultural diffusion and creation on YouTube: An analysis of YouTube memes. *Journal of Broadcasting & Electronic Media*, 60(1), 104–122.
- Zhang, C., & Meadows, C. W., III (2012). International coverage, foreign policy, and national image: Exploring the complexities of media coverage, public opinion, and presidential agenda. *International Journal of Communication*, 6, 20.
- Zhong, X., & Lu, J. (2013). Public diplomacy meets social media: A study of the US Embassy's blogs and micro-blogs. *Public Relations Review*, 39(5), 542–548.

George A. Barnett (PhD, Michigan State University, 1976) is distinguished Professor of Communication at the University of California, Davis. He has written extensively on organizational, mass, international, intercultural and political communication, as well as the diffusion of innovations. Professor Barnett served as Chair of the Communication and Technology Division of the International Communication Association and President of the International Network for Social Network Analysis (INSNA). He edited the *Handbook of Organizational Communication, Organization ↔ Communication: Emerging Perspectives, Advances in Communication Sciences, and Encyclopedia of Social Networks*. His current research focuses on international information flows and their role on socioeconomic and cultural change, and the process of globalization.

Weiai Wayne Xu, Assistant Professor, Department of Communication, University of Massachusetts - Amherst. His research exams internet communities and their impact on people's social and civic life.

Jianxun Chu (PhD, University of Science and Technology of China, 2006) is an Associate Professor of Media Management at the Department of Sci-Tech Communication and Policy, University of Science and Technology of China (USTC), and also the Deputy Director of Science Communication Research Centre at USTC, Hefei, China. His research focuses on the impact of *Social Media, Social Networks and Transactive Memory Systems* in the fields of *Innovation Diffusion, Science Communication and Crisis Communication based on Big Data and modelling simulation of System Dynamics*. He has been invited to give a keynote speech in conferences including the *International Communication Association (ICA)*, *System Dynamics Society (SDS)*, *International Network for Social Network Analysis (INSNA)* and *Sino-German Social Computing (SGSC)*. Further, he is the PI of several projects by *National Natural Science Foundation of China (NSFC #71573241)*, *Chinese Academy of Sciences (CAS)*, and *China Association for Science and Technology (CAST)*.

Ke Jiang is a PhD candidate in the department of Communication at University of California, Davis. She received her M.A. from the University of Science and Technology of China in 2010. She was a news anchor in China Economic Radio Station of Anhui Province. Her research focuses on news framing in the era of globalization, communication network analysis, semantic network analysis, network dynamics, network co-evolution, network visualization, intercultural communication, and cultural convergence.

Catherine Huh is a doctoral student in Communication at the University of California, Davis. Her research interests include communication technologies and emerging media.

Ji Young Park (MA, Yeungnam University, South Korea) is a doctoral candidate in Interdisciplinary Program of East Asian Cultural Studies at Yeungnam University. Her research areas include social media & big data in Asia, cross-cultural & intercultural communication, and new media & digital technology.

Han Woo Park (State University of New York at Buffalo, PhD) is a Full Professor in the Dept. of Media & Communication, Interdisciplinary Programs of Digital Convergence Business, and Directors of Cyber Emotions Research Institute (since 2010) at Yeungnam University, South Korea. His research focuses on the use, impact, and role of open and big data in extending academic, governmental, and business networks in scientific, technical, and innovative activities. He was a pioneer in network science of open and big data in the early 2000s (often called *Webometrics, Hyperlink Network Analysis, Link Analysis, etc.*) when he used to work for Royal Netherlands Academy of Arts & Sciences (*KNAW* in Dutch), and was Principal Investigator of the World Class University (*WCU*) research project (2009–2011) funded by Korean government. Professor Park has published >100 articles in *Web of Science* Journals (often called *Social Science Citation Index*). He is currently the president (since 2013) of the World Association for Triple Helix and Future Strategy Studies (*WATEF*). Since the establishment of open data law in Korea, he has actively participated in the *Strategic Committee of Public Data* chaired by Prime Minister and international events including 'Big Data and the 2030 Agenda for Sustainable Development' workshop organized by UN-ESCAP. He has founded a prestigious conference on big data, government 3.0, and triple network in Asia, called *DISC* (Data, Innovation, Social networks, Convergence Conference) that is only conference acknowledged by the International Networks for Social Network Analysis (*INSNA*). Professor Park was a local organizer of the Internet Research15 conference of the Association of Internet Researcher (*AoIR*) that held in Asia for the first time. He also sat on the consulting boards of European Union project on open data (<http://www.data4policy.eu>) in collaboration with *Oxford Internet Institute* where he used to be a visiting scholar. He has been invited to give a keynote speech in a number of workshops and conferences including the *International Communication Association (ICA)*, *International Conference on e-Democracy and Open Government (CeDEM)*, and *NetGlow*. Further, he is strongly affiliated with several prestigious journals on open government and big data such as *Big Data & Society, Technology Forecasting & Social Change*, and *Scientometrics*. Further, he is a principal investigator of *OpenData500.com* on Korean side (<http://www.opendata500.com/kr>). Additionally, Professor Park was recently appointed as MICE (Meeting, Incentive tour, Convention, Exhibition) Ambassador for Daegu, Korea.