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Online public deliberation in China: evolution of interaction patterns and network homophily in the Tianya discussion forum

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Abstract

Internet discussion platforms in China provide a hugely interesting and relevant source for understanding dynamics of online discussions in a unique context. Adopting the theoretical lens of public deliberation, this paper investigates the evolution of patterns of similar-minded and different-minded interactions over time on a Chinese online discussion forum. We analyse the content and reply networks of 18,000+ messages on four highly debated topics on the Bulletin Board System (BBS) platform Tianya. Findings provide nuanced evidence to the phenomenon of increased network homophily over time, mitigated in discussions where the difference between opinion sides is smaller, and participants have positive opinions. Providing empirical foundation for testing and refining the tenets of public deliberation in the unique socio-cultural and institutional environment of China, this study lays ground for future investigation on independent variables for understanding dynamics of online discussions, and for studies comparing cases across different contexts.

Keywords: online discussion; public deliberation; network homophily; China; Tianya; discussion forum

Introduction

The diffusion of horizontal channels of interaction between users on the Internet has been highlighted as potentially bringing about a large number of disruptive societal changes. Such phenomena have led to a rich debate over the changing nature of public discussions in a digital environment. In particular, a wide range of speculations has been brought forward over the effect of the emergence of digital public spaces on how public opinions are formed and public discussions are conducted. On the one hand, digital tools are believed to carry the potential to expose individuals to a wider array of information and opinions than ever, and thus to improve the quality and richness of discussions over public matters (Dahlberg, 2001c; Schneider, 1996). On the other hand critics point out that, since they are very effective at filtering out unwanted information, digital tools tend to create closed groups of like-minded individuals, who only interact with each other, fail to contribute to a meaningful development of a common public sphere, and increase opinion polarization and societal fragmentation (Morozov, 2012; Sunstein, 2001).

Deepening knowledge on these issues is particularly relevant especially when looking at regions of the world where both the diffusion of digital channels and the dynamics of public opinion are experiencing unprecedented growth. Emerging economies like China are an underexplored context for providing new insights into the dynamics of public discussion networks, given the massively booming diffusion of digital channels, and of the rich conversations that occur over them (W. Chen, 2014; L. Li, Gao, & Mao, 2014). Moreover, theoretical tenets that have traditionally been supported by empirical data originating in the Western context need to be challenged and enriched with insights from non-Western digital scenarios.

Research on discussion patterns in online media has started to tackle these issues, trying to unfold the characteristics, antecedents, and impacts of digital tools on the way networks of individuals formulate, share, and shape their opinions on a given public topic. The challenges that the current body of research has to face are manifold. On the one hand, never before has data on how public discussions unfold been so readily available; on the other hand, with the mushrooming of discussion communities over an endless variety of contexts (from news sites, to movie catalogues, to microblogging), it is increasingly harder to make sense of the massive array of intervening variables within a shared theoretical framework.

This paper contributes to research on online discursive interaction by investigating the development of patterns of interactions among similar-minded and different-minded individuals over time in online forums in China. It aims at filling a gap related to the dearth of studies analysing discussion patterns over time, and of studies on public deliberation in a non-Western context. The theoretical lens adopted in this study is the one of public deliberation, a set of assumptions regarding the way opinions and sentiments are exchanged, argued, and negotiated as a result of interaction with other participants in a public debate. Public deliberation, as a very complex and layered construct, includes many components that have been constantly contended in theoretical and empirical literature. However, we deem public deliberation as an ideal model to be a very powerful lens to evaluate emerging forms of public sphere. Thus the research question driving this study is:

How do the patterns of similar-minded and different-minded interactions in an online discussion network evolve over time?

The paper is structured as follows: in the next section we present public deliberation as the theoretical framing of the study, discussing its relevance for the analysis of online discussion interactions, and the options for its operationalization. In the section on previous research, we review and discuss studies on the impact of digital channels on public deliberation, and on the phenomenon of network homophily in digital networks, identifying research streams, and gaps to be filled. The following section presents the empirical case, arguing for the relevance of the Chinese online public sphere development as a context for testing our understanding of online public deliberation, and describing the case of the Tianya BBS online forum. The method section illustrates the processes of data collection and analysis, and the findings section presents the results of the study. In the discussion section we discuss the implications of the findings and their relevance for future research. In the conclusion we summarize the study and highlight its contributions.

Theoretical framework: public deliberation

The concept of public deliberation, originally rooted in the habermasian reflection on the historical development of the public sphere and the theory of communicative action (Habermas, 1984, 1991), has been conceptualized as the mode of network interaction whereby individuals publicly confront their opinions through persuading or being persuaded by the "forceless force of the better argument" (Habermas, 1975, p. 108) and not by mere aggregation of preferences, or by violent force (Carpini, Cook, & Jacobs, 2004).

However, as a result of the accumulation of a rich literature of theoretical reflection on the concept of deliberation, "there exist varied theoretical conceptions of public deliberation and no clear – let alone widely adopted – conceptual definitions of the term" (Gastil & Black, 2008, p. 1). With the diffusion of the Internet, scholars have seized the opportunity to adopt the lens of public deliberation in order to speculate and investigate on the potential of digital networks to bring about changes in the public sphere (Benhabib, 2001; Coleman & Moss, 2012; Dahlberg, 2001a, 2001c; Gimmler, 2001). However, while the normative assumptions behind the deliberative mode of interaction have been widely investigated, there is much less existing empirical ground for testing these assumptions (Carpini et al., 2004). Moreover, there is little agreement regarding how public deliberation might be measured empirically (Friess & Eilders, 2015; Muhlberger, 2000).

Table 1 presents a summative overview of the main characteristics of public deliberation as presented in existing theoretical and empirical research literature. While an extensive review of all the conceptual articulations and the different empirical operationalizations of public deliberation is clearly outside the scope of this study, we have here adopted three steps to build a map of the constructs that form the concept of public deliberation, in order to identify the available options for operationalizing it in our study: 1) a systematic analysis of key theoretical contributions to the core constructs of public deliberation (Benhabib, 2001; Bohman & Rehg, 1997; Chambers, 2003; Cohen, 1989; Dryzek, 2000; Elster, 1998; Fishkin, 1991; Gimmler, 2001; Gutmann & Thompson, 2002; Habermas et al., 1974); 2) a review of methodological

contributions proposing measures of public deliberation (Bächtiger, Niemeyer, Neblo, Steenbergen, & Steiner, 2010; Steenbergen, Bächtiger, Spörndli, & Steiner, 2003; Stromer-Galley, 2007); and 3) an incorporation of the findings of recent literature reviews of empirical studies on public deliberation (Carpini et al., 2004; Friess & Eilders, 2015; Thompson, 2008). In Table 1, the first column to the left presents a list of constructs included in key definitions of public deliberation; the second column presents a corresponding operational definition of those constructs; and the third column provides examples of empirical studies that draw on that operational definition.

The table only includes examples of empirical studies that explicitly refer to public deliberation as their theoretical framework. Moreover, as this mapping serves the purpose of identifying the best strategy for operationalizing the concept of public deliberation process in our study, we included only constructs and studies on the cognitive, attitudinal, and behavioral aspects of the public deliberation *process*, and left out studies on *inputs* to deliberation (i.e., determinants or facilitating factors, such as e.g. platform design, moderation, and anonymity), or on *outcomes* of deliberation (such as e.g., increased arguments repertoire, community engagement, social trust).

<Table 1 about here>

Among all constructs that can be argued to make up the phenomenon of public deliberation, we put forward that the presence of *disagreement*, operationalized as the interaction between participants with different opinions, is the fundamental one. As well argued by Stromer-Galley (2007):

> "The question of whether there is disagreement in a deliberation matters for three reasons. The first is that disagreement is an indication that there are diverse viewpoints in the group. The participants are not homogenous in their viewpoints […]. The second is that there is a concern that people who share similar perspectives are more likely to polarize in their beliefs; […] When there are participants in the dialogue with alternative perspectives, this can mitigate the polarization effect (Sunstein, 2003). Third, people who differ on a position are more likely to have their own views further examined and strengthened in a more rational way when they are exposed to disagreement and the articulated perspectives disagreement invites (Cappella, Price, & Nir, 2002)". (Stromer-Galley, 2007, p. 5)

In other words, exposure to different opinions is either the necessary condition for public deliberation, or the only purposeful scenario in which all the other characteristics (and supposed benefits) of public deliberation can occur. Without exposure to different opinions (*disagreement*) – and the existence thereof (*diversity*) – participants have no point in elaborating claims of validity (*rationality*) (Cappella et al., 2002); in listening to other participants' arguments (*interactivity/reciprocity*) (W. Zhang, Cao, & Tran, 2013); in reflecting on another's claim or reason against one's own claim (*reflexivity*) (Price, Cappella, & Nir, 2002); in having to

behave politely (*civility*) (Scheerhorn, 1991); in considering the well-being of other participants (*empathy*) (Mutz, 2006); in striving to make all information known to other participants (*sincerity*) (W. Zhang, 2005); in considering the well-being of the community at large (*common good reference*) (Mutz, 2006); and in sharing the rates of participation equally (*equality*) (Halpern & Gibbs, 2013). As well summarized by Thompson: "If the participants are mostly like-minded or hold the same views before they enter into the discussion, they are not situated in the circumstances of deliberation" (Thompson, 2008, p. 502). Exposure to different opinions, in the form of different-minded interactions, can thus be considered the *sine qua non* of deliberative potential, the one dimension without which all other highlighted characteristics of deliberation loose their function.

While any operationalization necessarily limits the scope of the many facets of public deliberation that could arguably be relevant to investigate, we deem this aspect to be the most relevant to focus on in our empirical study. The details on the operationalization of the dimension of exposure to different opinions in the research design of this study are presented in the methods section.

Previous research: online public deliberation and network homophily

A growing body of empirical research has focused on the impacts of digital channels on the characteristics of deliberation, in a continuum that spans from supporting a positive view on impacts of digital platforms on the quality of public discussions (Dahlberg, 2001c; Schneider, 1996), to a potentially negative one (Morozov, 2012; Sunstein, 2001).

Studies that highlight the positive effects of digital tools on public deliberation stress the fact that online spaces, such as online forums, enable decentralized communication of many-to-many (Janssen & Kies, 2005), and provide the potential to build a common discussion ground between deliberating actors (Liang, 2014). Social media are seen as enhancing civic participation and decision making (Carty, 2010; Lerman, 2007; Macintosh, 2004). A number of studies distinguish between deliberation on different platforms: the ones based on written and asynchronous characteristics may support more reflexive, rational and argumentative conversations (Stromer-Galley & Wichowski, 2011), compared with synchronous channels (Coleman & Gotze, 2001).

Many empirical studies, on the other hand, highlight the more nuanced effects of digital tools on the quality of public discussions (Carpini et al., 2004). Ever since the emergence of the first virtual public boards, critics have pointed out that online deliberation does not expand the informal zone of the public sphere (Wilhelm, 1998), to the point of de-individuating participants, by encouraging uncivil discourse and group-based stereotyping (Kiesler, Siegel, & McGuire, 1984). In particular, the absence of cues (Papacharissi, 2004) and anonymity (Rowe, 2015) in digital interactions have been identified as often leading to flaming and uncivil behaviour.

A relevant stream of research focuses on the phenomenon of network homophily, defined as "the degree to which pairs of individuals are similar in terms of certain attributes" (Brown, Broderick, & Lee, 2007, p. 10). Studies drawing on the concept of network homophily test in an online environment the well-established hypothesis from the social psychology field

that people prefer to form groups among those with whom they agree (Blau, 1977; Huckfeldt & Sprague, 1995; McPherson, Smith-Lovin, & Cook, 2001; Schachter, 1959). Within this stream of research, the way participants in discussions interact with each other in relation to the polarity of their opinion (positive vs negative) has been focused on in studies that adopt the lens of sentiment analysis of online networks (Hillmann & Trier, 2012, 2013). Findings link the observed phenomenon of homophily to a fragmentation of the public into divided electronic communities made of groups that tend to self-segregate (Lawrence, Sides, & Farrell, 2010; Van Alstyne & Brynjolfsson, 2005). As a result, homogeneous groups tend to polarize, and thus radicalize their positive or negative sentiments (Sobkowicz & Sobkowicz, 2012a, 2012b).

Overall, studies on the impacts of digital channels on the quality of deliberation, and of online social network studies on the phenomena of homophily and sentiment polarization still provide mixed results: besides examples of online communities facilitating public deliberation, we have evidence of online interactions characterised by homophily and resulting in sentiment polarization.

Shared across the types of the findings, however, two key aspects of online public deliberation remain underexplored. Firstly, most of the empirical studies that investigate the behavioural, cognitive, and attitudinal characteristics of participants in online discussions, and of their interactions, do it by providing still snapshots of the observed phenomena, and thus tend to overlook capturing the phenomena from a longitudinal perspective. Few exceptions base their empirical analysis on the development of series of data over time (e.g. Schoberth, Preece, & Heinzl, 2003; Y. Yang, Chen, & Liu, 2010). This gap is particularly striking, as public deliberation is first and foremost a process: thus there is a key need for further empirical insights into the development of discussion patterns over time.

Secondly, while the concept of public deliberation carries strong implicit claims of universality, with its ideals of rationality, publicity, equality, argumentation and reasoning, existing research on public deliberation appears to be heavily immersed in Western cultural and methodological standards (Min, 2014). This bias has identifiable roots, as historically the conceptualization of deliberation as we know it today is mainly a product of Western Enlightenment ideals (Min, 2009). The resulting gap in empirical research proves very limiting, especially considering the global nature of digital arenas where online public deliberation occurs (L. Li et al., 2014; Sass & Dryzek, 2014).

Case presentation

The development of the Chinese digital public sphere

With the world's largest population of Internet users (649 million as of the end of December 2014) (CNNIC, 2015; Internet Live Stats, 2015), and 43.8% of netizens claiming to be 'fond' or 'very fond' of posting comments on the Internet (CNNIC, 2015), China naturally provides fertile ground for extending the investigation of online public deliberation.

Since the country's opening and reform triggers from the late 1970s, China has experienced a boom in the adoption and diffusion of Information Technology (IT), with IT spending estimated at 166.8 billion USD in 2014 (Zagada, 2015). This has affected virtually all sectors in the economy, and had deep societal impacts (Hughes & Wacker, 2003; Qiang, 2007; X. Zhang & Zheng, 2009). The Internet has been claimed to bring about swift transformations not only in the economic sphere of e-commerce, but also in the communication sphere of the emergent civil society (Tai, 2006), on modes of political participation (Y. Zhou, 2005), and citizen activism (G. Yang, 2013, 2015).

However, research on online interactions in the Chinese context has only started to scratch the surface of the different aspects of these massive and speedy changes (W. Chen, 2014). A number of contributions have started to provide overviews on the impacts of the diffusion of digital tools on the characteristics of the Chinese public sphere in wide brushstrokes. These studies highlight the speed of the emergence of a Chinese digital public sphere (Zheng & Wu, 2005); its fragmented nature (Leibold, 2011); or suggest the presence of unique traits of arguing and confrontation in the Chinese cyberspace (S. Li, 2010), such as carnivalism and playfulness (Herold & Marolt, 2011; Wu, 2014).

A limited number of studies focus on discussion patterns: they look at motivations for engaging in discussions (Chan, Wu, Hao, Xi, & Jin, 2012; Liu, Liu, & Li, 2012; Medaglia & Zhu, 2016), posting styles and sentiments (Gao, Abel, Houben, & Yu, 2012), reply networks (Zhongbao & Changshui, 2003), and information diffusion (Huang & Sun, 2014). The limited available data on the deliberative nature of online discussions in China provides inconclusive evidence, with interactions among participants characterized by rationality, but also constantly under the pressure of flaming wars, and by participants' sincerity, although not matched by reflexivity (W. Zhang, 2005).

Tianya BBS' Free Discussion Space: four cases

Although Chinese social network sites and applications such as Sina Weibo and WeChat are increasingly popular, when it comes to online discussions, traditional online forums still play a very important role in China's Internet, especially in discussing public events (CNNIC, 2015). One of the biggest online forums for discussing public news is the Bulletin Board System (BBS) of the portal Tianya (www.tianya.cn), with more than 80 million registered users, and more than 1 million daily unique visitors, contributing with about 20,000 new threads every day (Trackalytics, 2015). Many big events in recent years have been firstly reported in and transferred from the most popular sub-forum of Tianya, called Free Discussion Space. We adopted this sub-forum as the platform to collect data on discussion interactions.

Among all debated topics discussed in the Free Discussion Space of Tianya, we have identified four of them that featured a great impact and unique characteristics for the purpose of this study:

(1) *Tsinghua University renames a teaching building after a clothing company*. On May 24th, 2011, Beijing-based Tsinghua University, one of the top universities in China, announced a plan to rename one of its teaching buildings after a clothing company, Jenvis. The

announcement sparkled a big debate, with some seeing the event as an unacceptable corruption of Chinese education values by commercial interests, and some others highlighting that there should not be interference into each university's management choices.

(2) *Should China build its first aircraft carrier?* On Aug 10th, 2011, China's first aircraft carrier started its pilot navigation. Although many people regarded the battleship as a necessary weapon for China to protect itself, many thought that the cost was too high, and that there must be alternative options for public spending in the interest of the nation. The two sides argued about this topic on the BBS for nearly two months.

(3) *Interception of a truck carrying stray dogs on the highway*. On April 15th, 2011, a truck carrying stray dogs was intercepted on a highway by hundreds of dog lovers, determined to protect them. In the debate about this event, supporters praised these people because of their warm heart, while opponents considered their dangerous behaviour on the highway as potentially causing serious traffic accidents.

(4) *Musician Gao's article and his arrest*. On April 18th, 2011, famous Chinese musician Xiaosong Gao published an article strongly condemning the tragic episode of a music school student who ran over and killed a pedestrian with his car. Dramatically, 22 days later Gao was arrested for a car accident caused by his own drunk driving. Gao soon announced his will to accept any punishment without appeal, which earned him the understanding of many of his sympathizers. During this period, supporters and opponents of Gao heatedly discussed the event.

The reasons why we chose these cases are: (a) the topics are very controversial, and people are divided into opposite sides, so that the debating process can be observed clearly; (b) the topics are not directly politically sensitive so, as a result, there are only few threads filtered by forum managers; (3) the topics are mainly about public events without commercial interest, which reduces the likelihood of the presence in the discussions of paid posters, a relatively common phenomenon in the Chinese online environment referred to as the "Internet water army" (C. Chen, Wu, Srinivasan, & Zhang, 2013).

Methods

Discussions on the Tianya BBS are structured in different threads. Each thread is launched by a user/author by posting the first message with a title. For the purpose of clarity, we call this message a *post*. After reading this post, other people may express their opinion in the thread following the first post: we call these messages *replies*. All posts and replies are considered as *messages* in this context.

We retrieved all messages (i.e., posts and replies) related to the four topics using a spider software program specifically developed for this study by one of the authors. All threads in the platform were then filtered using keywords related to the four cases. To improve accuracy, a manual examination was then carried out on the selected threads.

As often observed in studies on online discussion forums (Y. Yang et al., 2010), the discussion on a topic can last a very long time, even years after the event, but the frequency of

messages is concentrated mostly within a limited period of time in which there is a surge of communication and the discussion blooms, before dying out. Therefore, we selected the 'blooming period' of each topic as the sample period to be studied, during which most of the messages about the topic were posted. Figure 1 shows the amount of messages posted on the four topics each day, starting from the day of the creation of the thread, indicated as Day 1 on the horizontal axis.

<Figure 1 about here>

As indicated in the figure, with the only exception of case 2, all cases begin their blooming period right after the first post. As further illustrated in Table 2, in most cases the blooming period selected is the one in which more than 90% of all the messages posted throughout the year appear.

<Table 2 about here>

In the following stage, the opinion expressed by each message was classified using a 5-point scale (very negative, negative, neutral, positive, very positive), plus unclear/unclassifiable opinion. This was carried out manually by a team of 10 trained graduate student assistants, with the support of a software tool developed for the purpose by one of the authors. A random sampling cross-check was performed by the researchers to ensure consistency in the classification procedure. For the purpose of simplicity in the study design, the five opinion categories were subsequently merged into three (positive, neutral, negative). We then classified each author's opinion by averaging all his/her messages' opinions, using the posters' registered account IDs.

In the final stage, direct discussion networks have been singled out. The first step to construct a discussion network is to represent every author who posted a message (post or reply) in any of the threads as a network node. Generally, messages on the forum can be classified in two groups: (1) messages posted only to express the author's opinion, without direct reference to any other message; and (2) messages posted as a reply or as a question to other author(s) who have posted a message. We singled out this latter group, in order to capture the dynamics of cross-opinion exposure through interaction. In order to do so, we looked for the reference to other authors in all messages. If a message contained another author's name, then the message was considered as a direct discussion between its author and the author whose name is mentioned in the message. This procedure was deemed necessary, since the Tianya's BBS discussions, unlike other online forums, are not organized in a tree structure. The sizes of the direct discussions networks in each case are illustrated further below in Table 5.

All steps taken in the data collection and analysis are summarized in Table 3.

<Table 3 about here>

The methodological choices of this study carry a number of limitations to be taken into account. Firstly, although the choice of discussion topics has been aimed explicitly at providing data that is as free as possible from bias or external influence, we are not able to estimate, for instance, to what extent the sample used is missing messages due to platform moderation, censorship, or paid posters (C. Chen et al., 2013; King et al., 2013). Secondly, there is a possible

limitation in our choice of the individual authors of comments as the unit of analysis. This choice implied classifying each author/node based on the average polarity of his/her messages, and thus attributing opinion polarity at the level of authors, and not of messages. We acknowledge the potential limitation of this approach, as it could lead to a loss of information on e.g., possible messages of one polarity that end up averaged in another polarity that might prove very influential for the evolution of a discussion. However, we deemed the unit of analysis of authors to be a best fit since we see the public deliberation process as an instance of interaction not between messages, but between people.

Findings

The descriptive statistics of the basic dataset identified in Step 2 of the analysis (Table 3) are summarized in Table 4.

<Table 4 about here>

The absolute figures show that case 3 (stray dogs) is the most discussed topic, with 23,960 messages. With the exception of case 4 (musician Gao), in which there is a large presence of neutral opinions, all cases display a majority of negative opinions expressed, with a ratio of about 3 to 1. This is in contrast with findings of some previous studies, which observed a prevalence of positive sentiments expressed in online social networks (Thelwall, Wilkinson, & Uppal, 2010).

The most interesting findings emerge from the final sample of 10,990 messages representing the direct discussions networks (Table 5).

<Table 5 about here>

The cumulative figures of the direct discussion networks presented in Table 5 provide a first glance on the extent to which participants in the discussions interact with similar-minded and different-minded individuals in each of the opinion sides. In most cases, the interactions with similar-minded authors (P-P and N-N) are by far in larger number than the interactions with different-minded authors. The only exception is case 3 (stray dogs), which is also the case with the largest network, where cross-group discussion is higher in absolute terms.

To assess the potential influence of interaction with similar and different-minded participants on the evolution of the network of opinions, we have examined the changes in intra-opinion and inter-opinion interactions over time. In Figure 2 we illustrate the changes over time for each case in the proportion between similar-minded interactions (P-P and N-N) and the total number of messages, and the proportion between different-minded interactions (P-N) and the total number of messages.

<Figure 2 about here>

We can observe that in two of the cases (2 and 4) the proportion of similar-minded interactions for every day passed is usually significantly higher than the proportion of different-minded interactions. While in case 4 the difference between the proportion of similar-minded

and different-minded interactions stays relatively stable over time, in case 2 we observe some fluctuations that indicate a slight increase in the difference between the two.

Cases 1 and 3, in this respect, offer more interesting insights. In case 1 (Tsinghua University) we observe that the discussion, before being overtaken by similar-minded interactions, actually starts with quickly increasing proportions of cross-group interactions and diminishing intra-group interactions. This phenomenon reaches a peak around halfway into the blooming period, when cross-group interactions overtake intra-group ones. After this peak, the difference between the two types of interactions moves back in favour of the similar-minded ones. Case 3, as observed, is the only case in which cross-group discussion is higher in absolute terms. Notwithstanding some small fluctuations, the proportion values of the two types of interactions stay similar for the first half of the period observed. In this case as well, it is interesting to notice that about halfway into the period analysed this equilibrium is broken, eventually resulting in the prevalence, albeit not excessive, of different-minded interactions.

It is to be noted that the relevance of the value of the proportion between similar and different-minded interactions and the total number of messages, however, can be biased by the absolute size of the two groups (P-P plus N-N, versus P-N). In order to more accurately assess to what extent conversations over time tend to concentrate towards similar-minded interactions (thus potentially leading to group polarization), or the opposite, we compared the number of the observed interactions with the number of interactions to be expected in a random simulation in the same networks. The rationale of this operation is that, if message authors actually tend to prefer interactions with similar-minded or with different-minded participants, they should do so more often than if they would select a discussion partner randomly in the network.

Data shows that in all cases the number of each kind of observed edges (similar-minded or different-minded) is higher than in the random simulation, with the exception of case 4, in which the population of negative side is too small compared to the positive side to allow any significant inference from the random simulation comparison. Interestingly, the inner-side discussions (P-P and N-N) display the largest difference between actual and random interactions. In other words, participants are consistently more markedly willing to engage in discussion with similar-minded partners.

Lastly, we investigated the incidence of the positive or negative opinion expressed on the difference between actual and randomly simulated interactions. Interestingly, as illustrated in Figure 3, in all cases but case 2 (air carrier), the most significant difference between actual and random interactions in similar-minded groups is in the positive opinion side.

<Figure 3 about here>

Discussion

The data analysis provides three main findings:

a) Nuanced evidence of homophily: digital netizens tend to prefer interactions with similar-minded individuals, if not over time, at least overall;

b) The increase of homophily over time is mitigated in discussions in which the difference in size between the opinion sides is smaller;
c) The increase of homophily over time is higher in discussion groups with positive opinions.

Data from the case primarily suggests that while over time some discussion groups do feature some spurts of cross-opinion interactions, the overall process over time does not feature the key feature of public deliberation, that is interaction with participants of different opinions. With only one exception, all of the four discussion dynamics observed feature consistent evidence of homophily increasing over time, a finding in line with previous studies on sentiments and polarization in online social networks (Hillmann & Trier, 2012, 2013; Sobkowicz & Sobkowicz, 2012a, 2012b; Y. Yang et al., 2010).

The longitudinal nature of this study, however, enabled us to capture spikes and lows of online public deliberation over time, as observed in some of the cases. One of the factors affecting the likelihood of cross-opinion interaction over time is the difference in size between opinion sides: discussions where there is less difference in size between groups of two opinions are more likely to be deliberative. This finding provides arguments to the scholarly side that points out to diversity as a key factor conducive to public deliberation in online environments (Moy & Gastil, 2006; Wilhelm, 1998; W. Zhang et al., 2013).

Another factor emerging from the data analysis is the polarity of the opinions expressed: the observed decline of cross-opinion interactions is higher among groups that have a positive opinion. While the overall prevalence of a polarity of sentiments in online discussion groups has been previously researched (Thelwall et al., 2010), the relationship between polarity and deliberation opens for a new direction of research worth pursuing in the future. Further qualitative data is required to investigate the rationale of this observed phenomenon.

Lastly, even when findings are consistent over the four discussion groups, there are exceptions across cases, depending on the type of topic discussed. Some topics seem to lend themselves more to cross-opinion exposure than others. The discussion over the celebrity musician's drunk driving, for instance, shows a much higher level of homophily and polarization than the one on stray dogs. Previous research has argued that the degree of proximity to the ideals of public deliberation might also be influenced by the nature of the topic discussed: there is evidence to the fact that online discussions on politics-related topics tend to be less deliberative than non-political ones (Gonzalez-Bailon, Kaltenbrunner, & Banchs, 2010). Our findings are in contrast with this, as we observed relevant differences in levels of cross-opinion interaction across online discussions on topics that are not directly related to politics. While the definition of what constitutes a 'political' topic is obviously nuanced (Gonzalez-Bailon et al., 2010), it is interesting to observe that the largest differences in degrees of development of homophily and polarization over time in our study are observed between what could be argued to be the least 'political' of the four topics – that is the stray dogs and the celebrity behaviour – as opposed to the university initiative and the discussion on military spending for an air carrier, which could be argued to feature characteristics that are more political in a wider sense.

Overall, the nuanced evidence of homophily development over time presented in this study calls for further research in order to control for other possible determining factors, besides the groups' opinion diversity, opinion polarity, and nature of the topic, affecting the dynamics of online discussions over time. Further research into the cognitive and attitudinal characteristics of participants could provide further insights into, for instance, the influence of characteristics of specific participants as nodes of the discussion networks, such as experience, reputation, and social capital, on the dynamics of cross-opinion interactions. While the size of our sample and the accuracy of the manual coding can be considered the strength of this study, we suggest to complement our quantitative approach with a qualitative one to capture these elements in future research.

The findings provided in this study also aim to represent a building block in understanding the dynamics of online discussion networks in China. Our findings provide an empirical basis for existing arguments that speculate on the nature of the Chinese online public sphere. The observed trends towards homophily over time in online discussions in public Chinese forums align with contributions highlighting the fragmentation of the Chinese cyberspace (Leibold, 2011; Medaglia & Zhu, 2016). Whether this fragmentation can be considered a cause or an effect of the observed phenomena calls for further research.

From a theoretical point of view, the adoption of the public deliberation lens to analyse the Chinese context rests on our will to open up two distinct lines of enquiry. The first one is focused on establishing a shared framework that enables comparative studies on online discussions in different contexts, in a cumulative fashion. Modelling public deliberation with a set of agreed indicators will support the empirical testing of the many existing hints there are on the unique characteristics of the Chinese online public sphere, such as fragmentation (Leibold, 2011), the presence of constant negotiation between resistance and control (Rauchfleisch & Schäfer, 2015), and online carnivalism and playfulness (Herold & Marolt, 2011; Wu, 2014). Providing an informed analysis of online discussions in China against the framework of public deliberation enables making sense of such hypothesised unique features, and to move beyond impressionistic accounts.

The second line of enquiry we put forward concerns testing and refining the theoretical tenets of public deliberation itself, informed by the phenomena emerging from data of the Chinese case in an inductive fashion. Public deliberation as a framework has been praised and adopted as much as it has been debated and criticised for what many see as its unrealistic or fuzzy normative components (Mutz, 2008). Moreover, public deliberation is historically a creation of Western thought and empirical research (Min, 2009, 2014), and critics have pointed out the limitations of applying it as a theoretical framework in the Chinese context (G. Yang & Calhoun, 2007). We put forward that experimenting with applying operationalizations of the tenets of public deliberation to a new context can provide an opportunity to both question some of the aspects of this framework, and to enrich it with new perspectives. Findings from this study could provide, for instance, an input to selectively identify which of the constructs of public deliberation apply to a Chinese context, which ones cannot be expected to occur, and what new ones might emerge from empirical data. While some scholars propose to move away from the conception of public deliberation in tackling the case of the Chinese online public sphere – for instance by stressing that collective identity building, and not rationality, dominates

Chinese online interactions (G. Yang, 2003, 2015) – we call to incorporate such new aspects into a revised view on public deliberation. Future studies could find, for example, that rationality or disagreement prove to be less of a cornerstone of deliberative interaction compared to – say – interactivity and empathy, or new constructs such as identity building (G. Yang, 2003, 2015), or playfulness (Herold & Marolt, 2011).

Conclusion

This study has investigated the occurrence of public deliberation in four online discussion networks in China, by analysing patterns of similar-minded and different-minded interactions among discussion participants over time.

The overall contribution of this study is threefold. On the empirical level, our findings provide evidence based on a large, manually processed longitudinal dataset of the increase of homophily in online discussions over time, and on the role of differences in size between opinion groups, of polarity of sentiment, and of topic type, in the increase; moreover, this study contributes to the needed building of a body of research on public deliberation in the unique booming context of China, which can in turn help us rethink the Western-originated theoretical lenses that currently drive our understanding of online public deliberation. On the methodological level, this study provides a theoretically-grounded argument for modelling public deliberation by singling out a key component: disagreement as cross-opinion interaction. This key indicator can be used in future research as a starting point to systematize and build a hierarchy of operationalizations of public deliberation, in order to allow easier comparability of findings from different studies, in a cumulative fashion. On the policy level, our empirical findings provide insights into factors that make deliberative interactions more or less likely to occur, an issue which has fundamental importance when online deliberation is to be embedded in public opinion consultations and public policy making, or occurs in contexts with unique characteristics.

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Figure 1. Number of messages posted over time (days) in the four cases.

Figure 2. Proportion of similar and different opinion interactions over time (days) in the four cases.

Figure 3. Actual number and randomly simulated number of intra-group interactions in the four cases over time (days).

Table 1. Constructs and operational definitions of the public deliberation process

Construct	*Operational definition*	*Example of empirical study*
Civility	Participants interact with each other politely and with mutual respect (Papacharissi, 2004)	(Black, Welser, Cosley, & DeGroot, 2011) (Halpern & Gibbs, 2013) (Papacharissi, 2004) (Rowe, 2015) (Steenbergen et al., 2003) (W. Zhang et al., 2013) (X. Zhou, Chan, & Peng, 2008)
Common good reference	Participants consider the well-being of the community at large (Graham & Witschge, 2003)	(Steenbergen et al., 2003)
Disagreement	Participants interact with other participants that hold different opinions (Thompson, 2008)	(Stromer-Galley, 2007) (Wojcieszak & Price, 2012) (W. Zhang, 2015)
Diversity	There are participants in the dialogue with distinct views on a particular issue (Stromer-Galley, 2007)	(Wilhelm, 1998) (W. Zhang et al., 2013)
Empathy	Participants consider the well-being of other participants (Mutz, 2006)	(Steenbergen et al., 2003)
Equality/discursive inclusion	The rate of participation in discussion is equally distributed among participants (Dahlberg, 2001c; Habermas, 1984)	(Albrecht, 2006) (Schneider, 1996) (Halpern & Gibbs, 2013)
Interactivity/Reciprocity	Participants read (or listen to) all other participant's validity claims and arguments (Fishkin, 1997; Graham & Witschge, 2003)	(Graham & Witschge, 2003) (Halpern & Gibbs, 2013) (Moy & Gastil, 2006) (Wilhelm, 1998)
Rationality	Participants support their statements with reasoned validity claims (Habermas, 1984, 1991)	(Albrecht, 2006) (Graham & Witschge, 2003) (Halpern & Gibbs, 2013) (Moy & Gastil, 2006) (Price et al., 2002) (Steenbergen et al., 2003) (Stromer-Galley, 2007) (Wilhelm, 1998) (W. Zhang et al., 2013)
Reflexivity	Participants reflect on another's claim or reason against one's own claim (Arendt, 1961; Dahlberg, 2001b)	(Fishkin, 1992) (Moy & Gastil, 2006)
Sincerity	Participants strive to make all information – including their motives, interests, intentions, desires, and needs – known to other participants (Graham & Witschge, 2003)	(W. Zhang, 2005)

Table 2. ‘Blooming periods’ of discussion in the four cases.

Case	*Period*	*Message Count*	*Proportion of messages posted in the period/ in the whole year*	*Positive messages*	*Negative messages*
1 (Tsinghua University)	Day 1-9	4226	97%	522	1379
2 (Air carrier)	Day 130-157	4888	77%	414	1137
3 (Stray dogs)	Day 1-33	16439	95%	2079	7204
4 (Musician Gao)	Day 1-13	4234	98%	2976	150

Table 3. Steps taken in identifying the sample of analysis.

Selection Step	*Selection criteria and process*	*Result*
Step 1: Selecting topics	Controversial topics with opposite opinions Non politically-sensitive topics No commercial interests involved	4 topics selected
Step 2:Downloading data	All threads whose title contains keywords related to the four topics.	32,352 messages
Step 3: Selecting 'blooming' periods	Selection of the 'blooming period' of each topic, during which most of the messages about the topic were posted.	29,787 messages
Step 4: Identifying opinions	Opinions of each message are identified and classified on a 5-point scale, subsequently merged into a 3-point scale. All unclassifiable or unclear messages are discarded.	18,513 messages
Step 5: Identifying direct discussion networks	A discussion network is built based on the reference to other author's name(s) in the individual messages. All messages not referring to other authors' messages are discarded.	10,990 messages

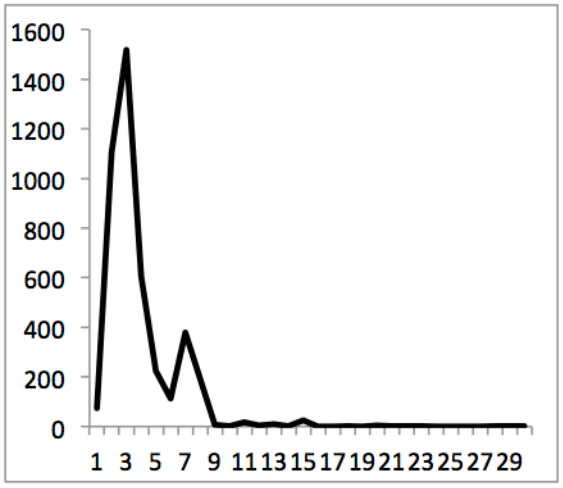
Table 4. The basic dataset (Step 2 of Table 3).

Case	*Messages*						*Authors*			
	Total	*Post*	*Reply*	*Positive*	*Negative*	*Neutral*	*Total*	*Positive*	*Negative*	*Neutral*
1 (Tsinghua University)	4354	65	4290	538	1413	204	2382	348	822	131
2 (Air carrier)	6382	30	6352	661	1531	368	2388	352	966	277
3 (Stray dogs)	23960	185	23775	3388	10736	432	7181	1074	3747	266
4 (Musician Gao)	9546	108	9438	3749	701	5140	6311	2686	500	1089

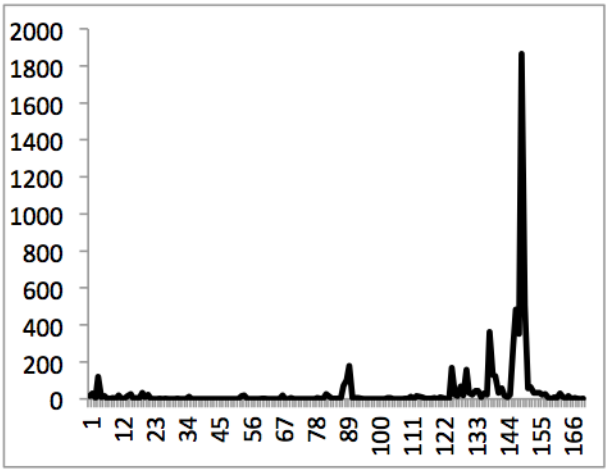
Table 5. Descriptive statistics of the direct discussion networks (P=positive opinion; N=negative opinion).

Case	*Direct-Discussion Messages*				*Involved Authors*		
	Total	*P-P*	*N-N*	*P-N*	*Total*	*Positive*	*Negative*
1 (Tsinghua University)	380	36	77	66	344	65	127
2 (Air carrier)	2036	30	810	188	743	86	379
3 (Stray dogs)	7506	815	2450	3541	2638	565	1673
4 (Musician Gao)	1068	758	2	47	1010	805	38

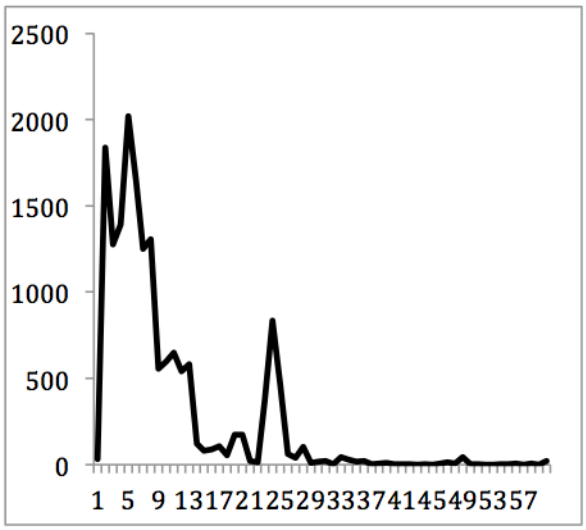
Figure 1. Number of messages posted over time (days) in the four cases.



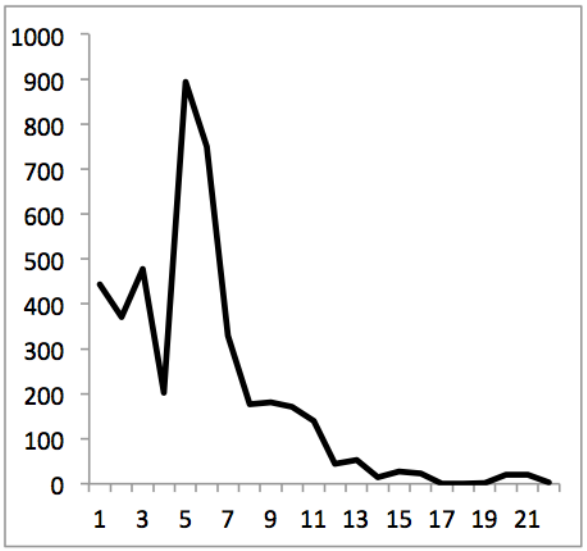
(1) Tsinghua University



(2) Air Carrier

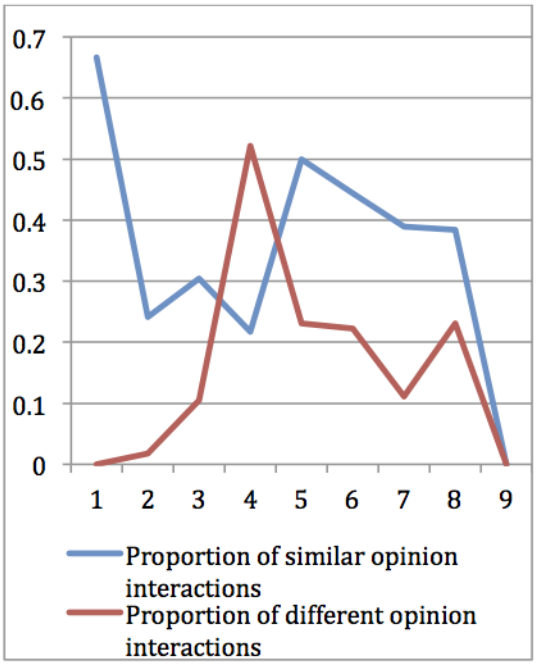


(3) Stray dogs

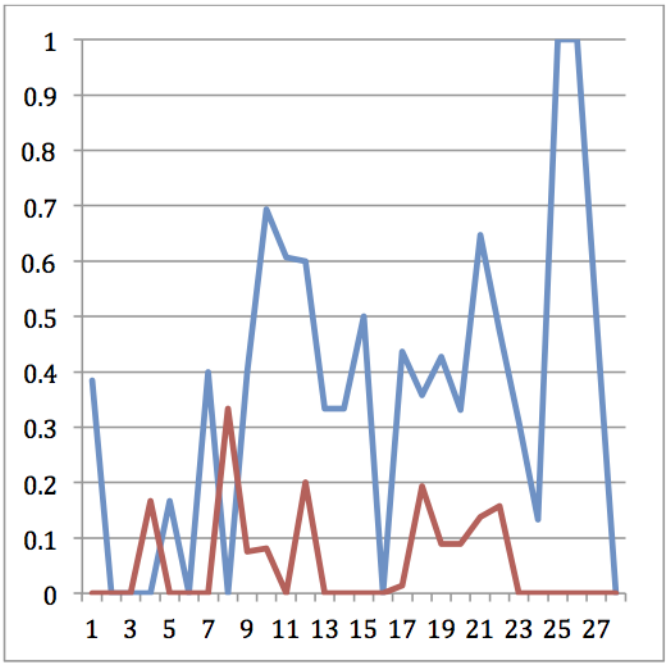


(4) Musician Gao

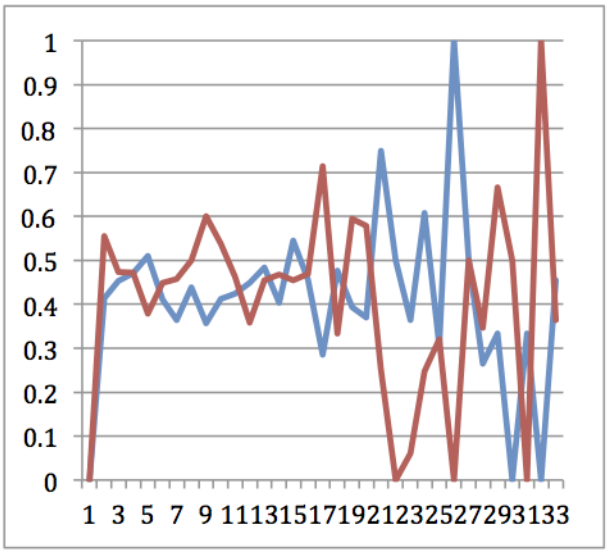
Figure 2. Proportion of similar and different opinion interactions over time (days) in the four cases.



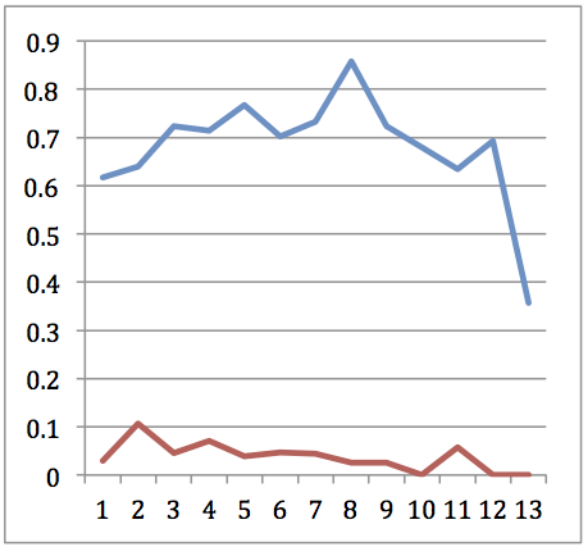
(1) Tsinghua University



(2) Air carrier



(3) Stray dogs



(4) Musician Gao

Figure 3. Actual number and randomly simulated number of intra-group interactions in the four cases over time (days).