The Structures of Twitter Crowds and Conversations

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1 Summary of Findings

Social media promises to provide access to a vast variety of human interactions, important and trivial. More than traditional electronic media or interpersonal contact, social media allows people to find and interact based on common interests rather than physical proximity. Billions of people have embraced these tools, entering social media spaces to exchange trillions of messages. Social media interactions may not be as rich as face-to-face interactions, but they offer access to a wide range of people and topics. Success has led to new problems, as social media offers too many contacts, too many interactions, and poor tools for filtering and gaining an overview of the larger landscape of communication. Social media is created and consumed through tools that limit the observer's view to individual messages or short chains of messages and replies. The leaf and the branch of social media is visible, but not the tree or the forest. The result is an information and interaction deluge. The overwhelming amount of data and the limited ways to understand it can be seen as a negative consequence of social media. For many ordinary users social media is an incomprehensible torrent. Proposed solutions, such as automatic filters that select relevant information for us, are often seen as worse than the problem it is meant to solve. "Filter bubbles" can trap users in homogeneous

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collections of information, losing sight of the larger range of discussions and content. Social media is inherently a social network, meaning that people use it to create collections of connections that have an emergent form, structure and shape. Interfaces to social media, however, lack insights into the nature, topology, and size of the networks they present. Access to social media network information is of academic and practical interest. Social Network Analysis (SNA) offers a powerful method to conceptualize, analyze and visualize social media—leading to new applications and user interfaces that help users make their own decisions about content relevance and the credibility of other users. Social media can be much more useful for users, and the information in it can be more easily evaluated, if its underlying network structure is made more visible and comprehensible.

In this chapter we demonstrate that mapping the structure of social media is practical and provides parsimonious answers for basic questions like "what type of social interaction am I a part of", "what topics are discussed here", "who are the most active and/or central players in this conversation". Mapping social media networks can reveal the landscape of discussions, highlighting areas of community, fragmentation, division, and celebrity.

2 Twitter Social Media Networks

As Twitter users share information and talk about a wide range of topics they form social media networks. There are intimacies, shouting matches, soapbox barkers, commercial come-ons, cliques, mobs, congregations, and everything in-between. People reply-to and mention one another, forming links that aggregate into various shapes and structures. Popular topics attract crowds of people who form a range of network structures. Twitter data can be collected and analyzed to reveal and visualize the shape of these crowds, summarize their topics of discussion, and figure out which people are at the center of them. In effect, we can create an aerial photo of the social media crowd as it forms while listening carefully to the banter taking place on the ground. The resulting maps and reports can inform users, giving them a better chance to manage the flow of information, make their voices heard, and help them detect untrustworthy communicators or messages.

The Pew Research Center's Internet & American Life Project collaborated with the Social Media Research Foundation to gain insights into the way people use Twitter. The goal was to detect the simplest and most common ways in which Twitter social media conversations take shape. Using a social media network analysis tool called NodeXL[1] the report analyzed data collected from Twitter

[1] NodeXL is a free and open tool for network analysis that provides special support for collecting and visualizing social media network data. The download and support site for "NodeXL"—the network overview, discovery and exploration add-in for Excel is located at: http://nodexl.codeplex.com. The NodeXL Graph Gallery website hosts a collection of social media network visualizations, descriptions, and data sets for download: http://nodexlgraphgallery.org/. NodeXL is created by the Social Media Research Foundation which fosters the creation of *open tools*, *open data*, and *open scholarship* related to social media: http://www.smrfoundation.org/.

conversations and communities related to a range of topics and then generated network visualization maps and reports that highlighted key people, groups, and topics. The goal was to create a taxonomy of basic interactions, at the group level. The report was intend to reveal the basic building blocks of social interactions in social media, starting with the most prevalent social interaction patterns on Twitter. These patterns are important not only as visualizations. They can reveal who drives the conversation, what type of energies are spent on it, and who are the most central nodes (users). These reports allow us to draw some conclusions about the roles different Twitter users play, based on the positions they hold in the networks in which they are a part.

Social media network maps are created by drawing lines between Twitter users for each connection they formed as they follow, reply to, or mention one another. By reviewing many thousands of these social media network visualizations we found six distinctive social media network patterns, which illustrate the range of social typologies and roles that can occur.

We identified six different kinds of social media networks:

Polarized: Polarized discussions feature *two big and dense groups that have little connection between them*. The topics being discussed are often the most divisive and heated social and political subjects. In fact, there is usually little conversation between these groups despite being focused on a shared topic. Polarized groups are not arguing, they are ignoring one another while pointing to different web resources and using different hashtags.

In-group: In-group networks are *tight communities*. They are characterized by smaller groups of highly interconnected people with few disconnected, isolated participants. Many conferences, professional topics, hobby groups, and other subjects that attract communities have an in-group form.

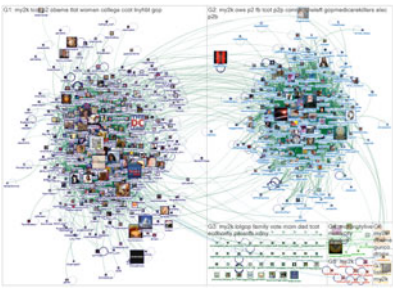
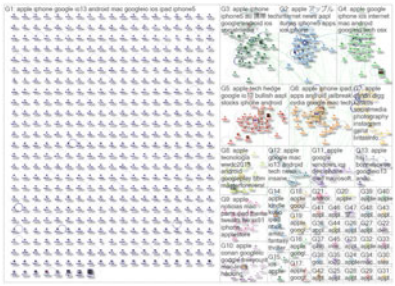
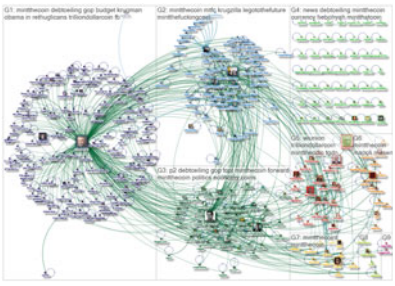
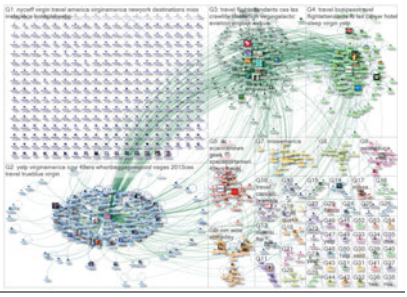
Brands: Products, services, and events often get discussed in Twitter, attracting wide comment from large populations of *disconnected participants*. The better known a brand or the bigger an event, the larger the population talking about it. As the Twitter population around a subject grows, the less likely are the people talking about it to be connected to one another. Therefore, brands networks in social media often have a low density of connections with many "isolated" people who have no connections at all to others talking about the same brand.

Clustered: Some popular topics may attract many smaller groups, which often form around a *few hubs each with its own audience, influencers, and sources of information*. Global news stories often attract coverage from many outlets each with its own following, creating a collection of medium-sized groups.

Broadcast: Conversations around major news stories and the output of media outlets have a distinctive hub and spoke pattern in which *many people repeat what the news organization tweets*, forming a disparate "audience" group. The audience is often connected only to the hub news source, without connecting to one another. In some cases there are smaller subgroups of densely connected people—think of them as subject groupies—who regularly discuss the news with one another.

Support: Customer complaints for a major business are often handled by a Twitter service account that attempts to resolve and manage customer issues around their

Table 1 Six forms of social media network found in Twitter, each form has distinct structural properties that are associated with different kinds of discussions and social processes

	
Polarized: two dense groups with little interconnection	*In-group*: few disconnected isolates, many connections
	
Brand/Public Topic: many disconnected isolates, some small groups	*Clustered*: many medium sized groups, some isolates
	
Broadcast: a hub which is retweeted by many disconnected users	*Support*: a hub which replies to many disconnected users

products and services. This produces a hub and spoke pattern that is different from the Broadcast pattern. In the Support network pattern, the hub account replies-to many otherwise disconnected users. In contrast, in the Broadcast pattern, the hub gets replied to (re-tweeted) by many disconnected people.

Below is an expanded and annotated version of the polarized crowd map from Table 1, which highlights key features illustrated by this "aerial view" of social media crowds (Fig. 1).

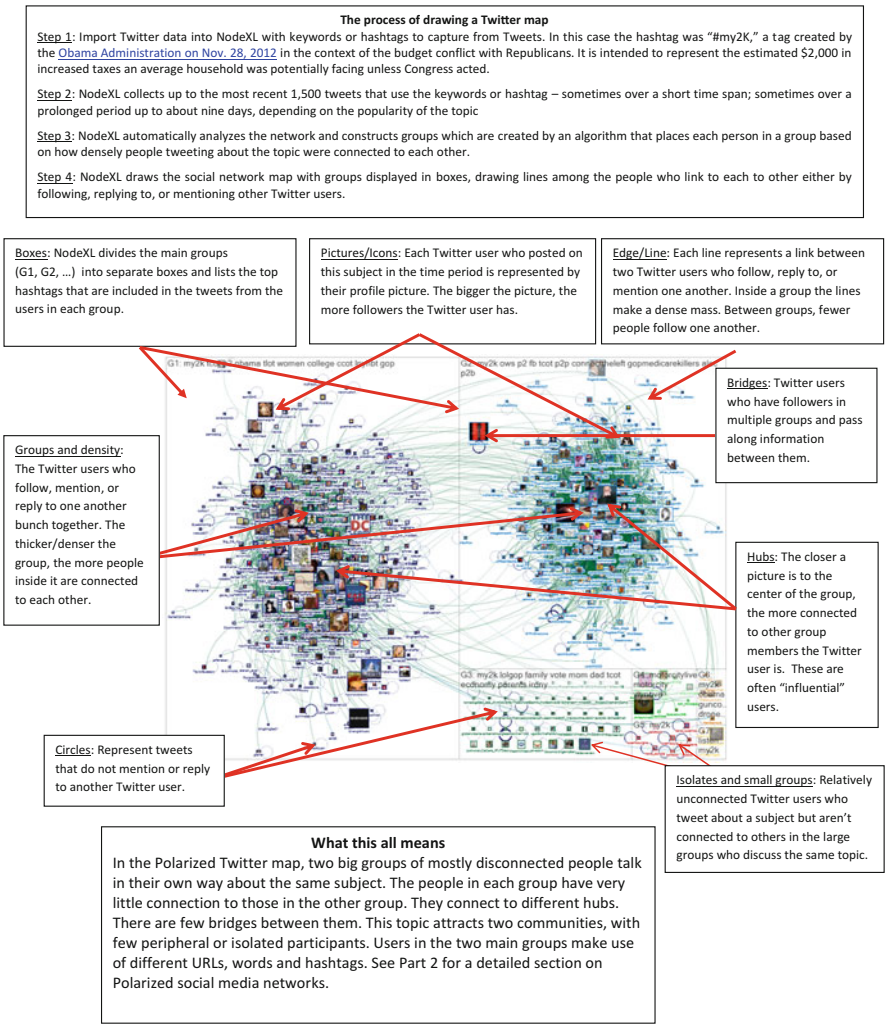


Fig. 1 The process of drawing a Twitter map

3 Influencers: Hubs and Bridges in Networks

These maps also highlight key participants in Twitter conversations in several ways. First, in the visualizations, each user who sends tweets is represented by her/his profile photo. The larger images indicate people who have larger numbers of other users following them. Those are the people who start with the largest audience for what they have to say.

Second, some users in these conversations link to and receive links from more Twitter users than others. Our network maps call out these key people at the center

of their conversational networks—they are "hubs" and they are notable because they have the most engaged followers.

Third, the maps point out the people who have links to several groups—they are called "bridges." They are important because they pass along information from one group to another and often play a role in causing a message to "go viral."

The maps show that each kind of crowd has its own pattern of influence with key users occupying strategic locations, like hubs and bridges, in the network.

Our research also assess the content created by the people within each subgroup. Content is analyzed by examining the words, URLs, and hashtags that are most common in each subgroup. Different types of social media network crowds have distinct content structures with varying levels of overlap and diversity.

In the following we document in detail what happens in each kind of social media network crowd, highlighting the information that gained the greatest attention in the population, and the kinds of people and institutions that shape the conversion.

4 A Taxonomy of Network Types: Purpose, Division, Density

Our initial six forms of social media networks can be more precisely defined in quantitative terms as relationships between different network measures.

Structure	Group count and group size	Level of group interconnectivity	Density	Examples
Polarized	2 Large	Disconnected	Few	Political controversy: Divisive topics display separated "echo chamber" pattern
In-Group	2–6 Medium	Connected	Few	Hobbies, professional topics, conferences. No "outsiders," all participants are "members"
Brand/ Public Topic	Many small	Few connections	Many	Brands, public events, popular subjects
Clustered	Many small	No connections	Many	Global media topics
Broadcast	1 large, some secondary	Inbound connections	Moderate	News and media outlets, famous individuals
Support	1 large, some secondary	Outbound connections	Moderate	Companies and services with customer support

The first two networks are opposites of one another in terms of division; the polarized network type is divided while the in-group network is unified. The next pair of networks, the brand and the clustered community, shares a large population of isolates, but they vary in terms of their density of connections; the brand network

pattern has small disconnected groups with many isolated participants, while the clustered community network pattern has larger, more connected groups. The last two networks are inversions of one another; the broadcast model features many spokes pointing inward to a hub while the support pattern features a hub linking outward to many spokes. Each of these network types is described in detail below.

5 Part 1: Research Method and Strategy

To understand the nature of Twitter conversations, the Pew Internet Project solicited help from researchers at the Social Media Research Foundation, a group of scholars whose mission is to support the creation and application of open tools, open data, and open scholarship related to social media. The foundation maintains a software project called NodeXL, a plug-in extension to Microsoft Excel spreadsheets that enables **n**etwork **o**verview, **d**iscovery, and **e**xploration. NodeXL allows users to import network data and perform analysis and visualization of networks. NodeXL permits anyone to connect to social media services (including Twitter, Facebook, YouTube, flickr, Wikis, email, blogs and websites) and retrieve public data about the connections among users, pages, and documents. In the specific case of Twitter, the tool captures information about the content of each message (the "tweet"), which may contain usernames, hyperlinks and hashtags, along with information about each author's connections to other Twitter users. In Twitter, these connections include relationships among users who follow one another, who mention one another, and reply to one another.

Our Twitter datasets start with keyword searches that return a set of tweets from the Twitter Search service. Maps are then constructed by examining the content of each tweet that is returned in the Twitter Search results for the query. In addition, NodeXL captures information about the Twitter user's connections to other Twitter members. Data are also retrieved from each user's public Twitter profile, which includes the number of tweets the user has posted, the number of other users that the user follows, and the number of persons who follow that user, among other things. Author statistics are combined with information about the connections among the people who shared the use of the same word, phrase, or term. For example, if Alice and Betty both post a message that includes the term "Obama" and Alice follows Betty on Twitter, our data captures this relationship.

Only publicly available messages are analyzed in our studies. No direct messages or other private content are collected or analyzed. Any message defined by its author as private (from, for example, "protected accounts") is excluded from analysis.

There are clear limits to any dataset captured by NodeXL. The tweets we collect are snapshots of finite periods of conversation around a topic or phrase. The data here do not represent the sentiments of the full population of Twitter users or the larger period of discussion beyond the data collection window. Further, Twitter users are not representative of the full range of the population of the United States or even the population of the Internet or even of social media users generally. Thus, we are not

arguing that this analysis represents all that happens on Twitter or that it is a proxy for national sentiment on these topics. However, we believe these data sets contain useful snapshots of the structure of social media networks around topics that matter.

6 Taking "Aerial Photographs" of Twitter Crowds

Our method is similar to taking aerial photographs or short videos of crowds in public spaces, particularly pictures of rallies, protests, political events, and culturally interesting phenomena. No one snapshot or video clip of a crowd completely captures the event, but our method has the benefit of producing crowd photos from social media spaces, a domain that has not been widely pictured before. Like aerial crowd photographs, social media network maps show the size and shape of the crowd along with the key actors in that crowd.

These network maps can reveal information at the level of both individuals and groups. Social media networks often have just a few people who stand out in terms of the unique ways they connect to others. Some networks are composed of just a single group, while others are divided into sub-groups. Groups can be more or less connected to other groups. These shapes tell a story about the kinds of interactions that take place in Twitter.

7 Group Density

Each group can be measured in terms of the density of its connections. A group of people with many connections among its members is more "dense" than a group that has few connections. Our maps allow groups to be compared both in terms of content members of the group share and in terms of how strong the linkage is among members of that group. Density is measured as the ratio of the number of existing relationships among nodes over the total number of possible relationships. The density can vary between zero (i.e., no connections among nodes) and 1 (i.e., all nodes in a network are connected to all other nodes). As groups grow in size it is harder to interact with all other participants, so as a rule, the larger the numbers of people in a social network the lower the density of their connections. As a result, no one value is a specific threshold for high or low density but networks are considered loosely-knit, low density networks when few of the participants are connected to one another.

Twitter social media network maps show how interconnected people are when they engage in conversations. People often "clump" into groups. Some groups have high levels of internal connection and limited connectivity to people outside their group. The amount of internal and external connection is an important indicator of how exposed people are to differing points of view from people in different groups. If there are few ties between groups, people may not be exposed to content from users in other groups.

8 More on Hubs and Bridge

Social network maps created from collections of Twitter relationships often highlight a few individual users who occupy key positions in the network. We refer to the few highly connected users as "hubs." Many other users follow these hubs; far more than follow the majority of people in the network. Hubs are important because they have large audiences. Some people have fewer connections but are equally important because they have the rare trait of having connections that link across the network to other groups, acting as "bridges." While big hubs can also occupy the important position of "bridge," a user with just a few relatively unique connections may also be an important bridge.

9 Part 2: Extracting the Six Conversation and Group Network Structures in Twitter

After examining hundreds of maps of thousands of subjects and events we have found six distinct network structures in Twitter social networks. Each is profiled below. There is no doubt there are other styles and structures of social media networks remaining to discover, as the taxonomy above in fact suggests. The landscape of social media remains a partially undiscovered and poorly mapped terrain. The six network types we describe are intended as initial examples of distinct forms not as an exhaustive list of all possible forms. It is also important to note that these maps only cover Twitter. Different kinds of social media services may generate different patterns of networks. Yet, we have reasons to believe, again, based on the taxonomy listed above, that the six forms are representative for the sets of motivations and constraints that are most commonly encountered on social media.

Social media researchers, managers and participants who wish to extend the typology may want to ask a series of questions related to the social media network maps of their own topics and related discussions. What kind of social media network is formed by the people talking about the topics that matter most to you? How does your topic's network compare to competing topics? Who are the key people and groups in these networks? How do these networks change over time, particularly as events and engagements occur?

10 Group Type 1: Polarized

Polarized social media networks feature at least two large dense groups that have little inter-connection or bridge between them. These networks are often focused on divisive topics and are especially likely to involve political content.

The "#My2K" hashtag is a good example of this type of network structure. The data set for this visualization is available here: https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2272.

"#My2K" is a hashtag proposed by the White House on November 28, 2012 in the context of the ongoing budget conflict with congressional Republicans. The hashtag is intended to represent the "2 K" or the estimated $2,000 in increased tax costs that the average U.S. household was facing unless Congress acted to head off an automatic tax increase. The President proposed this hashtag to rally Twitter supporters to press Congress to preserve the tax break.

To understand what kind of crowd gathered around the "My2K" banner, we collected and analyzed a network graph that represents a network of 688 Twitter users who tweeted a message starting January 6th and ending on January 8th, 2013 that mentioned "My2K." There is a green edge, or connecting line, for each instance when someone in our sample who tweeted about "My2K" was also a follower of another person who used the term. Separately, there is also a blue edge if someone in our sample "replies-to" or "mentions" another Twitter user who has written about "my2K." There is a self-loop edge for each tweet about "my2K" that is not a "replies-to" or "mentions." We call these Twitter users "isolates" in these conversations because they are not connected to others in the conversation.

The social media network map for #My2K looks like:

The #My2K hashtag network map features two dense groups of Twitter users with very few connections between them, meaning few people in one group replied to, mentioned, or followed people in the other group (Fig. 2).

Analysis of the content of the tweets created by the people in these groups showed that the words, hashtags, and URLs mentioned by people in each group are very different despite the common topic of their tweets. In the network map each group is labeled with the ten most frequently mentioned hashtags used by the users in that group. The group on the left is a large dense group of 360 people who often added the hashtag "#tcot" (which stands for "Top Conservatives on Twitter") and is often used by conservative Twitter users to self-identify with conservative politics. The group on the opposite side of the graph is composed of 254 people who often added hashtags like "#ows" (Occupy Wall Street) and "#p2" (Progressives 2.0) to their tweets.

The map illustrates that conservatives discussed the subject of "My2K" with one another and liberals discussed it among themselves, but few spoke to someone from the other group—or heard from someone in the other group.

Outside of these major groups are smaller groups with just 74 people who have few connections to other users. Some 48 of them had no connections at all—we call them "isolates" because they are not connected to anyone else in this particular Twitter conversation. These disconnected people mentioned the "#My2K" hashtag but were not observed to follow, reply or mention anyone else who did so in this dataset. These may be people who are just starting to mention this topic and related political issues, since they lack connections to people who discuss this already.

In the middle of each of the two large groups are "hubs," people with many connections. However, in a polarized network, these connections rarely span the

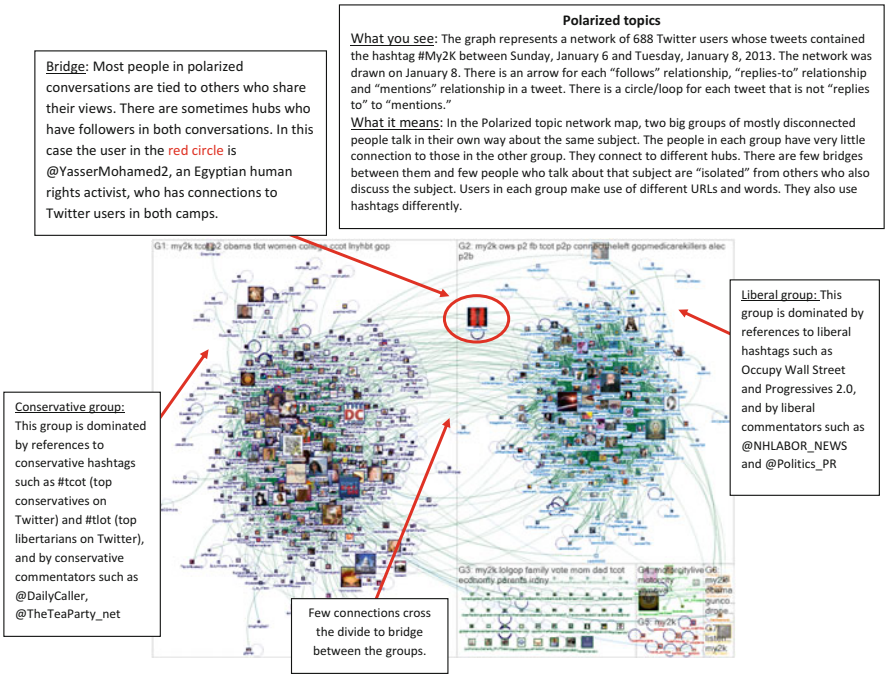


Fig. 2 The network of connections among people who tweeted "#My2K" over the 1-day, 21-h, 39-min period from Sunday, 06 January 2013 at 03:30 UTC to Tuesday, 08 January 2013 at 01:09 UTC

divide to connect to people in the other group. Each group has a small number of highly central core participants. In the conservative-leaning Group 1, the most central people are: @DailyCaller, @TheTeaParty_net, @JC7109, @PeterMAbraham, @saramarietweets—all self-identified conservatives with considerable followings. In the liberal-leaning Group 2, the most central people are: @Politics_PR, @NHLABOR_NEWS, @PaulStewartII, @BODIESOFLIGHT, @CAFalk. The user @YasserMohamed2 stands out as a highly followed user (red icon) who bridges the right wing group and the left wing group.

When the most frequently used hashtags in each group are contrasted, we can get a better sense of the topical focus and orientation each group displays.

Similarly, the most frequently used URLs in the tweets in each group indicate the kinds of web resources each group is interested in sharing. The comparison of the URLs used in Group 1 and Group 2 illustrate the contrast between their political orientations, as seen in Table 2. Group 1 links to partisan news sites devoted to a conservative perspective. Group 2 links to mainstream and liberal news sites and services.

The relative absence of connections between these groups shows that people who tweet about #My2K rarely follow, reply to, or mention anyone who is located in the other group. Indeed, the chart below shows how dense each group is and how

Table 2 Top Hashtags by frequency of mention in Group 1 and Group 2 in the #MY2K Twitter Network

Top Hashtags in the conservative-oriented	Top Hashtags in the liberal-oriented
Group 1[a]	Group 2
#tcot—top conservatives on Twitter	#ows—Occupy Wall Street
#p2—progressives 2.0	#p2—Progressives 2.0
#obama	#fb—hashtag for posting tweets to Facebook
#tlot—top libertarians on Twitter	#tcot (Top Conservatives on Twitter)
#women	#p2p (peer-to-peer)

[a]Hashtags were identified using the website http://tagdef.com/

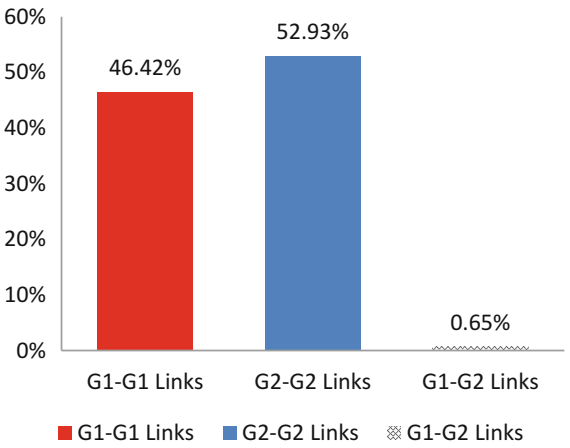


Fig. 3 Analysis of links between users in each of the two largest network groups within the hashtag #MY2K showing that very few of the connections among those who used the hashtag crossed group boundaries

few people in each group link to people in the other group (Fig. 3). Some 46 % of all the personal connections in the map are among those in the tight conservative group (G1) and 53 % of the connections are in the tight liberal group (G2). Less than 1 % of the connections are between people in the different groups (Table 3).

There were 13,341 different relationships among those who used the hashtag #My2K from January 6–8, 2013. Figure 3 shows that only .65 % of connections crossed between the two groups.

Most topic networks on Twitter do not look like polarized topics, but many political discussions are structured this way. For instance, similar polarized conversation pattern can be seen in the network of people discussing "Sequester OR Sequestration": https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=3441.

Automatic across the board budget cuts, called "sequestration" have been imposed by the US Congress. The topic of "sequestration" is a divisive political issue that generates a clearly polarized pattern in Twitter. The topic attracts a large number of people who appear in Group 1 who share the quality of having no visible connections to others. These "isolates" are an indication of the public quality of the topic—that is, many people have heard of the term even if they do not already

Table 3 Contrasting URLs frequently used in two groups discussing "#My2K"

Top Hashtags in Tweet in Group 1	Top Hashtags in Tweet in Group 2
http://dailycaller.com/2013/01/06/white-house-online-My2K-campaign-fails-as-us-workers-payroll-taxes-increase/	http://ireport.cnn.com/docs/DOC-500857
http://www.breitbart.com/Big-Peace/2013/01/01/Hezbollah-Joining-Cartels-in-Mexico-s-War	http://www.cnn.com/
http://tpnn.com/obama-we-dont-have-a-spending-problem/	http://www.youtube.com/watch?v=SOBsoUZFae8&feature=related
http://www.washingtontimes.com/news/2013/jan/6/obama-supporters-shocked-angry-new-tax-increases/	http://www.huffingtonpost.com/2011/09/15/americas-poorest-states-_n_964058.html
http://mobile.wnd.com/2012/12/the-nazi-roots-of-u-s-gun-control-laws/	http://www.flamethrowermagazine.com/david-koch-secret-right-wing-attack-machine/

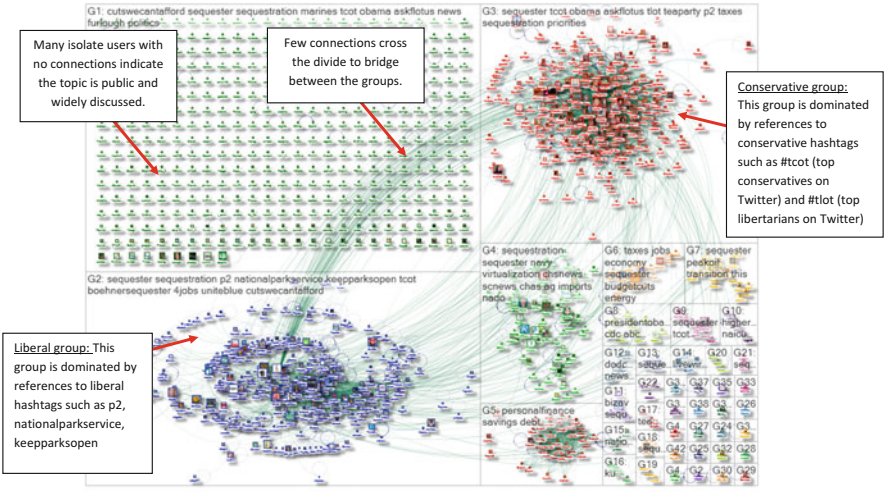


Fig. 4 The graph represents a network of 1,253 Twitter users whose recent tweets contained "sequester OR sequestration" made over the 1-h, 22-min period from Monday, 11 March 2013 at 18:15 UTC to Monday, 11 March 2013 at 19:38 UTC

follow or reply to others who also tweet about the topic. This is a common pattern for brands and well known issues and events (Fig. 4).

What makes this pattern a polarized one is the relationship between groups 2 and 3, two large dense communities of people who have many connections within their group and few to other groups. As seen in Fig. 5, the two groups are linked to one another with only 3 % of links. Contrasted with networks described below, particularly the "in-group" network pattern, this level of inter-group connection is very low. The low level of connection is an indicator that these groups are socially isolated from one another, despite tweeting about the same topic (Fig. 5).

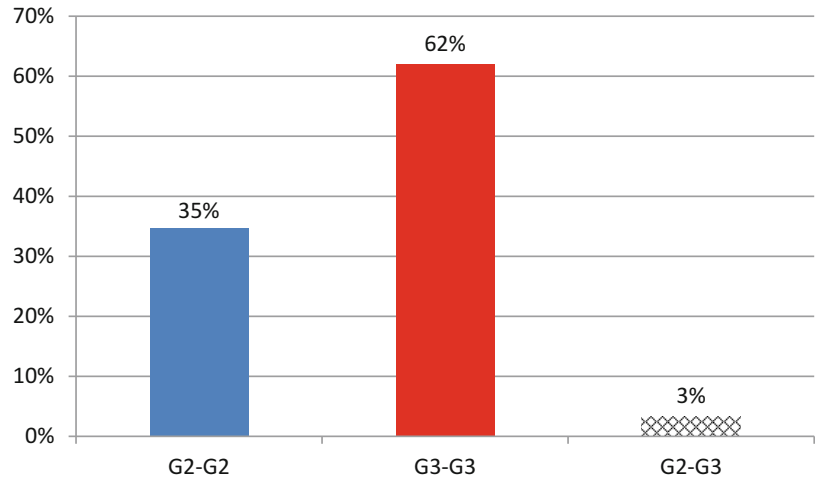


Fig. 5 Analysis of links between users in each of the two largest network groups within the hashtag #sequester showing that only a few of the connections (3 %) among those who used the hashtag crossed group boundaries

Table 4 Contrasting URLs frequently used in two groups discussing "sequester" or "sequestration"

Top URLs in Tweet in Group 2	Top URLs in Tweet in Group 3
http://www.washingtonpost.com/blogs/plum-line/wp/2013/03/11/gop-triumphalism-about-the-sequester-is-premature/	http://www.bernardgoldberg.com/sun-still-rises-after-sequester-so-prez-comes-up-with-plan-b-to-insure-hardship/
http://www.dailykos.com/story/2013/03/11/1193173/-Republicans-are-all-for-sequestration-until-their-something-gets-sequestered-in-their-back-yard	http://thehill.com/blogs/floor-action/house/287371-gop-suggests-dhs-using-sequester-as-excuse-to-weaken-immigration-laws#ixzz2NG7SD4lM
http://www.nps.gov/applications/digest/headline.cfm?type=Announcements&id=13550	http://www.realclearpolitics.com/articles/2013/03/11/obama_flails_as_republicans_stand_firm_on_sequester_117365.html
http://tv.msnbc.com/2013/03/11/obama-jokes-about-sequester-my-joke-writers-have-been-placed-on-furlough/	http://www.youtube.com/watch?v=3gXOV_XWJck&feature=youtu.be
http://www.whitehouse.gov/sites/default/files/omb/assets/legislative_reports/fy13ombjcsequestrationreport.pdf	http://foxnewsinsider.com/2013/03/11/u-s-park-ranger-claims-obama-administration-making-spending-cuts-so-public-feels-pain-from-sequestration/

Another indicator of the divisions between these groups can be seen in a comparison of the URLs user frequently post in tweets in each group as displayed in Table 4. The URLs in Group 2 are critical of conservative positions or reference official documents that describe the impact of budget cuts. In contrast, the URLs mentioned in Group 3 are critical of concerns that the budget cuts will have major

Table 5 Top Hashtags by frequency of mention in Group 2 and Group 3 in the sequestration Twitter Network

Top Hashtags in Tweet in Group 2	Top Hashtags in Tweet in Group 3
Sequester	sequester
Sequestration	tcot
p2	obama
Nationalparkservice	Askflotus
Keepparksopen	Tlot

consequences. They also tie to concerns about immigration politics. And they also cite criticism of the Administration.

The differences between these groups are also reflected in the different hashtags used in the tweets from users in each group.

While both groups used hashtags for "sequester" and "sequestration," they otherwise use different labels in their tweets. Settings these terms aside, in Group 2, the "p2" (Progressives 2.0) hashtag is the most frequently used label while in Group 3 "tcot" (top conservatives on Twitter) is most frequently used. Other Group 2 hashtags ("nationalparkservice" and "keepparksopen") suggest a focus on the negative effects of budget cuts on national parks. In contrast, Group 3 is focused on "Obama," "askflotus" (for questions directed at the First Lady of the United States), and tlot (top libertarians on Twitter) (Table 5).

Many politically controversial topics have this polarized pattern, topics that attract divided populations who converge on the same topic, term or hashtag. For example, discussions about contraception often have a large dense but separate group that is opposed to legal access to birth control. But not all, or even most, topics have this form. There are many topics that have a network that has a pattern that is the opposite of the polarized pattern, the "in-group."

11 Group Type 2: In-Group

Unlike polarized conversations, people in "in-group" conversations have strong connections to one another and significant connections that bridge between sub-groups. These dense networks are often communities of people who are aware of one another and converse often. These networks have many people who follow one another and reply to and mention one another. People who share a common interest and a common orientation to that interest often populate in-groups. These networks are composed of a single group where conversations sometime swirl around, involving different people at different times. In the in-group topic there is no polarized "other" group (Fig. 6).

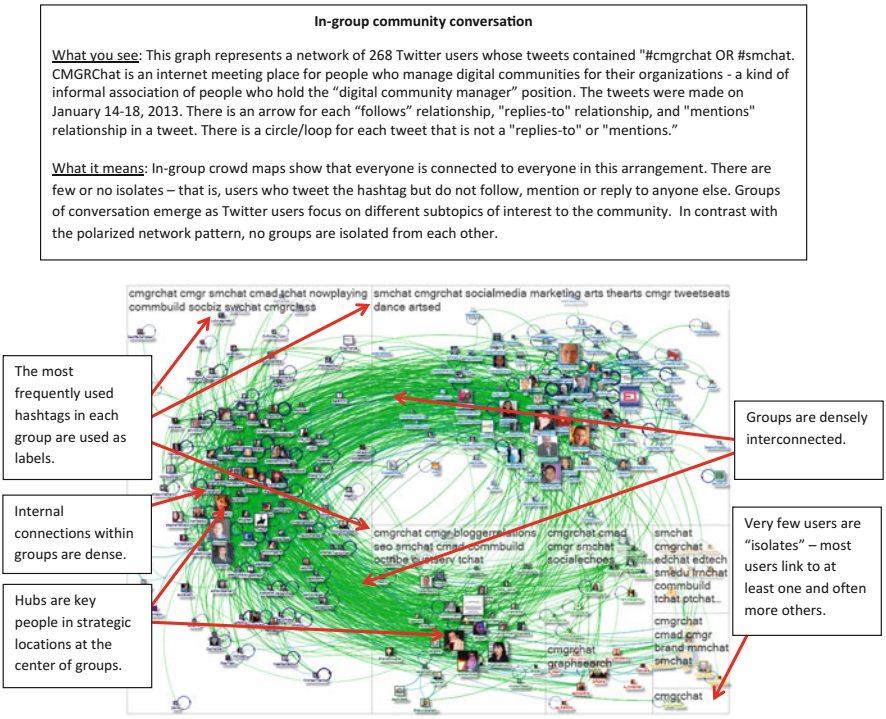


Fig. 6 The graph represents a network of 268 Twitter users whose recent tweets contained "#cmgrchat OR #smchat" made over the 3-day, 21-h, 15-min period from Monday, 14 January 2013 at 18:23 UTC to Friday, 18 January 2013 at 15:38 UTC

In-Group Community Conversation

What you see: This graph represents a network of 268 Twitter users whose tweets contained "#cmgrchat OR #smchat." CMGRChat is an internet meeting place for people who manage digital communities for their organizations—a kind of informal association of people who hold the "digital community manager" position. The tweets were made on January 14–18, 2013. There is an arrow for each "follows" relationship, "replies-to" relationship, and "mentions" relationship in a tweet. There is a circle/loop for each tweet that is not a "replies-to" or "mentions."

What it means: In-group crowd maps show that everyone is connected to everyone in this arrangement. There are few or no isolates—that is, users who tweet the hashtag but do not follow, mention or reply to anyone else. Groups of conversation emerge as Twitter users focus on different subtopics of interest to the community. In contrast with the polarized network pattern, no groups are isolated from each other.

In-group conversations take place in networks that have few if any isolates—people who have no connections to anyone else in the network. In these network maps, isolates are people who use a hashtag or mention a topic, but have not been observed to follow, reply to, or mention *anyone* else who talked about the topic.

The #CMGRChat hashtag is a good example of an in-group topic: https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2434. CMGRChat is a social media outlet for people who manage digital communities for their organizations—a kind of informal association of people who hold the "digital community manager" position. Social media professionals who discuss and share resources about the best practices in running message boards, Facebook pages, and Twitter streams populate this network. While some of these contributors have more connections than others, no participant in this discussion has zero connections and most have several.

It is often the case that "everyone knows everyone" in these dense communities of connected participants. The map of tweets using the hashtag #CMGRChat between January 14–18, 2013 shows a conversation divided into sub-groups, but one with many connections that bridge the divisions, suggesting these groups are more closely tied sub-communities rather than divided, insulated and separate communities.

While the frequently mentioned URLs in each of the largest groups in the #CMGRChat networks are different, there is little evidence of a polarized focus. Many of the URLs point to resources related to a diverse range of social media related topics, but the topics are not in conflict with one another (Table 6).

A similar pattern is found in the various hashtags that are more frequently used in each group in the #CMGRChat network. All of the groups mention the common terms #cmgr, #cmgrchat, and #smchat. Group 1 has a focus on the related chat hashtags, Group 2 has a focus on marketing, and Group 3 is focused on bloggers and search engine optimization (SEO) (Table 7).

Examination of the patterns of linkage between groups shows that there is significant cross connection, indicating the presence of a single community, rather than divided polarized groups (Fig. 7).

The #MLA13 hashtag, used in conjunction with the Modern Language Association conference, is another example of an in-group social media network is. The Modern Language Association annual conference attracts many scholars who study culture and language. Like "CMGRChat," the "#MLA13" topic network in Twitter is an in-group with few isolates and just a few small groups with significant interconnections (Fig. 8).

This graph represents a network of 599 Twitter users whose recent tweets contained "mla13": http://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2274. The network was obtained on Tuesday, 08 January 2013 at 14:54 UTC. There is a green edge for each follows relationship, and a blue edge for each "replies-to" and "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions." The tweets were made over the 1-day, 19-h, 31-min period from Sunday, 06 January 2013 at 19:05 UTC to Tuesday, 08 January 2013 at 14:36 UTC.

The people who tweeted the hashtag for this conference are highly likely to follow and reply to multiple other people who also mention the name of the conference. A relatively small group of people mentioned the event and had no

Table 6 Contrasting URLs frequently used in three groups discussing #CMGRChat

Top URLs in Tweet in Group 1	Top URLs in Tweet in Group 2	Top URLs in Tweet in Group 3
https://plus.google.com/u/0/events/cc1ho11fo5gopmo94q5u4bdrtlo	http://socialmediachat.wordpress.com/2013/01/09/arts-diablo/	http://www.buzzstream.com/blog/turning-blogger-relations-into-an-overall-inbound-strategy.html
http://www.womma.org/blog/2013/01/wommachat-on-jan-24-influencers-community-management	http://socialmediachat.wordpress.com/2013/01/09/arts-diablo/#comment-554	http://www.wilhelmus.ca/2013/01/two-facebook-pages-best-practices.html
http://info.socious.com/bid/62373/25-Tweetable-Online-Community-Tips-from-Richard-Millington-s-Book-Buzzing-Communities	http://heidicohen.com/social-media-35-brand-attributes-to-consider/	http://www.feverbee.com/2013/01/meaningful-conversations.html
http://mycmgr.com/community-manager-job-roundup-jan-14/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed:+mycmgr+(My+Community+Manager)&buffer_share=0d1fa	http://www.huffingtonpost.com/2013/01/09/diablo-ballet-crowdsourcing_n_2443783.html	http://socialmediachat.wordpress.com/2013/01/09/arts-diablo/#comment-554
http://socialmediatoday.com/jd-rucker/1155901/being-bold-social-media-about-risk-versus-reward?utm_source=feedburner&utm_medium=feed&utm_campaign=Social+Media+Today+(all+posts)&buffer_share=dc8aa	http://paper.li/CreativeSage/SMchat	http://mashable.com/2013/01/14/skittles-twitter/

Table 7 Top Hashtags by frequency of mention in groups in the #CMGRChat Twitter Network

Top Hashtags in Tweet in Group 1	Top Hashtags in Tweet in Group 2	Top Hashtags in Tweet in Group 3
cmgrchat	smchat	cmgrchat
cmgr	cmgrchat	cmgr
smchat	socialmedia	bloggerrelations
cmad	marketing	seo
tchat	arts	smchat

connections at all to others. These "isolates" are an indication that news of the event was reaching new communities of people, but the dense connections among most people taking about the "MLA" suggests that this is a community or in-group. The use of hashtags and URLs in the content in each group is another way to contrast these groups. The most frequently mentioned URLS in the largest groups in the

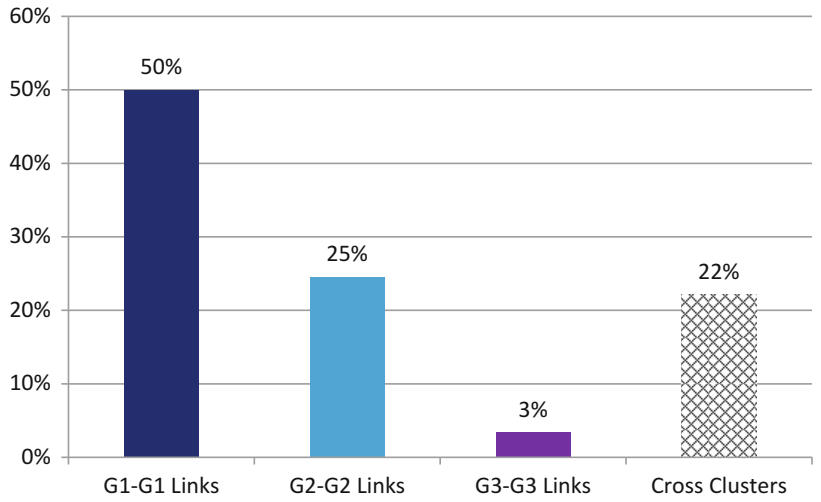


Fig. 7 Analysis of links between users in each of the three largest network groups within the hashtag #CMGRChat. Many of the connections among those who used the hashtag crossed group boundaries

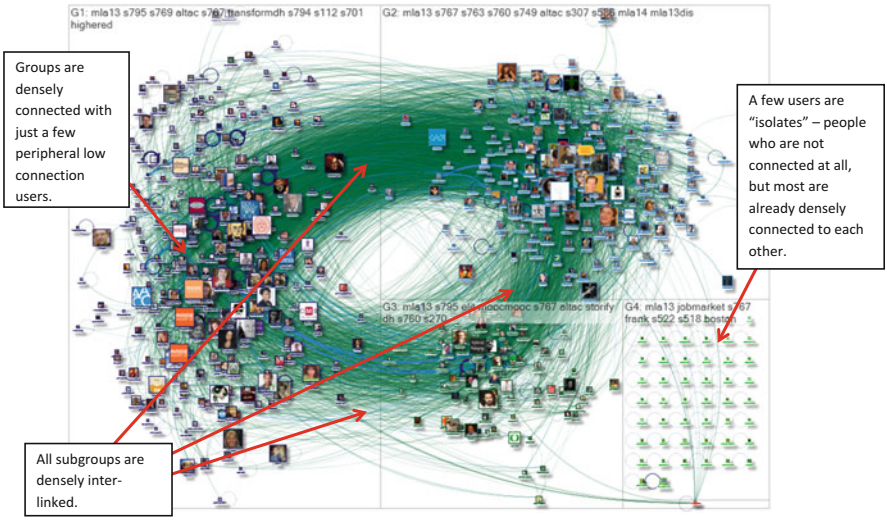


Fig. 8 Network graph of 599 Twitter users whose recent tweets contained "mla13" made over the 1-day, 19-h, 31-min period from Sunday, 06 January 2013 at 19:05 UTC to Tuesday, 08 January 2013 at 14:36 UTC

MLA13 network are displayed in Table 8. The overlap among these lists is an indication that groups shared a common interest and referred to similar content. This is in contrast to networks in which there is little or no overlap in the URLs used in different groups, which would indicate polarization and division. In the MLA network all the sub groups linked to common articles on the "InsideHighEd"

Table 8 Contrasting URLs frequently used in three groups discussing #MLA13

Top URLs in Tweet in Group 1	Top URLs in Tweet in Group 2	Top URLs in Tweet in Group 3
http://www.insidehighered.com/news/2013/01/07/mla-discussions-how-digital-communications-can-help-level-playing-field	http://www.insidehighered.com/news/2013/01/07/mla-discussions-how-digital-communications-can-help-level-playing-field	https://docs.google.com/document/d/1fjtpe3eNUASbilrugEgMKgABcoglwmrwAHJbizv0YUk/edit
http://anitaconchita.wordpress.com/2013/01/07/mla13-presentation/	http://katinarogers.com/2013/01/06/rebooting-graduate-training-mla/	http://storify.com/kathiiberens/the-classroom-as-interface-mla13?utm_content=storify-pingback&utm_campaign=&utm_source=direct-sfy.co&awesm=sfy.co_jD7M&utm_medium=sfy.co-twitter
http://chronicle.com/blogs/conversation/2013/01/06/what-if-the-adjuncts-shrugged/	http://www.uminnpressblog.com/2013/01/from-mla-2013-considering-serial.html	http://chronicle.com/blogs/conversation/2013/01/05/on-the-dark-side-of-the-digital-humanities/
http://storify.com/rogerwhitson/s112	http://nowviskie.org/2013/resistance-in-the-materials/	http://www.insidehighered.com/news/2013/01/07/mla-discussions-how-digital-communications-can-help-level-playing-field
http://www.insidehighered.com/blogs/confessions-community-college-dean/dropping-mla	http://storify.com/rogerwhitson/s112	http://sarahwerner.net/blog/index.php/2013/01/make-your-own-luck/

website and Chronicle.com and Storify websites. The common use of content across these groups suggests that these networks are divided by small differences in social relationships rather than major divisions. These groups are lobes of a common group rather than separate disconnected entities.

The common focus between the groups in the MLA13 network is also reflected in the most frequently used hashtags as displayed in Table 9. The top hashtags in each group refer to the sessions people attended and Tweeted about. The sub-groups represent the sub-populations of people who attended different sessions at the conference. While session 767 was popular in all groups, each group also had at least one term that was unique to it.

The connections people create can stay within their group or cross to end in another group. The measure of these intergroup connections reflects the in-group or polarized character of a network. The rate of internal connection is plotted in Fig. 9. The high level of cross group linkage is a strong indicator that the MLA13 network is an in-group network.

Table 9 Top Hashtags by frequency of mention in groups in the #MLA13 Twitter Network

Top Hashtags in Tweets in Group 1	Top Hashtags in Tweets in Group 2	Top Hashtags in Tweets in Group 3
mla13	mla13	mla13
s795	s767	s795
s769	s763	elit
altac	s760	moocmooc
s767	s749	s767

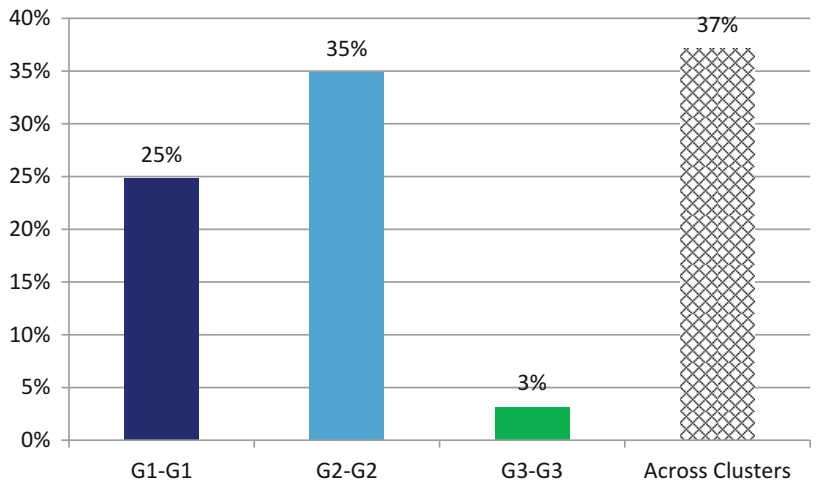


Fig. 9 Analysis of links between users in each of the three largest network groups within the hashtag #MLA13. Many of the connections among those who used the hashtag crossed group boundaries

Groups that use language in unique ways often create in-group networks. These topics share a common quality: People outside the group are unlikely to know or use the term. Technical terms, hobbyist vocabulary, and professional events are all examples of topics that form in-group networks. In-groups often form around topics that have limited general appeal but are topics of great interest to a small minority. People who have a passionate interest in esoteric topics often find one another in social media. These people often form multiple connections to one another as they share information about their niche interest. Therefore, a network map of an in-group community is a useful way to quickly identify the key people, topics and URLS that are central to the discussion of that topic.

12 Group Type 3: Brands, Breaking News, and Big Events

Brands and other public topics are the opposite of in-groups or communities; they have very low density and have many isolated participants. In a brand topic many people are likely to mention the topic without having any connection to one another. Advertised products, public events, and news are likely to have this pattern.

An example of a brand network is the Apple network: http://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=4681.

Apple is a major brand recognized widely around the world. Brands have a distinctive pattern of connection featuring large groups of people who have no links at all to others. In this network most users do not follow, reply or mention any other user who also tweeted about Apple. A large proportion of users share the common attribute of having mentioned the Apple brand name but lack any connection to one another. This pattern is common when a topic or term is widely known. Small groups are present in a brand network, visible in the upper right corner of the network map in Fig. 10. These groups are composed of small collections of users who discuss features and new releases of devices.

The graph represents a network of 834 Twitter users whose recent tweets contained "#apple," taken from a data set limited to a maximum of 1,500 users. The network was obtained on Wednesday, 15 May 2013 at 19:34 UTC. There is a green edge for each follows relationship. There is a blue edge for each "replies-to" or "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions."

In the groups that formed around the brand, there is limited interaction and little overlap in terms of resources linked to. None of the URLS frequently mentioned in each of the largest groups in the Apple network were mentioned in more than one group. This lack of URL overlap across groups suggests that the groups are distinct and focus on different aspects of the Apple product experience (Table 10).

Users in each group made use of different hashtags as well as URLs. Table 11 displays the frequently mentioned hashtags in the largest groups in the Apple network. The differences in hashtags suggest that each group is devoted to

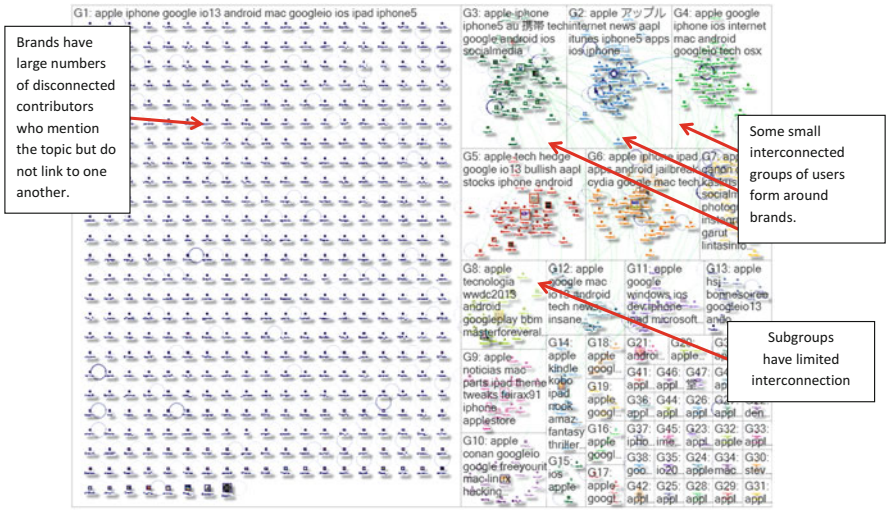


Fig. 10 Network graph of 834 Twitter users whose recent tweets contained "Apple" made over the 1-h, 41-min period from Wednesday, 15 May 2013 at 17:43 UTC to Wednesday, 15 May 2013 at 19:24 UTC

discussion of different Apple products (iTunes, iPhone), investment in Apple, or comparison between Apple and Android mobile devices.

Mentions of brands in Twitter generate networks composed of disconnected individuals and small groups. These groups are relatively interconnected, suggesting that brands are not polarized. The rates of connections between groups discussing Apple in Fig. 11 illustrates the modest levels.

13 Group Type 4: Clustered Community

When groups of people form several evenly sized groups, a network structure different from the Brand structure emerges. We call it a clustered community (or sometimes a "bazaar") because it is a collection of medium sized groups. An example is the discussion of the First Lady Michelle Obama's Twitter username "Flotus": https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2440.

While many of these contributors are isolates, demonstrating the brand quality of this topic, there are more connected groups of relatively equal size in a Clustered Community. These types of social media networks have many hubs each with a separate crowd—in a sense, it can be compared to people clustering in different stalls at a bazaar (Fig. 12).

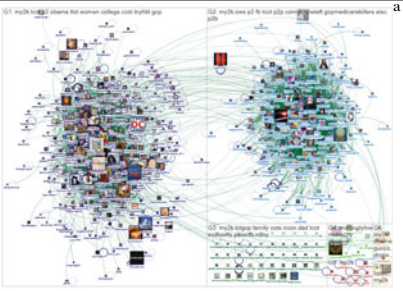
The graph represents a network of 1,260 Twitter users whose recent tweets contained "flotus." The network was obtained on Friday, 18 January 2013 at 18:26 UTC. There is a green edge for each follows relationship. There is a blue

Table 10 Contrasting URLs frequently used in groups discussing #Apple

Top URLs in Group 2	Top URLs in Group 3	Top URLs in Group 4	Top URLs in Group 5	Top URLs in Group 6
http://www.tuaw.com/2013/05/15/google-announces-new-hangout-app-to-hit-ios-today/	http://www.empiremedia.com/what-is-google-play/	http://instagram.com/p/ZV86V8QPdy/	http://finance.yahoo.com/news/hedge-funds-slash-apple-stakes-183323376.html	http://dealspl.us/Cell-Phones_deals/p_roocase-ultra-slim-gloss-black-shell-case-for-apple?r=seanvcxz
http://www.tuaw.com/2013/05/15/belkin-wemo-rolls-out-ifttt-multi-device-control/	http://partners.webmasterplan.com/click.asp?ref=517172&site=2732&type=text&tnb=87	http://mashable.com/2013/05/15/apple-to-samsung-the-s4-infringes-on-our-patents/	http://finance.yahoo.com/news/david-teppers-appaloosa-reduces-apple-175700791.html	http://www.scoop.it/t/future-business-technology/p/4001692666/top-rated-ios-and-android-apps
http://www.macrumors.com/2013/05/15/google-unifies-cross-platform-messaging-services-with-hangouts/	http://dealspl.us/Cell-Phones_deals/p_roocase-ultra-slim-gloss-black-shell-case-for-apple?r=seanvcxz	http://mashable.com/2013/05/14/apple-location-data-stalk-users/?utm_source=twitter&utm_medium=social&utm_content=47853	http://blogs.wsj.com/moneybeat/2013/05/15/time-to-worry-about-apple-again/	http://www.valuewalk.com/2013/05/caller-id-apps-for-iphone-android-blackberry-and-nokia-devices/

http://sportstalkflorida.lockerdome.com/contests/107693493	http://appleinsider.com.feedsportal.com/c/33975/f/616168/s/2bf680a6/l/0Lappleinsider0N0Carticles0C130C0A50C150Cgoogles0Eall0Eaccess0Emusic0Estreaming0Eservice0Eto0Etake0Eon0Espotify0Epandora/story01.htm	http://feeds.feedburner.com/~r/flipboardapple/~3/MFkFfOmb7xE/?utm_source=feedburner&utm_medium=twitter&utm_campaign=flipboardapple	http://www.insidermonkey.com/blog/apple-inc-aapl-billionaire-george-soros-is-also-bullish-on-cupertino-139026	http://www.ft.com/cms/s/0/fef37ffc-bd71-11e2-890a-00144feab7de.html
http://clkuk.tradedoubler.com/click?p=23708&a=1950257&url=https%3A%2F%2Fitunes.apple.com%2Fgb%2Fapp%2F1password-password-manager%2Fid443987910%3Fmt%3D12%26uo%3D2%26partnerId%3D2003&utm_source=dlvr.it&utm_medium=twitter	http://9to5mac.com/2013/05/15/google-maps-coming-to-ipad-this-summer-updated-with-new-design-improved-rating-system-in-app-offers-much-more?utm_source=twitterfeed&utm_medium=twitter	http://feeds.feedburner.com/~r/flipboardapple/~3/bhKgV0Fg--A/?utm_source=feedburner&utm_medium=twitter&utm_campaign=flipboardapple	http://www.businessinsider.com/why-apple-is-unlikely-to-change-its-famous-app-icons-shape-2013-5	http://www.amazon.co.jp/APPLE-mini-2-5GHz-Thunderbolt-MD387J/dp/B009X5EJR8/ref=zg_bs_2151949051_5/375-2400889-4913026?tag=ama012p-22

Table 11 Top Hashtags by frequency of mention in groups in the #Apple Twitter Network

Top Hashtags in Group 2	Top Hashtags in Group 3	Top Hashtags in Group 4	Top Hashtags in Group 5	Top Hashtags in Group 6
 [a]	Iphone	google	tech	iphone
internet	iphone5	iphone	hedge	ipad
news	Au	ios	google	apps
aapl	携帯	internet	io13	android
itunes	Tech	mac	bullish	jailbreak

[a]Apple in Japanese

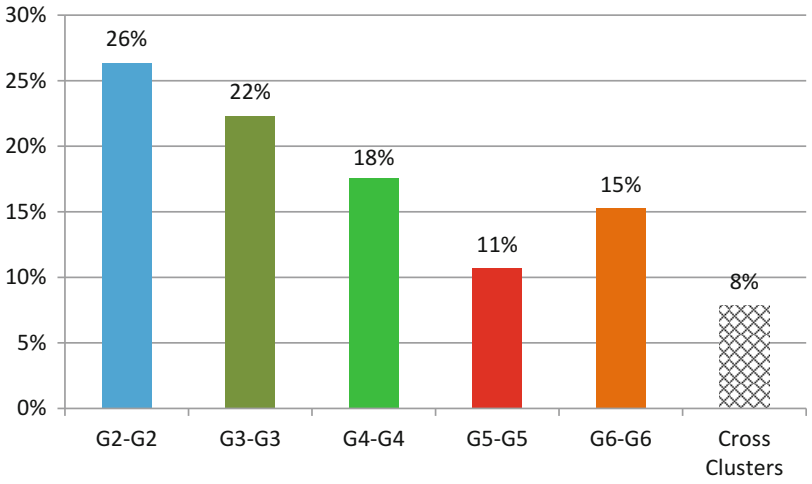


Fig. 11 Analysis of links between users in each of the largest network groups within the hashtag #Apple. Few of the connections among those who used the hashtag crossed group boundaries

edge for each "replies-to" or "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions."

There was more than the usual amount of social media activity related to Michelle Obama that day because the Administration and activists were eager to tie to her birthday and generate attention for some of their work. At the same time, there were different ways that people made reference to her, the birthday, and the

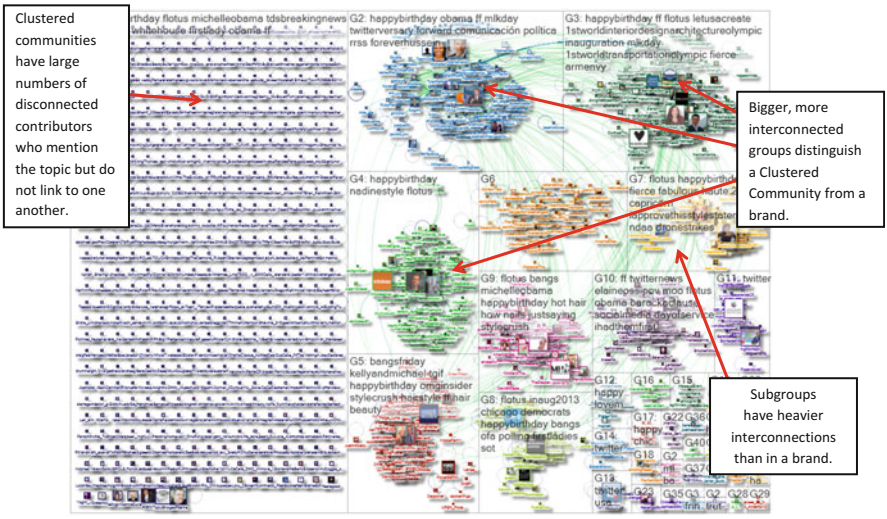


Fig. 12 Network graph of 1,260 Twitter users whose recent tweets contained "Flotus" made over the Friday, 18 January 2013 at 15:16 UTC to Friday, 18 January 2013 at 18:20 UTC

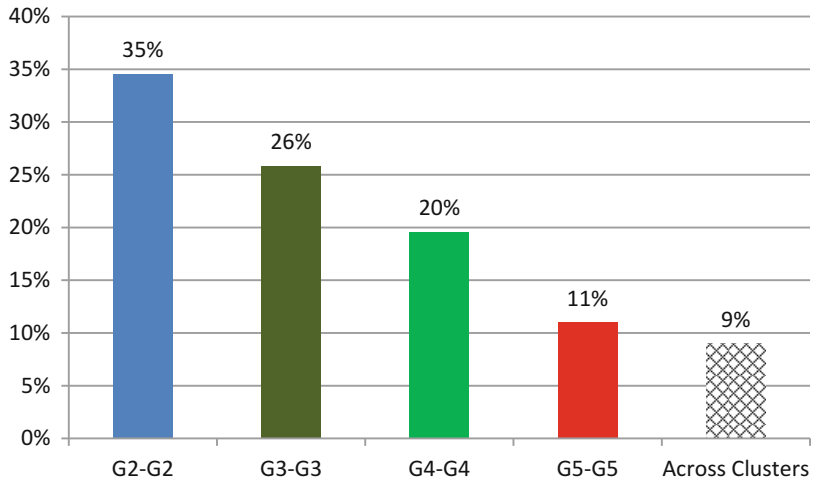


Fig. 13 Analysis of links between users in each of the largest network groups within the Flotus network. Few of the connections among those who used the term Flotus crossed group boundaries

activities of President Obama's allies and that was reflected in the different sources of information and URLs that were cited in each group.

There are 1,608 different relationships among those who used the hashtag #flotus in and across the top four groups (Fig. 13).

Table 12 Contrasting URLs frequently used in groups discussing Flotus

Top URLs in Tweet in Group 2	Top URLs in Tweet in Group 3	Top URLs in Tweet in Group 4	Top URLs in Tweet in Group 5
http://www.whitehouse.gov/blog/2013/01/18/follow-first-lady-michelle-obama-flotus-twitter	http://www.youtube.com/watch?v=YNbAvEe7FbI&feature=youtu.be	http://america.infobae.com/notas/65045-Michelle-Obama-abrio-una-nueva-cuenta-en-Twitter	http://pics.lockerz.com/s/277758941
http://www.youtube.com/watch?v=HYT68Uii1dk&feature=youtu.be	http://www.2013pic.org/service	http://www.2013pic.org/service	https://www.facebook.com/photo.php?fbid=10151341475790480&set=a.389111920479.168476.288878190479&type=1
http://govne.ws/item/Follow-First-Lady-Michelle-Obama-FLOTUS-on-Twitter	https://www.facebook.com/media/set/?set=a.10151436465887994.549161.128463482993&type=1&notif_t=like	http://simpsons.wikia.com/wiki/Michelle_Obama	http://ow.ly/i/1of6A
http://www.whitehouse.gov/blog/2013/01/18/follow-first-lady-michelle-obama-flotus-twitter?utm_source=twitter-feed&utm_medium=twitter	http://www.whitehouse.gov/blog/2013/01/18/follow-first-lady-michelle-obama-flotus-twitter	n/a	http://www.krnb.com/wpblog/?p=32021
http://flic.kr/s/aHsjDE7Xbh	http://obamafoodorama.blogspot.com/2013/01/president-obama-treats-first-lady-to.html	n/a	http://www.whitehouse.gov/blog/2013/01/18/follow-first-lady-michelle-obama-flotus-twitter

At the same time, there was some overlap among the groups because they shared an interest in her. That is evident in the link-count analysis chart below. In Clustered Community conversations many people are in the same conversational "vicinity," but their attention is often focused on separate things. The tone of the shared information in different groups also varies—some is serious, some is funny or wry, some is challenging and skeptical (Tables 12 and 13).

Another example is the network of people who tweeted about the Consumer Electronics Show (CES2013)—a giant trade show aimed at introducing new consumer-focused technology products that occurs every January: https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2275.

Table 13 Top Hashtags by frequency of mention in groups in the Flotus Twitter Network

Top Hashtags in Group 2	Top Hashtags in Group 3	Top Hashtags in Group 4	Top Hashtags in Group 5
happybirthday	happybirthday	happybirthday	Bangsfriday
obama	ff	nadinestyle	Kellyandmichael
ff	letusacreate		Tgif
mlkday	1stworldinteriordesignarchitectureolympic		Happybirthday
twitterversary	inauguration		Omginsider

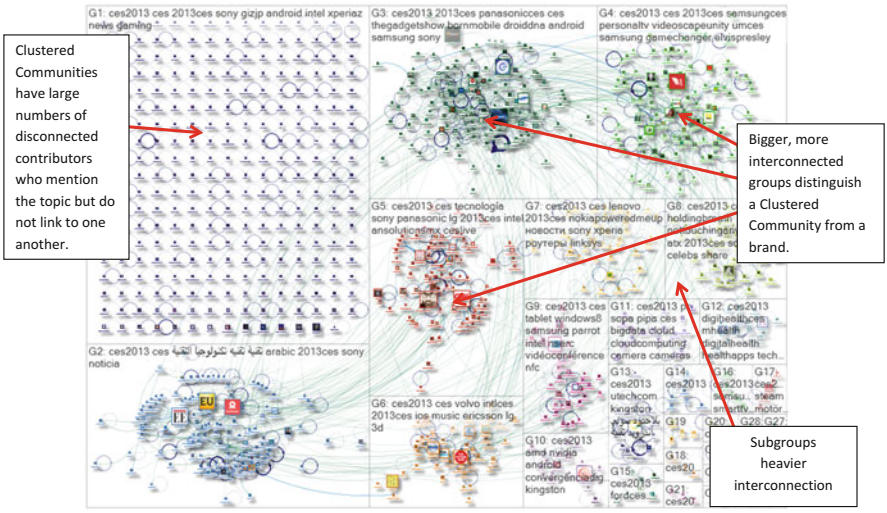


Fig. 14 Network graph of 1,260 Twitter users whose recent tweets contained "ces2013" made over the 47-min period from Tuesday, 08 January 2013 at 16:01 UTC to Tuesday, 08 January 2013 at 16:48 UTC

The graph represents a network of 1,041 Twitter users whose recent tweets contained "CES2013." The network was obtained on Tuesday, 08 January 2013 at 16:56 UTC. There is a green edge for each follows relationship. There is a blue edge for each "replies-to" and "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions" (Fig. 14).

Again, the groups are at the same conversational "bazaar" but their interests vary from stall to stall and that is what is reflected in popular URLs in each cluster.

Moreover, there is notable overlap among the groups in a Clustered Community-style Twitter conversation. The people in the cluster don't just link to and talk to each other, they have relatively overlapping ties to those in other clusters, as shown by the chart below (Tables 14 and 15) (Fig. 15).

There are 1,942 different relationships among those who used the hashtag #Flotus in and across the top four groups.

Table 14 Contrasting URLs frequently used in groups discussing CES2013

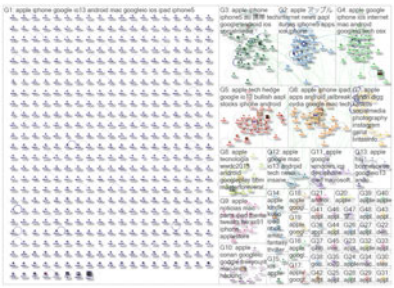
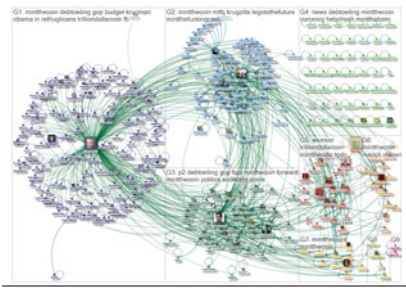
Top URLs in Tweet in Group 2	Top URLs in Tweet in Group 3	Top URLs in Tweet in Group 4	Top URLs in Tweet in Group 5
http://feedproxy.google.com/~r/enterCO/~3/dRBWva8m7MM/?utm_source=twitterfeed&utm_medium=twitter	http://panasonic.com/ces	http://ces.massrelevance.com/	http://www.cnnexpansion.com/tecnologia/2013/01/08/ultrad-le-quita-los-lentes-al-3d
http://www.elespectador.com/tecnologia/articulo-395530-xperia-z-el-telefono-resistente-al-agua-y-al-polvo	http://www.panasonic.com/promos/ces/2013/?cm_mmc=PNA-Web-_-Alias-_-Panasonic-_-CES2013-Microsite-Alias-10003-12212012	http://www.ipglab.com/2013/01/08/the-trigger-lexus-autonomous-driving/	http://www.revistasumma.com/tecnologia/33622-los-5-gadgets-mas-curiosos-del-ces.html
http://www.eluniversal.com/vida/130108/los-gigantes-de-la-tecnologia-dejan-versus-nuevos-productos	http://www.qualcomm.com/sweepstakes/ces2013	http://www.youtube.com/watch?v=-pdOCi-83Fc&feature=youtu.be	http://www.cnnexpansion.com/tecnologia/2013/01/07/3m-touch-systems
http://www.elespectador.com/especiales/articulo-395516-tecnologia-se-toma-vegas	http://gadgetshow.channel5.com/gadget-show/gadget-news/sony-xperia-z-first-full-hd-phone-heads-to-the-uk	http://instagram.com/p/UOq3OLSdUT/	http://conecti.ca/2013/01/08/video-en-vivo-keynote-de-apertura-ces2013-a-cargo-de-panasonic/?utm_campaign=[VIDEO]%20En%20Vivo:%20Keynote%20de%20apertura%20#CES2013%20a%20cargo%20de%20Panasonic&utm_medium=twitter&utm_source=twitter
http://feedproxy.google.com/~r/enterCO/~3/dRBWva8m7MM/?utm_medium=twitter&utm_source=twitter-feed	http://www.ilounge.com/index.php/ces2013/report/incipio/	http://www.flickr.com/photo.gne?short=dJQ4pZ	http://rubiko.mx/lo-mas-relevante-del-ces2013-dia-uno/

14 Group Type 5: Broadcast

The broadcast pattern is dominated by a hub and spoke structure, with the hub often being a media outlet, surrounded by spokes of people who repeat the messages generated by the news organization or personality.

An example is the conversation about New York Times columnist Paul Krugman's article that appeared on January 11, 2013. The NodeXL map contains

Table 15 Top Hashtags by frequency of mention in groups in the CES2013 Twitter Network

Top Hashtags in Tweet in Group 2	Top Hashtags in Tweet in Group 3	Top Hashtags in Tweet in Group 4	Top Hashtags in Tweet in Group 5
 [a]	panasonicces	samsungces	Tecnología
	thegadgetshow	personaltv	Sony
	bornmobile	videoscapeunity	Panasonic
	droiddna	umces	Lg
arabic	android	samsung	Intel

[a]Technology, Tech, Technology, Technical, respectively

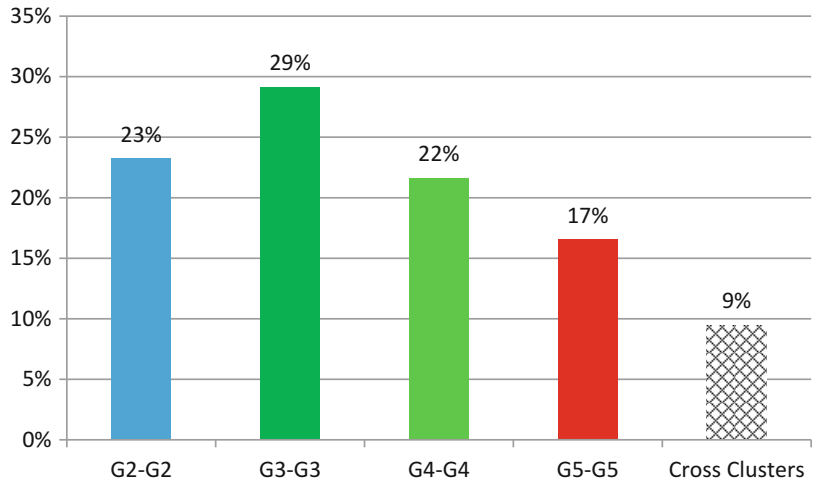


Fig. 15 Analysis of links between users in each of the three largest network groups within the hashtag #CES2013. Few of the connections among those who used the hashtag crossed group boundaries

people who linked to this column on Twitter: https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2313.

The graph represents a network of 399 Twitter users whose recent tweets contained "http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html." The network was obtained on Friday, 11 January 2013 at 14:27 UTC. There is a green edge for each follows relationship. There is a blue edge for each "replies-to" or "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions" (Fig. 16).

In this conversational structure, the "audience" of people who linked connect only to the Paul Krugman account are visible in Group 1, while Group 2 and Group 3 contain denser collections of people who could be considered part of the community interested in discussing Krugman's article. A collection of isolates suggests that the article was visible to many people, even if they weren't discussing it in Krugman discussion communities (Tables 16 and 17) (Fig. 17).

Advocacy organizations also often generate a broadcast pattern. For example, the "KilltheTrade" discussion focuses on the restriction of trade in endangered animal products. https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2483.

The graph represents a network of 1,196 Twitter users whose recent tweets contained "killthetrade," taken from a data set limited to a maximum of 1,500 users. The network was obtained on Monday, 21 January 2013 at 19:24 UTC. There is a green edge for each follows relationship. There is a blue edge for each "replies-to" or "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions." The tweets were made over the 2-day, 4-h, 8-min period from Saturday, 19 January 2013 at 15:07 UTC to Monday, 21 January 2013 at 19:15 UTC (Fig. 18).

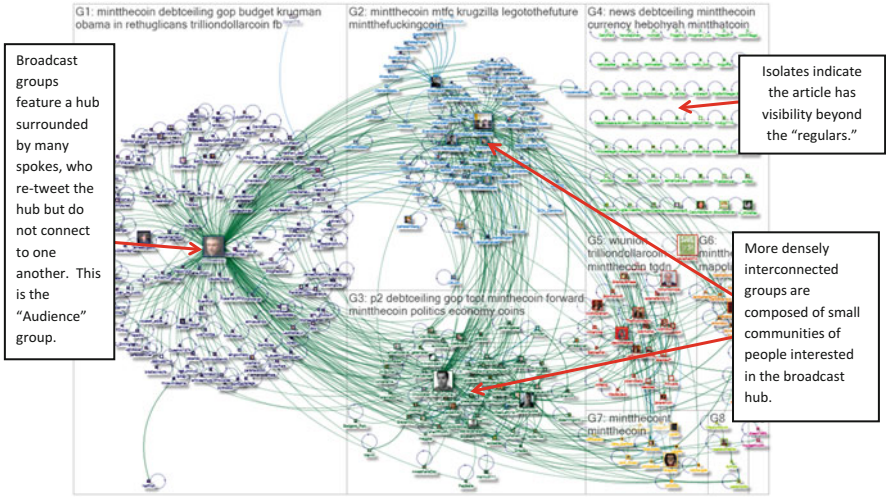


Fig. 16 Network graph of 399 Twitter users whose recent tweets contained a URL to a NYTimes article by Paul Krugman made over the 12-h, 32-min period from Friday, 11 January 2013 at 01:52 UTC to Friday, 11 January 2013 at 14:24 UTC

Table 16 Contrasting URLs frequently used in groups discussing a New York Times article by Paul Krugman

Top URLs in Tweet Group 1[a]	Top URLs in Tweet Group 2	Top URLs in Tweet Group 3
http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html?smid=tw-NytimesKrugman&seid=auto	http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html?smid=tw-NytimesKrugman&seid=auto	http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html?smid=tw-share
http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html?smid=tw-share	http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html?smid=tw-share	http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html?smid=tw-NytimesKrugman&seid=auto
http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html	http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html	http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html
	http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html?smid=tw-NytimesKrugman&seid=auto&_r=0	http://www.nytimes.com/2013/01/11/opinion/krugman-coins-against-crazies.html?hp
		http://www.nytimes.com/

[a] Links appearing only once were removed

Table 17 Top Hashtags by frequency of mention in groups in the Paul Krugman Twitter Network

Top Words in Tweet in Group 1	Top Words in Tweet in Group 2	Top Words in Tweet in Group 3
coins	rt	Coins
against	crazies	Against
crazies	against	Crazies
nytimeskrugman	coin	Rt
rt	coins	Krugman

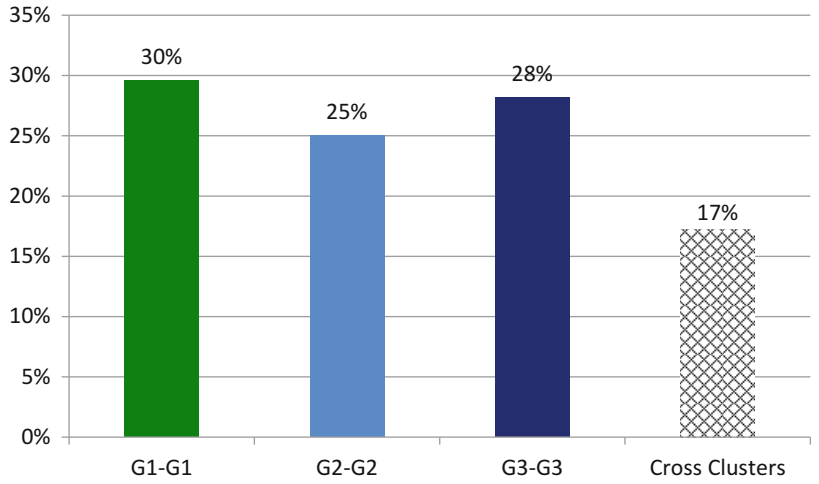


Fig. 17 Analysis of links between users in each of the three largest network groups within the Paul Krugman article network. There are 1,072 different relationships among those who used the URL for Krugman's column in and across the top four groups. Many of the connections among those who used the hashtag crossed group boundaries

At the center of the largest group is the account for the World Wildlife Foundation surrounded by a large number of participants who connect only to the WWF account. This is a low density hub-and-spoke group that contains the audience for the WWF. In contrast, Group 2 and Group 3 are communities composed of densely connected participants who all have many links to one another.

A broadcast network often has one or two large hubs with many spokes while the other groups are relatively small (Tables 18 and 19) (Fig. 19).

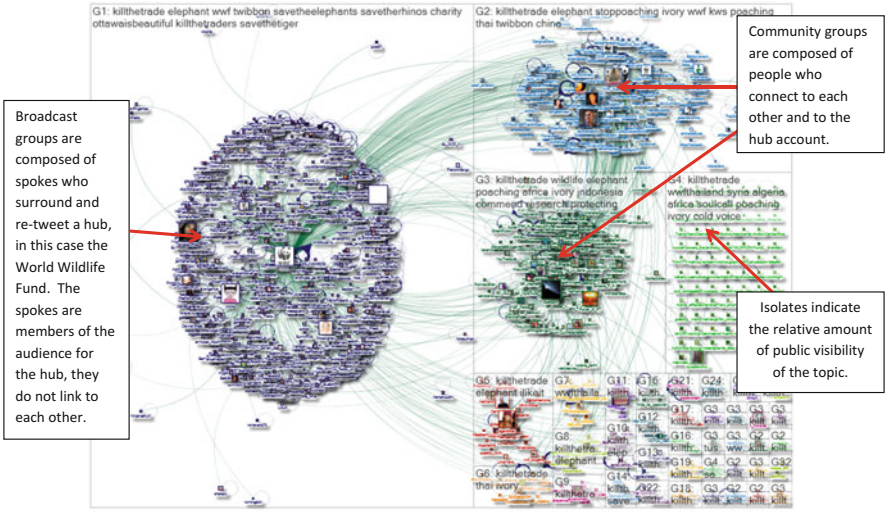


Fig. 18 Network graph of 1,196 Twitter users whose recent tweets contained killthetrade made over the 2-day, 4-h, 8-min period from Saturday, 19 January 2013 at 15:07 UTC to Monday, 21 January 2013 at 19:15 UTC

Table 18 Contrasting URLs frequently used in groups discussing "KillTheTrade"

Top URLs in Tweet in Group 1	Top URLs in Tweet in Group 2	Top URLs in Tweet in Group 3
http://wwf.panda.org/ban?utm_source=socialmedia&utm_medium=twitter&utm_content=thaipetition&utm_campaign=iwtc	http://wwf.panda.org/ban?utm_source=socialmedia&utm_medium=twitter&utm_content=thaipetition&utm_campaign=iwtc	http://wwf.panda.org/ban?utm_source=socialmedia&utm_medium=twitter&utm_content=thaipetition&utm_campaign=iwtc
http://wwf.panda.org/ban	http://wwf.panda.org/ban	http://wwf.panda.org/ban
http://wwf.panda.org/elephants	http://wwf.panda.org/elephants	http://wwf.panda.org/elephants
http://www.youtube.com/watch?v=MFdfocXRCT0	http://www.youtube.com/watch?v=MFdfocXRCT0	http://forcechange.com/53815/urge-indonesia-to-crack-down-on-illegal-ivory-imports/
http://ow.ly/gP2OE	http://www.africam.com/wildlife/tembe_webcam	http://forcechange.com/52018/commend-research-protecting-wildlife-against-illegal-poaching-in-africa/

Table 19 Top Hashtags by frequency of mention in groups in the "KillTheTrade" Twitter Network

Top Hashtags in Tweet in Group 1	Top Hashtags in Tweet in Group 2	Top Hashtags in Tweet in Group 3
elephant	elephant	wildlife
wwf	stoppoaching	elephant
twibbon	ivory	poaching
savetheelephants	wwf	africa
savetherhinos	kws	ivory

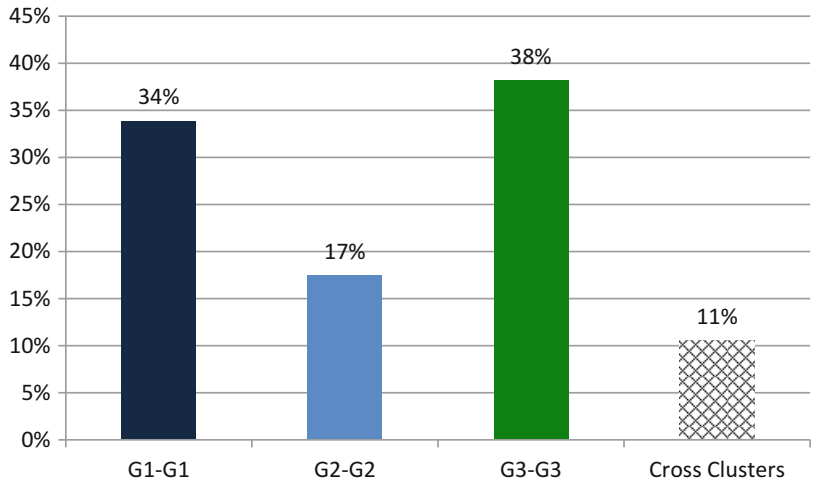


Fig. 19 Analysis of links between users in each of the three largest network groups within the "KillTheTrade" network. There are 4,314 different relationships among those who used the hashtag #killthetrade in and across the top four groups. Many of the connections among those who used the hashtag crossed group boundaries

15 Group Type 5: Support

Many large companies provide customer support via Twitter, maintaining a user account to listen to and reply to user complaints and issues. This account replies to many other accounts, which are not linked to one another directly. https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2956.

The graph represents a network of 388 Twitter users whose recent tweets contained "delllistens OR dellcares." The network was obtained on Tuesday, 19 February 2013 at 17:44 UTC. There is a green edge for each follows relationship. There is a blue edge for each "replies-to" or "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions." The tweets were made over the 6-day, 21-h, 58-min period from Tuesday, 12 February 2013 at 19:34 UTC to Tuesday, 19 February 2013 at 17:33 UTC (Tables 20 and 21) (Figs. 20 and 21).

The support pattern is also visible in the Virgin America network: https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2414.

The graph represents a network of 1,040 Twitter users whose recent tweets contained "Virgin America." The network was obtained on Wednesday, 16 January 2013 at 22:48 UTC. There is a green edge for each follows relationship. There is a blue edge for each "replies-to" or "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions." The tweets were made over the 7-day, 18-h, 19-min period from Wednesday, 09 January 2013 at 04:18 UTC to Wednesday, 16 January 2013 at 22:38 UTC (Fig. 22).

Table 20 Contrasting URLs frequently used in groups discussing DellCares OR DellListens

Top URLs in Tweet in Group 1	Top URLs in Tweet in Group 2	Top URLs in Tweet in Group 3
http://dell.to/OqhRhj	http://www.youtube.com/watch?v=A-qq2gOLIOg&feature=share&list=PLmbFlhPb2qyWJ330CTZBEmPUqYpYKRXlK	https://pbs.twimg.com/media/BBT3RrHCEAA6CXp.jpg
http://dell.to/XazIZH	http://www.youtube.com/watch?v=g1OOq1t8Ybk&list=PLmbFlhPb2qyWJ330CTZBEmPUqYpYKRXlK&index=17	http://lt.dell.com/lt/lt.aspx?CID=68634&LID=4675173&DGC=SM&DGSeg=CBG&RED=301&DURL=http://en.community.dell.com/support-forums/customercare/f/4674/p/19491559/20299447.aspx&buffer_share=96621&utm_source=buffer
http://dell.to/XaPGD9	http://mashable.com/2013/02/18/ubuntu-tablet/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+Mashable+%28Mashable%29	
http://del.ly/l/6015nMIV	http://www.dell.com/content/topics/topic.aspx/global/products/pedge/topics/en/config_calculator?c=us&l=en&s=gen	
http://news.cnet.com/8301-1009_3-57569018-83/microsoft-delivers-fixes-for-windows-8-windows-rt/	http://www.dell.com/support/drivers/us/en/19/DriverDetails?driverId=KT6P7	

Table 21 Top Hashtags by frequency of mention in groups in the DellCares OR DellListens Twitter Network

Top Hashtags in Tweet Group 1	Top Hashtags in Tweet Group 2	Top Hashtags in Tweet Group 3
dellcares	dellcares	nevahold
windows8	delllistens	whatawaste
xps	windows8	nosolutions
csrblast	dell	
frustrated	supportquality	

Note: URLs mentioned only once were removed

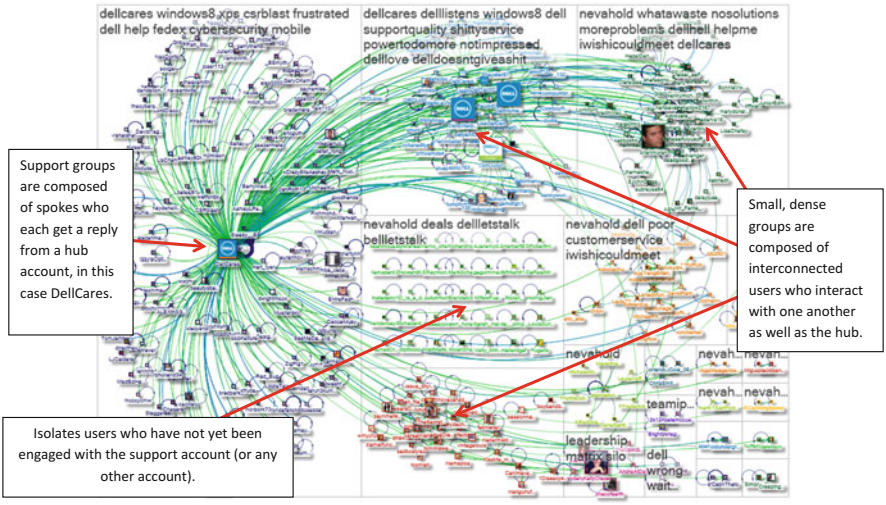


Fig. 20 Network graph of 388 Twitter users whose recent tweets contained delllistens OR dellcares made over the 6-day, 21-h, 58-min period from Tuesday, 12 February 2013 at 19:34 UTC to Tuesday, 19 February 2013 at 17:33 UTC

This map illustrates a hybrid that has brand features and a hub-and-spoke structure that is an indicator of a customer service account along with smaller community groups of densely connected industry analysts and journalists. This pattern resembles the broadcast pattern discussed below but is distinguished by the high rates of mutual interactions between the hub account and the disconnected spokes of customers seeking travel assistance (Tables 22 and 23) (Fig. 23).

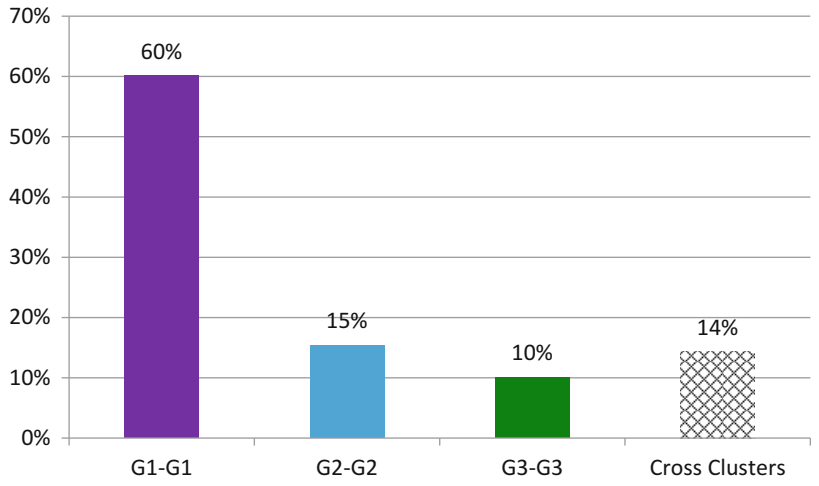


Fig. 21 Analysis of links between users in each of the three largest network groups within the delllistens OR dellcares networks. There are 1,445 different relationships among those who used the words delllistens OR dellcares in and across the top four groups. Many of the connections among those who used the hashtag crossed group boundaries

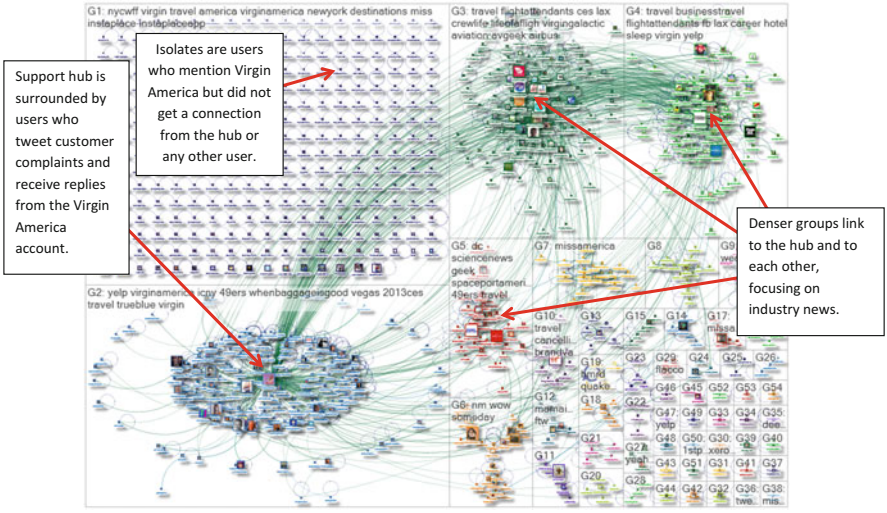


Fig. 22 Network graph of 1,040 Twitter users whose recent tweets contained "Virgin America" made over the 7-day, 18-h, 19-min period from Wednesday, 09 January 2013 at 04:18 UTC to Wednesday, 16 January 2013 at 22:38 UTC

Table 22 Contrasting URLs frequently used in groups discussing "Virgin America"

Top URLs in Tweet in Group 2	Top URLs in Tweet in Group 3	Top URLs in Tweet in Group 4
http://www.virginamerica.com/vx/lax-loft?cid=sm_social_FRI_118_2p_engagement_TW&stop_mobi=yes	http://www.cntraveler.com/daily-traveler/2013/01/first-class-cabins-singapore-airlines-emirate-etihad-cathay-asiana-ana-virgin-america-atlantic-el-al?MBID=twitter_#slide=1	http://www.cntraveler.com/daily-traveler/2013/01/first-class-cabins-singapore-airlines-emirate-etihad-cathay-asiana-ana-virgin-america-atlantic-el-al?MBID=twitter_#slide=1
http://www.yelp.com/biz/virgin-america-san-francisco-4	http://boardingarea.com/blogs/dealswelike/2013/01/15/virgin-america-matching-united-and-american-airlines-status/?utm_source=twitterfeed&utm_medium=twitter	http://fb.me/2aKzbWNeq
https://foursquare.com/nik_nik/checkin/50f470cde4b09661797ef01a?s=_zls9TjyRheB4G7dE1KTb-20Hfc&ref=tw	http://www.usatoday.com/story/todayinthesky/2013/01/16/virgin-america-adds-las-vegas-lax-nonstop/1840285/	http://www.smartertravel.com/airfare/virgin-america-sale-ends-Monday.html?id=13687378&source=rss&utm_source=twitterfeed&utm_medium=twitter
http://www.fastcompany.com/1675455/why-tech-nerds-love-flying-virgin-america	http://www.ausbt.com.au/virgin-america-s-lax-loft-lounge-rules-allow-only-australian-kids	http://Jump.priceline.com/pricebreakers/deal/PB_AIRVirginAmerica59_01152013.html?refid=PMSOCIAL&refclickid=TWITTER_PB|01152013-0200
http://www.yelp.com/biz/virgin-america-westchester	http://www.prnewswire.com/news-releases/virgin-america-launches-new-route--daily-flights-from-los-angeles-to-las-vegas-187146971.html	http://www.sun-sentinel.com/business/consumer-talk-blog/sfl-virgin-america-fll-route-sale-20130115,0,7873138.story

Table 23 Top Hashtags by frequency of mention in groups in the Virgin America Twitter Network

Top Hashtags in Tweet in Group 2	Top Hashtags in Tweet in Group 3	Top Hashtags in Tweet in Group 4
yelp	travel	travel
icny	flightattendants	businesstravel
49ers	ces	flightattendants
whenbaggageisgood	lax	fb
vegas	crewlife	lax

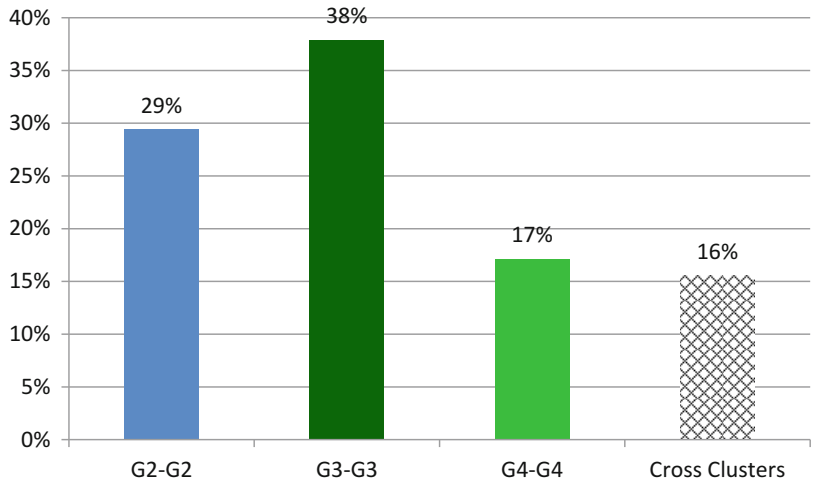


Fig. 23 Analysis of links between users in each of the three largest network groups within the "Virgin America" network. There are 2,353 different relationships among those who used the term Virgin America in and across the top four groups. Many of the connections among those who used the hashtag crossed group boundaries

16 Conclusions

Social media comes in different forms and structures. Mapping social media networks can enable a better understanding of the variety of ways individuals form groups and organize online. Social media network maps of Twitter have illustrated six different structures of connection around different kinds of topics.

It is possible to imagine any number of ways that these insights could find application for those interested in using social media to promote causes, to engage the stakeholders who are interested in their organizations or missions, and to start or enter social media conversations that matter to them.

For instance, those who run social media accounts for their organizations can explore how some of the conversational "styles" might be most applicable and useful to their work. Additionally, they might see how the "natural" structure of a conversation around their core topics could profit from adjustment. For example, a brand may want to cultivate community, or an in-group might want to open up to outsiders. Using these maps, participants can assess the type of social media network in which they participate and set a target for what they want their group to be like.

Social media is used by millions of individuals who collectively generate an array of social forms from their interactions. Social media network maps can be useful in understanding the variety of social structures that emerge. Network maps can reveal the structures of the crowd and highlight strategic locations or roles in these webs of connection. By mapping social media network spaces, researchers

and practitioners can learn about the most common and best uses for these communication services.

Additionally, network analysis provides insights into social media that can help individuals and organizations make informed decisions about online conversations. An organization may have a goal to create a discussion with a particular kind of social structure, like a community or a brand. Creating social media network maps of these topic spaces can be a useful way to track progress. Social media managers, for example, have many topics of interest, including brand names, events, products, services, companies, and candidates. Managers may want to ask themselves "Which kind of social media network is my topic most like?" Further, they may want to select a network type as their desired goal for their topic discussion. With a goal in mind, additional maps can be created over time to measure the difference between the current state of the topic network and the desired one. As experiments with various social media engagement strategies are performed, social media network maps can track the impact on the structure of social media spaces.

Resources

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