Mapping Twitter Topic Networks: From Polarized Crowds to Community Clusters

Twitter conversations around political issues often quickly polarize with people citing different information sources to make their case and clustering around different influencers who drive different points of view. But Polarized Crowds are not the only way that people gather on Twitter. There are at least six distinct types of conversations on Twitter based on the structure of people's networks, the subjects and content sources that matter to them, and the way they interact. These networks have different structures that reflect the social activity within them: divided, unified, fragmented, clustered, and inward and outward hub and spokes.

Marc A. Smith
Director, Social Media Research Foundation

Lee Rainie
Director, Pew Research Internet Project

Itai Himelboim
University of Georgia

Ben Shneiderman
University of Maryland

Summary of Findings

Polarized Crowds: Political conversations in Twitter

Conversations on Twitter create networks with identifiable contours as people reply to and mention one another in their tweets. These conversational structures differ depending on the subject and the people driving the conversation. Six structures are regularly observed: divided, unified, fragmented, clustered, and inward and outward hub and spoke structures. These are created as individuals choose whom to reply to or mention in their Twitter messages and the structures tell a story about the nature of the conversation.

If a topic is political, it is common to see two separate, polarized crowds take shape. They form two distinct discussion groups that mostly do not interact with each other. Frequently these are recognizably liberal or conservative groups. The participants within each separate group commonly mention very different collections of website URLs and use distinct hashtags and words. The split is clearly evident in many highly controversial discussions: people in clusters that we identified as liberal used URLs for mainstream news websites, while groups we identified as conservative used links to conservative news websites and commentary sources. At the center of each group are discussion leaders, prominent people who are widely replied to or mentioned in the discussion. In polarized discussions, each group links to a different set of influential people or organizations that can be found at the center of each conversation cluster.

While these polarized crowds are common in political conversations on Twitter, it is important to remember that the people who take the time to post and talk about political issues on Twitter are a special group. Unlike many other Twitter members, they pay attention to issues, politicians, and political news, so their conversations are not representative of the views of the full Twitterverse. Moreover, Twitter users are only [18% of internet users](#) and 14% of the overall adult population. Their demographic profile is [not reflective of the full population](#). Additionally, other work by the Pew Research Center has shown that tweeters' reactions to events are [often at odds](#) with overall public opinion— sometimes being more liberal, but not always. Finally, forthcoming survey findings from Pew Research will explore the relatively modest size of the social networking population who exchange political content in their network.

Still, the structure of these Twitter conversations says something meaningful about political discourse these days and the tendency of politically active citizens to sort themselves into distinct partisan camps. Social networking maps of these conversations provide new insights because they combine analysis of the opinions people express on Twitter, the information sources they cite in their tweets, analysis of who is in the networks of the tweeters, and how big those networks are. And to the extent that these online conversations are followed by a broader audience, their impact may reach well beyond the participants themselves.

Our approach combines analysis of the size and structure of the network and its sub-groups with analysis of the words, hashtags and URLs people use. Each person who contributes to a Twitter conversation is located in a specific position in the web of relationships among all participants in the conversation. Some people occupy rare positions in the network that suggest that they have special importance and power in the conversation.

Social network maps of Twitter crowds and other collections of social media can be created with innovative data analysis tools that provide new insight into the landscape of social media. These maps highlight the people and topics that drive conversations and group behavior – insights that add to what can be learned from surveys or focus groups or even sentiment analysis of tweets. Maps of previously hidden landscapes of social media highlight the key people, groups, and topics being discussed.

Conversational archetypes on Twitter

The Polarized Crowd network structure is only one of several different ways that crowds and conversations can take shape on Twitter. There are at least six distinctive structures of social media crowds which form depending on the subject being discussed, the information sources being cited, the social networks of the people talking about the subject, and the leaders of the conversation. Each has a different social structure and shape: divided, unified, fragmented, clustered, and inward and outward hub and spokes.

After an analysis of many thousands of Twitter maps, we found six different kinds of network crowds.
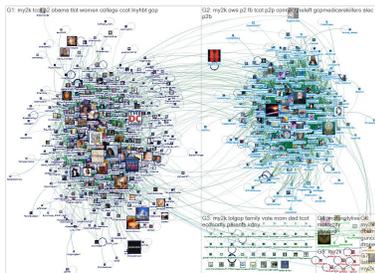

Polarized Crowd: Polarized discussions feature *two big and dense groups that have little connection between them*. The topics being discussed are often highly divisive and heated political subjects. In fact, there is usually little conversation between these groups despite the fact that they are focused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

Why this matters: It shows that partisan Twitter users rely on different information sources. While liberals link to many mainstream news sources, conservatives link to a different set of websites.
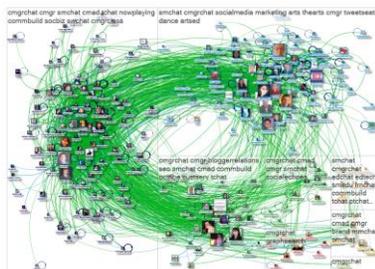
Tight Crowd: These discussions are characterized by *highly interconnected people* with few isolated participants. Many conferences, professional topics, hobby groups, and other subjects that attract communities take this Tight Crowd form.

Why this matters: These structures show how networked learning communities function and how sharing and mutual support can be facilitated by social media.
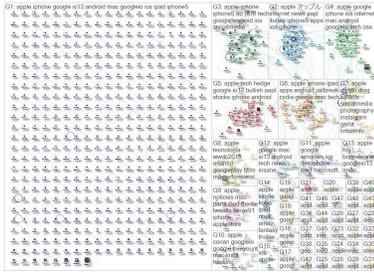
Brand Clusters: When well-known products or services or popular subjects like celebrities are discussed in Twitter, there is often commentary from many *disconnected participants*: These "isolates" participating in a conversation cluster are on the left side of the picture on the left). Well-known brands and other popular subjects can attract large fragmented Twitter populations who tweet about it but not to each other. The larger the population talking about a brand the less likely it is that the participants are connected to one another. Brand-mentioning participants focus on a topic, but tend not to connect to each other.

Why this matters: There are still institutions and topics that command mass interest. Often times, the Twitter chatter about these institutions and their messages is not among people connecting with each other. Rather, they are relaying or passing along the message of the institution or person and there is no extra exchange of ideas.

Community Clusters: Some popular topics may develop multiple smaller groups, which often form around a few hubs, each with its own audience, influencers, and sources of information. These
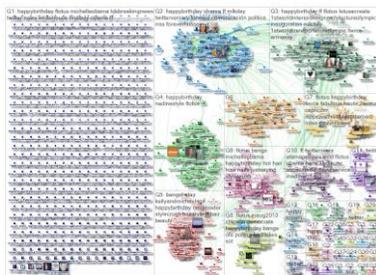
Community Clusters conversations look like bazaars with multiple centers of activity. Global news stories often attract coverage from many news outlets, each with its own following. That creates a collection of medium-sized groups—and a fair number of isolates (the left side of the picture above).

Why this matters: Some information sources and subjects ignite multiple conversations, each cultivating its own audience and community. These can illustrate diverse angles on a subject based on its relevance to different audiences, revealing a diversity of opinion and perspective on a social media topic.
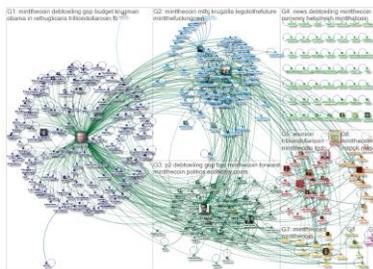
Broadcast Network: Twitter commentary around breaking news stories and the output of well-known media outlets and pundits has a distinctive hub and spoke structure in which *many people repeat what prominent news and media organizations tweet.* The members of the Broadcast Network audience are often 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 do discuss the news with one another.

Why this matters: There are still powerful agenda setters and conversation starters in the new social media world. Enterprises and personalities with loyal followings can still have a large impact on the conversation.
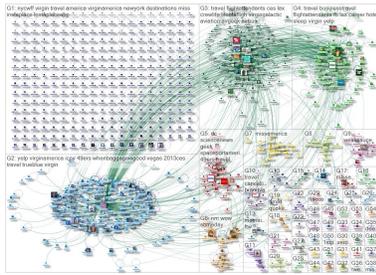
Support Network: Customer complaints for a major business are often handled by a Twitter service account that attempts to resolve and manage customer issues around their products and services. This produces a *hub-and-spoke structure* that is different from the Broadcast Network pattern. In the Support Network structure, the hub account replies to many otherwise disconnected users, creating outward spokes. In contrast, in the Broadcast pattern, the hub gets replied to or retweeted by many disconnected people, creating inward spokes.

Why this matters: As government, businesses, and groups increasingly provide services and support via social media, support network structure becomes an important benchmark for evaluating the performance of these institutions. Customer support streams of advice and feedback can be measured in terms of efficiency and reach using social media network maps.

Why is it useful to map the social landscape this way?

Social media is increasingly home to civil society, the place where knowledge sharing, public discussions, debates, and disputes are carried out. As the new public square, social media conversations are as important to document as any other large public gathering. Network maps of public social media discussions in services like Twitter can provide insights into the role social media plays in our society. These maps are like aerial photographs of a crowd, showing the rough size and composition of a population. These maps can be augmented with on the ground interviews with crowd participants, collecting their words and interests. Insights from network analysis and visualization can complement survey or focus group research methods and can enhance sentiment analysis of the text of messages like tweets.

Like topographic maps of mountain ranges, network maps can also illustrate the points on the landscape that have the highest elevation. Some people occupy locations in networks that are analogous to positions of strategic importance on the physical landscape. Network measures of "centrality" can identify key people in influential locations in the discussion network, highlighting the people leading the conversation. The content these people create is often the most popular and widely repeated in these networks, reflecting the significant role these people play in social media discussions.

While the physical world has been mapped in great detail, the social media landscape remains mostly unknown. However, the tools and techniques for social media mapping are improving, allowing more analysts to get social media data, analyze it, and contribute to the collective construction of a more complete map of the social media world. A more complete map and understanding of the social media landscape will help interpret the trends, topics, and implications of these new communications technologies.

Method: Network mapping the social media landscape with NodeXL

These findings come from a collaboration between the Pew Research Center's Internet Project and the Social Media Research Foundation. We used a free and open social media network analysis tool created by the Social Media Research Foundation called NodeXL[1] to collect data from Twitter conversations and communities related to a range of topics. NodeXL then generated network visualization maps along with reports that highlighted key people, groups, and topics in the social media discussions.

Network maps are created by drawing lines between Twitter users that represent the connections they form when they follow, reply to, or mention one another. Structures emerge in network maps when all the linkages between Twitter users discussing a particular subject are plotted.

A taxonomy of six distinct types of conversations emerged from our analysis of thousands of social media network maps on a variety of topics. Our method for discovery was *not* to build network maps that matched a type; we did not start by believing that all politics-related structures had the same structure. Rather, we made many maps on many subjects and then observed the structures created by each topic. Observational analysis led us to recognize recurring structures in these social media networks. Once those network structures became apparent, we explored the kinds of topics and issues that created those network structures.

The distinctive structures observed are not comprehensive—social media is a large-scale phenomenon and the efforts to map it have just begun. But these six social media network structures can be considered archetypes because they occur regularly and cannot be reduced to one another. Additional structures are possible and may be discovered by on-going search. As tools get easier to use and the number of investigators grows, a more complete composite picture of the landscape of social media will likely emerge.

In practice, many social media topics exhibit a hybrid network structure that combines elements of the six network types described here. For instance, a Tight Crowd may also have a Broadcast hub. Or a Support Network may also attract a sparse collection of unconnected people talking about a product or brand. Any given social media network may feature elements of these six core types. But these examples illustrate distinct structural patterns that define distinct dimensions of the social media landscape.

Below in Figure 1 is an annotated version of the Polarized Crowd map collected and drawn by NodeXL. It highlights key features of this "aerial view" of this kind of social media crowd.

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[1] NodeXL - the **n**etwork **o**verview, **d**iscovery and **e**xploration add-in for Excel - 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 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/.

Figure1: How to draw a Twitter social media network map

Step 1: Used NodeXL Twitter data importer to collect Tweets that contain selected keywords or hashtags. In this case the hashtag was "#my2K," a hashtag created by the Obama Administration on Nov. 28, 2012 in the context of the budget conflict with the Republicans. It is intended to represent the estimated $2,000 in increased taxes an average household was potentially facing unless Congress acted.

Step 2: NodeXL analyzes the collection of Tweets that contained the keywords or hashtag looking for connections formed when one user mentions or replies to another user. The tweets are sometimes collected over a short time span sometimes over a period up to about week, depending on the popularity of the topic.

Step 3: NodeXL automatically analyzed the network and constructed groups created by an algorithm that places each person in a group based on how densely people tweeting about the topic were connected to each other.

Step 4: NodeXL draws the social network map with users represented by their profile photo, groups displayed in boxes, and lines drawn among the people who link to each other either by following, replying to, or mentioning one other.

Boxes: NodeXL divides the network into groups (G1, G2, …) located in separate boxes and labeled by the top hashtags used in the tweets from the users in each group.

Pictures/Icons: Each Twitter user who posted on this subject in the time period is represented by their profile picture. The bigger the picture, the more followers the Twitter user has.

Edge/Line: Each line represents a link between two Twitter users who follow, reply to, or mention one another. Inside a group the lines make a dense mass. Between groups, fewer people follow one another.

Bridges: Twitter users who have followers in multiple groups and pass along information between them.

Groups and density: The Twitter users who follow, mention, or reply to one another bunch together. The thicker/denser the group, the more people inside it are connected to each other and the less connected they are to people outside their group.

Hubs: The closer a picture is to the center of the group, the more connected to other group members the Twitter user is. These are often "influential" users.

Circles: Represent tweets that do not mention or reply to another Twitter user.

Isolates and small groups: Relatively unconnected Twitter users who tweet about a subject but aren't connected to others in the large groups who discuss the same topic.
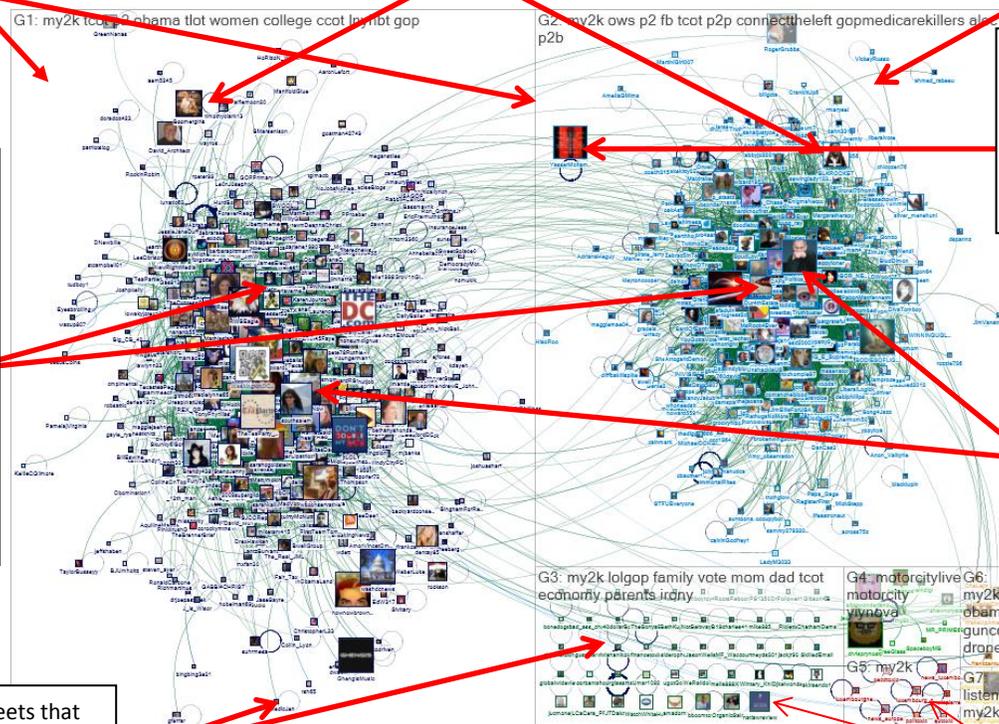
What this all means

In the **Polarized Crowd** Twitter social media network map, two big groups of mostly disconnected people talk about the same subject but in very different ways and not to people in the other group. People in each group connect to different hub users. There are few bridges between the groups. This topic attracts two communities, with relatively few peripheral or isolated participants. Users in the two main groups make use of different URLs, words, and hashtags. See Part 2 for a detailed section on Polarized social media networks.

Influencers: Hubs and bridges in networks

Social media networks have an overall structure while the individual people within them have a local network structure based on their direct connections and the connections among their connections. Network maps show that each kind of social media crowd has a distinct structure of connection and influence. Key users occupy strategic locations in these networks, in positions like hubs and bridges.

Network maps can highlight key individual participants in Twitter conversation networks. There are several indicators of an individual's importance in these network images. Each user is represented by her/his profile photo with a size proportionate to the number of other users who follow them. Some people have attracted large audiences for their content and are represented with a larger image. Some users in these conversation networks link to and receive links from far more Twitter users than most others. Network maps locate the key people who are at the center of their conversational networks – they are "hubs" and they are notable because their followers often retweet or repeat what they say. Some people have links across group boundaries – these users are called "bridges." They play the important role of passing information from one group to another. These users are often necessary to cause a message to "go viral."

NodeXL analyzes the content created by the people within each network and each subgroup within the network. Content is analyzed by examining the words, URLs, and hashtags that are most commonly used in the network and in each subgroup. Social media network crowds in each group have structures of content use with varying levels of overlap and diversity in contrast to their neighbor groups.

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

Pairs of network types: Division, density, and direction

The network types we have identified group together in pairs based on their key properties. Networks can vary in terms of their internal divisions, density, and the direction of their connections. The first two network types are opposites of one another in terms of division or unity; the **Polarized Crowd** type is divided while the **Tight Crowd** network is unified. The next pair of network types, **Brand Clusters** and **Community Clusters**, have large populations of isolates, but vary in terms of the density of clustered connections. The Brand Cluster network structure has small disconnected groups with many isolated participants, while the Community Clusters network structure has larger, more connected groups along with many isolates. The last two networks are inversions of one another: the **Broadcast Network** features many spokes pointing inward to a hub while the **Support Network** structure features a hub linking outward to many spokes. Each of these network types is described in detail below.

# Network metrics distinguish group types

Our initial six forms of social media networks can be more precisely defined in quantitative terms as relationships between different network measures – Figure 2 below.

Figure 2

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

Diagrams of the differences in the six types of social media networks would look like Figure 3:

Figure 3
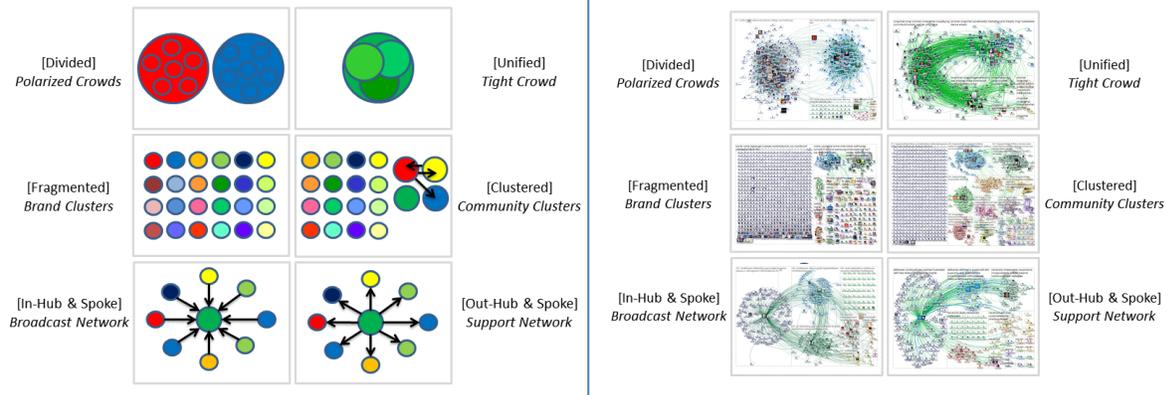
A gallery of other social media network map examples

We have compiled network maps of other conversations illustrating each of the six different conversational structures on Twitter. It can be found [here](). Furthermore, since 2010, some of the regular users of NodeXL have posted their work and network data and visualizations to the NodeXL Graph Gallery website: http://nodexlgraphgallery.org/Pages/Default.aspx. NodeXL is an open source and free Excel add-in that can be downloaded from the site http://nodexl.codeplex.com. Readers are welcome to download the tool and the data sets we reference. The data sets are linked to copies on the NodeXL Graph Gallery site. We invite others to participate in contributing data and visualizations to the NodeXL Graph Gallery site and we would especially like to see and hear about network maps of other conversational archetypes.

Part 1: In-depth Analysis: Research Method and Strategy

To understand the nature of Twitter conversations, the Pew Research Center Internet Project joined with 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 discovery of these six archetypical network structures emerged over several years as we examined thousands of Twitter networks on hundreds of topics. Some structures such as Polarized Crowds have been noted by other researchers and were anticipated in our exploration, but the other structures emerged by studying many maps. This kind of exploratory data analysis depends on effective visualization techniques. In our case, the key design advance was the Group-in-a-Box layout technique, which presents the results of clustering algorithms so as to clearly show the size of each cluster, connection density within each cluster, and the connection frequency between clusters.
As all exploratory data analysts do, we generated insights which we invite others to replicate with other tools, such as different visual layout techniques or statistical criteria. Our work is in the spirit of observational research that forms categories, like 17th century botanists describing the variety of flowers on a newly discovered island or astronomers whose new telescopes that allow them to see different categories of galaxies. Our naming reflects conjectures about why different structures emerge. These categories and explanations are open to challenge by others who may have differing perspectives and more powerful tools.

Our tool was a software tool 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.

We performed Twitter keyword searches which returned a set of tweets that were then used as datasets for analysis. Network connections were extracted from the content of each tweet returned in Twitter Search results. A link was created for every reply or mention we observed. In addition, NodeXL captures information about the Twitter user's connections to other Twitter members[2]. 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 other people 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

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[2] Twitter has subsequently reduced the accessibility of the Followers network data, see:
http://www.connectedaction.net/2013/06/11/over-the-edge-twitter-api-1-1-makes-follows-edges-hard-to-get/

Betty both posted a message in our dataset that includes the term "politics" and Alice follows Betty on Twitter, our data captured this relationship.

Only publicly available messages were analyzed in this study. No direct messages or other private content were collected or analyzed. Any message defined by its author as private (from, for example, "protected accounts") was 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.[3] 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.

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 other socially and culturally interesting phenomena. No one snapshot or video clip of a crowd completely captures the event, but taken together crowd images provide some insights into an event or gathering. Our method produces 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 structure of the crowd along with the key actors in that crowd.

These social media 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. Each group can be more or less connected to other groups. These structures tell a story about the kinds of interactions that take place in Twitter.

Networks, group density, and diversity of connections

Twitter social media network maps show how interconnected people become when they engage in conversations. People often "clump" into groups. Each network and its sub-groups can be measured in terms of the _density_ of its internal connections. A group of people with many connections among its members is more "dense" than a group that has few connections among the same number of participants. Density is measured as the ratio of the number of relationships among a population 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

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[3] Pew Internet Report on Twitter Demographics: http://www.pewinternet.org/Series/Twitter.aspx

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 separating high or low density groups. Generally, though, networks are considered to be loosely-knit, low density networks when only a few of the participants are connected to one another.

Some people within a sub-group connect to people outside their group. The amount of internal and external connection in a sub-group is an important indicator of how much people in that group are exposed to people with differing points of view in different groups. If there are few ties between groups, people may not be exposed to content from users in other groups. If there are many ties between groups there is likely to be a larger amount of information flowing between them.

More on network hubs and bridges

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 relatively rare highly connected users as "hubs." Many other users follow these hub users; far more follow the majority of other people in the network. Hubs are important because they have large audiences. Some people who have fewer connections can be equally important if their links are rare, connecting across the network to otherwise disconnected 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.

Part 2: Conversational Archetypes: Six Conversation and Group Network Structures in Twitter

After examining thousands of maps of hundreds of subjects and events we found six distinct network structures in Twitter social networks. Each is profiled below. There is no doubt that there can be other styles and structures of social media networks remaining to discover. 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. Similar structures may occur in similar types of social media services, but it might also be the case that different kinds of social media services may generate different structures of networks.

Network Type 1: Polarized Crowd

Polarized Crowd 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.

#My2K

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.

The hashtag "#My2K" was 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 "2K" 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 social media network graph that represents a network of 688 Twitter users who tweeted a message that mentioned "My2K" starting January 6th and ending on January 8th, 2013. 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.

The social media network map for #My2K looks like Figure 4 below:

Bridge: Most people in a Polarized Crowd are tied to others in the same group, who often share their views. There are rare users who have connections to other groups. In this case the user in the red circle is @YasserMohamed2, an Egyptian human rights activist, who has connections to Twitter users in both groups.

Figure 4: Polarized Crowd network

What you see: The network graph represents connections among 688 Twitter users whose tweets contained the hashtag #My2K between Sunday, January 6 and Tuesday, January 8, 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 "replies to" to "mentions."

What it means: In the Polarized Crowd network map, two large dense groups of people talk about the same subject, but do not connect to each other or use the same words, URLs and other hashtags. There are few users who bridge connections between these groups. Few people who talk about this subject are "isolated" from others; most users are connected to at least a few others.

Liberal group: This group is dominated by references to liberal hashtags such as Occupy Wall Street and Progressives 2.0, and by liberal commentators such as @NHLABOR_NEWS and @Politics_PR.
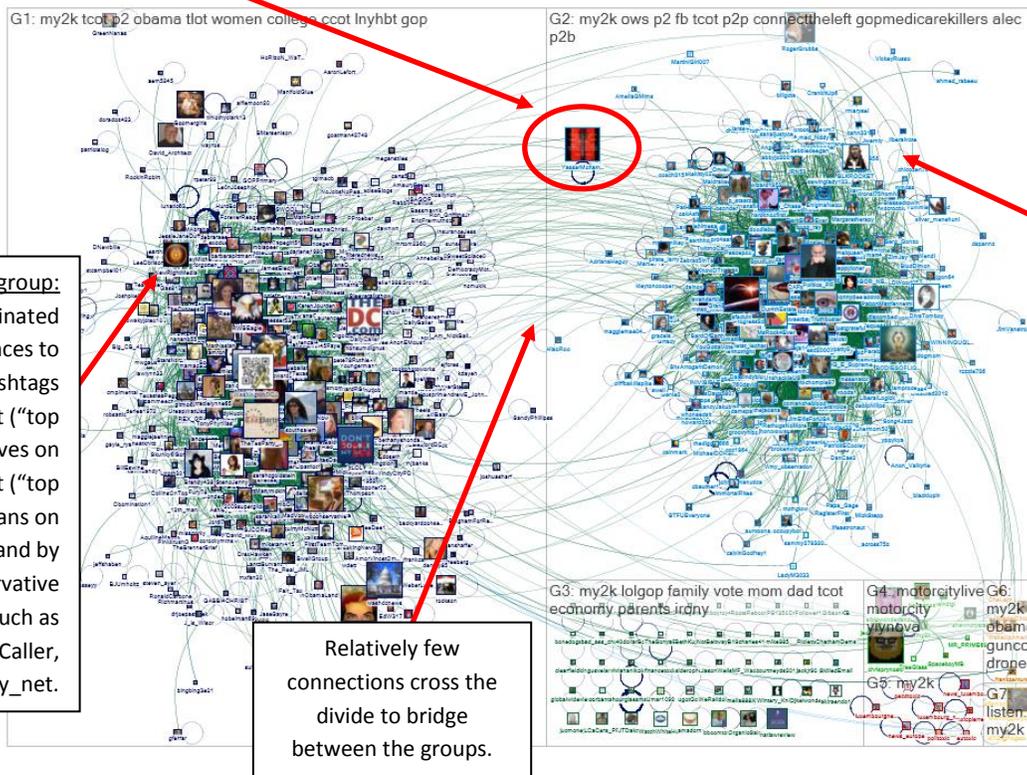
Conservative group: This group is dominated by references to conservative hashtags such as #tcot ("top conservatives on Twitter") and #tlot ("top libertarians on Twitter"), and by conservative commentators such as @DailyCaller, @TheTeaParty_net.

Relatively few connections cross the divide to bridge between the groups.

This is the network of connections among the 688 Twitter users who tweeted "#My2K" over a period from Jan 6-8, 2013. There is a green line or "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."

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

Analysis of the content of the tweets created by the people in each group showed that the words, hashtags, and URLs mentioned 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 "**T**op **C**onservatives **o**n **T**witter") 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" ("**O**ccupy **W**all **S**treet") and "#p2" ("**P**rogressives **2**.0") to their tweets, suggesting that they identify with progressive politics.

The network 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— these users are called "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 are already discussing the topic.

In the middle of each of the two large groups are users who are "hubs"; people with many connections. In a Polarized Crowd network, these connections rarely span the divide to connect to people in other groups. 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, the topical focus and orientation each group displays is brought into focus – Figure 5 below.

Figure 5: Top hashtags by frequency of mention for the two largest groups in the #MY2K Twitter network map.

Top Hashtags in the conservative-oriented Group 1[4]	Top Hashtags in the liberal-oriented 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)

Similarly, the most frequently used URLs in the tweets in each group are an indicator of 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 Figure 6 below. Group 1 links to

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

partisan news sites devoted to a conservative perspective. Group 2 links to mainstream and liberal news sites and services.

Figure 6: The web URLs most frequently used in the two largest groups discussing "#My2K."

Top Hashtags in Tweets in conservative-leaning Group 1	Top Hashtags in Tweets in liberal-leaning 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 Mark Pocan - Explains how ALEC is working to eliminate public education
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/

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 another group. Indeed, Figure 7 below contrasts the connections within and between groups, highlighting how few people in each group link to people in the other group. 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.

Figure 7: No talk across the aisle in Twitter Polarized Crowd conversations

The % of connections between the two largest groups in the #My2K network map. Conservatives connected with one another and liberals connected with themselves, but few connected outside their own group.
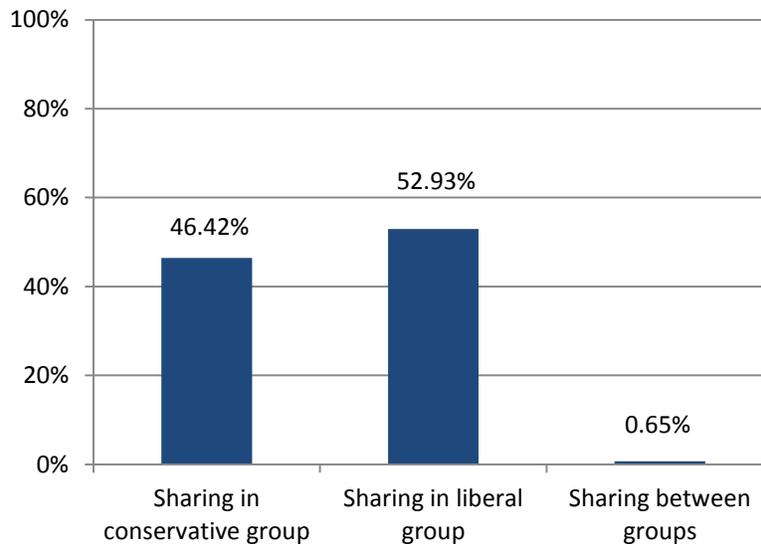
Source NodeXL Twitter data collection Jan 6-8, 2013. In all, there are 13,341 connections within and across the major groups in this network, the majority start and end within the same group while just a small fraction cross to the other group.

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There were 13,341 different relationships (created by tweets that contained other users' names or "follows" connections between two users) among those who used the hashtag #My2K from January 6-8, 2013. Figure 7 shows that only .65% (less than 1%) of connections crossed between the two groups.

Most topic networks on Twitter do not look like a Polarized Crowd, but many political discussions are structured in this way.

Sequester OR Sequestration

For instance, a similar Polarized Crowd conversation structure can be seen in the network of people discussing "Sequester OR Sequestration." Data for Figure 8 can be retrieved from: https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=3441
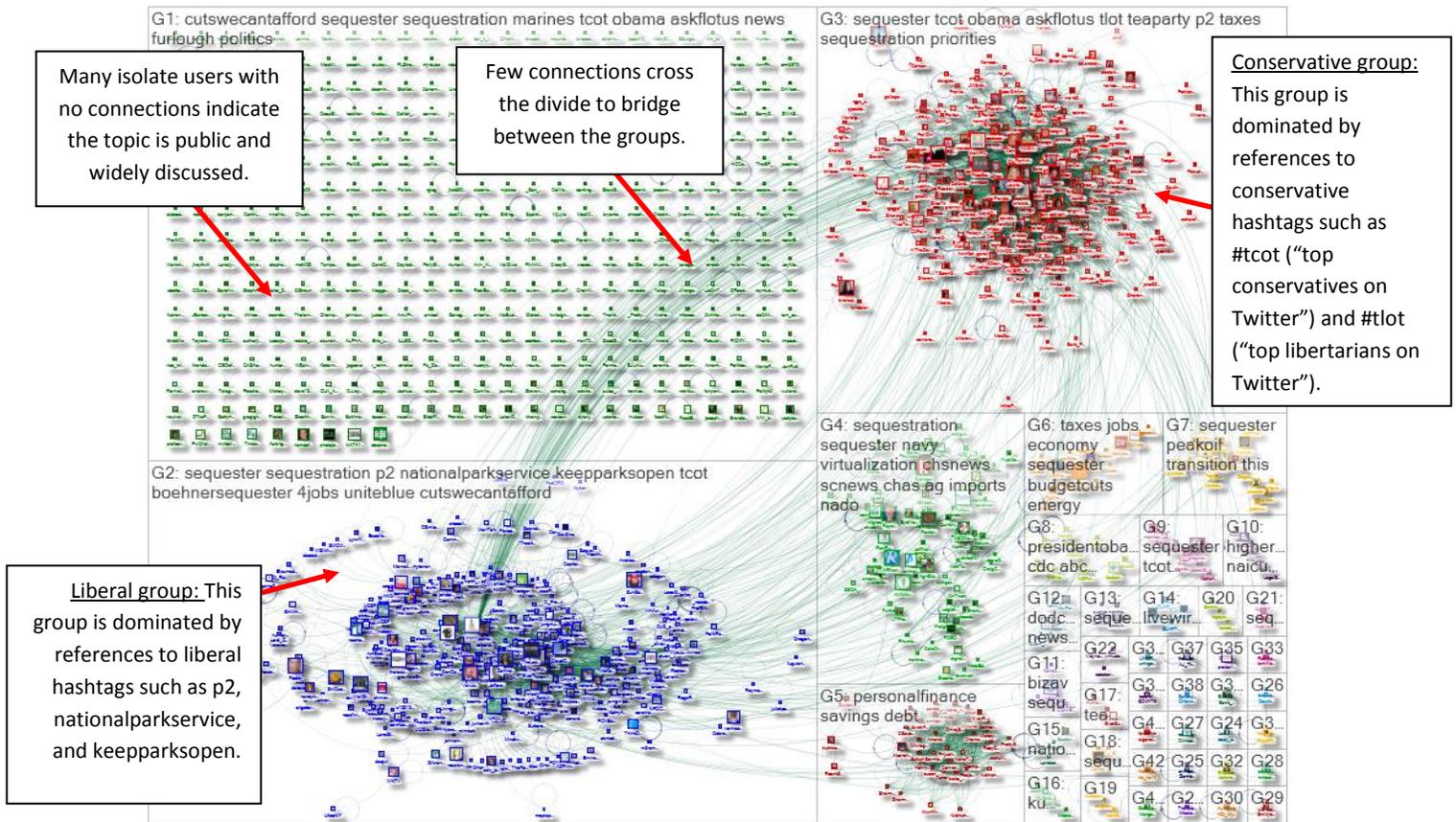
Figure 8: The graph represents a network of 1,253 Twitter users whose tweets contained "sequester OR sequestration" on March 11, 2013. There is a green line or "edge" for each follows relationship. There is a blue edge for each "replies-to" and "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions."

Automatic across the board budget cuts, called "sequestration," were imposed on federal agencies in 2013 by the U.S. Congress. The topic of "sequestration" is a divisive political issue that generates a clearly Polarized Crowd structure 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 follow or reply to others who also tweet about the topic. This is a common structure also found in Brand Cluster networks (Network Type 3).

What makes this structure a Polarized Crowd is the relationship between the liberal-leaning group 2 and the conservative-leaning group 3. These are two large dense groups of people who are both tweeting about "Sequestration." But while people in each group have many connections within their group, they have relatively few connections to people in the other group.

The chart below (Figure 9) shows how the two groups are linked to one another. Only 3% of the links in the network cross between the two groups. Contrasted with other networks described below, particularly the Tight Crowd network structure, this level of inter-group connection is very low. The low level of interconnection is an indicator that these groups are socially isolated from one another, despite tweeting about the same topic.

Figure 9: Sharing inside the group, but not outside, in a Polarized Crowd

The % of connections that are shared in groups in the "Sequester" network map where conservatives and liberals shared among themselves but few connected with the other group.
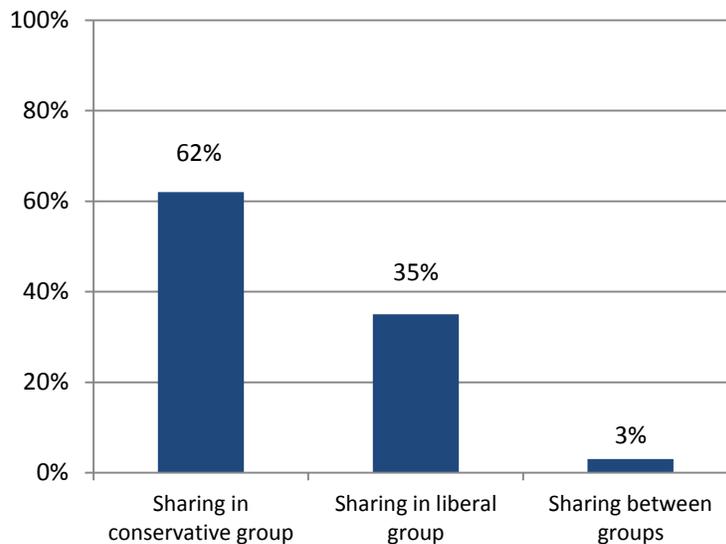
Source NodeXL Twitter data collection March 11, 2013. In all, there are 7,410 connections within and between the major groups in this network map, the majority start and end within the same group while just a small fraction cross to the other group.

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Another indicator of the divisions between these groups can be seen in a comparison of the URLs posted in the tweets created by people in each group – as seen in Figure 10 below. The URLs in Group 2 are critical of conservative positions or cite documents that describe the impact of sequester mandated budget cuts. In contrast, the URLs mentioned in Group 3 are critical of concerns that the budget cuts will have major consequences. They also link to concerns about immigration politics and cite criticism of the Administration.

Figure 10: Contrasting URLs frequently used in Group 2 and Group 3 in the "sequestration" Twitter network

Top URLs in Tweets mentioning "sequestration" in liberal-leaning Group 2	Top URLs in Tweets mentioning "sequestration" in conservative-leaning 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/

The differences between these groups are also reflected in the different hashtags most frequently used in the tweets from users in each group – Figure 11 below.

Figure 11: Top Hashtags by frequency of mention in Group 2 and Group 3 in the sequestration Twitter Network

Top Hashtags in Tweets in liberal-leaning Group 2	Top Hashtags in Tweets in conservative-leaning Group 3
Sequester	Sequester
Sequestration	Tcot
p2	Obama
Nationalparkservice	Askflotus
Keepparksopen	tlot

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" ("**P**rogressives **2**.0") hashtag is the most frequently used label, while in Group 3 "tcot" ("**t**op **c**onservatives **o**n **T**witter") 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 **F**irst **L**ady **of t**he **U**nited **S**tates), and tlot ("**t**op **l**ibertarians **o**n **T**witter").

Many politically controversial topics display the Polarized Crowd network structure; these topics 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 Twitter conversations have this form.

Network Type 2: Tight Crowd network communities

There are many topics that have a network structure that is the opposite of the Polarized Crowd network structure. We call this the Tight Crowd network structure. Unlike Polarized Crowd network conversations, people in Tight Crowd networks have strong connections to one another and significant connections that bridge between any 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 Tight Crowd networks. These networks are composed of a few dense and densely interconnected groups where conversations sometime swirl around, involving different people at different times. In the Tight Crowd network map there is no "other" group like those found in a Polarized Crowd network.

Tight Crowd network conversations have few if any isolates – the people who have no connections to anyone else in the network. In network terms, 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. Often, these are newcomers to the topic.

#CMGRChat

The #CMGRChat hashtag yields a good example of a Tight Crowd network conversation: https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2434. The #CMGRChat hashtag is used by people who manage digital communities for their organizations. They are social media professionals who discuss and share resources about the best practices in running message boards, Facebook pages, and Twitter streams for their companies or non-profit groups. People who Tweet using the hashtag #CMGRChat form a kind of informal association of people who share an interest in digital community management. While some of these contributors have more connections than others, no participant in this discussion has zero connections and most have several.

It often seems that "everyone knows everyone" in these dense network communities of connected participants. Figure 12 below is the network map of tweets using the hashtag #CMGRChat between January 14 and January 18, 2013. It shows a conversation divided into a few sub-groups with many connections bridging the divisions, suggesting these groups are more closely tied sub-communities rather than the divided, insulated, and separate communities found in the Polarized Crowd network structure.

Figure 12: Tight Crowd network community

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

What it means: Tight Crowd network community map illustrates high levels of internal connection – almost everyone in this network has multiple connections. There are few or no isolates—that is, users who tweet the hashtag but do not follow, mention, or reply to anyone else. Groups in the conversation emerge as Twitter users focus on different subtopics of interest to the community. In contrast to the Polarized Crowd network pattern, no large groups are isolated from each other in the Tight Crowd network.
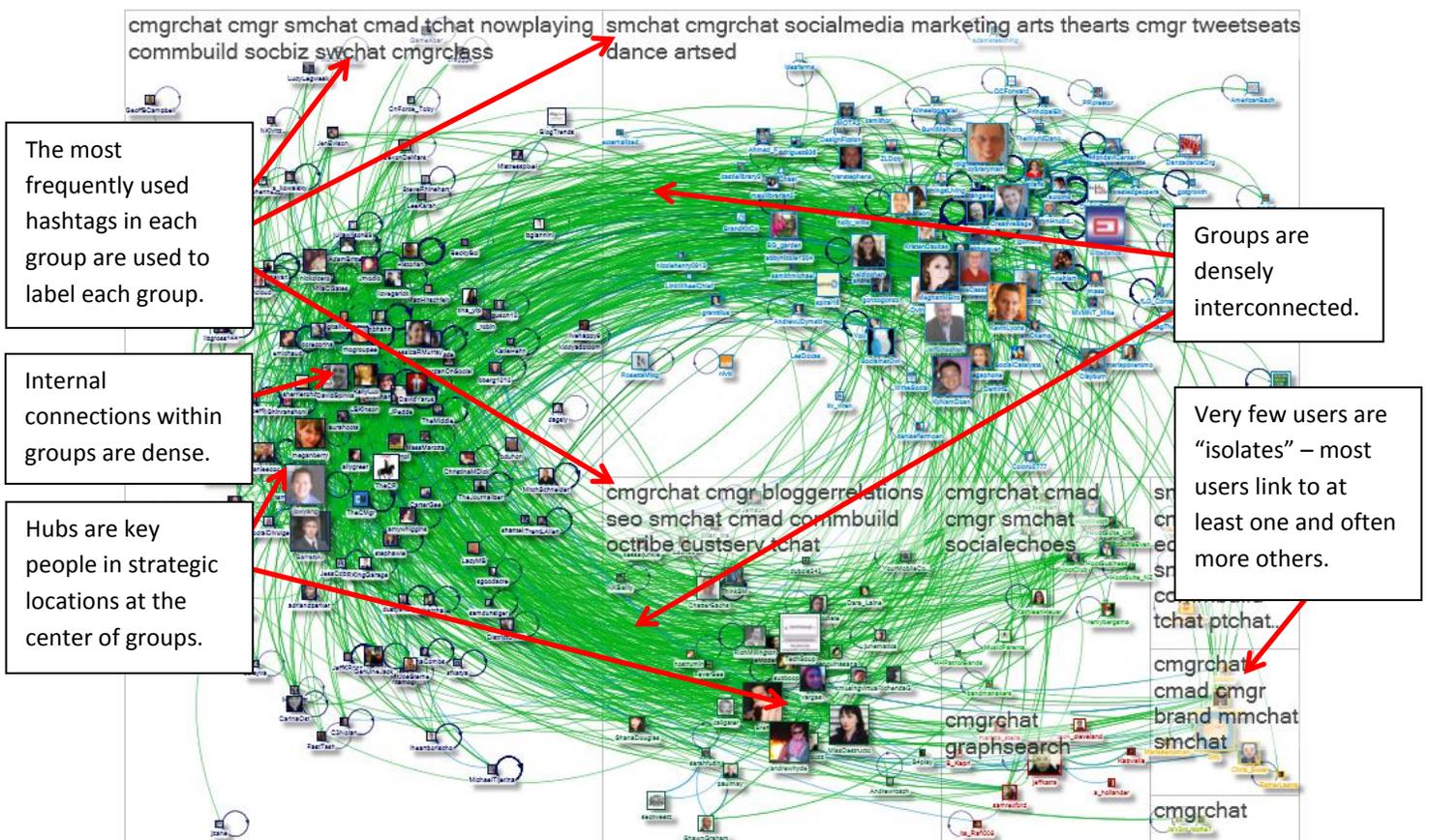
This network graph is an example of a Tight Crowd network community. Here, we examined 268 Twitter users who were having a conversation around hashtags used by those who hold similar job titles as "digital community manager." The hashtags are "#cmgrchat OR #smchat" and they are used by people who manage online communities for their organizations, such as health support groups, dog rescue organizations, and companies and consultants that serve those firms. Their discussions often revolve around what technology to use, techniques for using social media to draw attention to their causes, and stories or blog posts talking about how social media is affecting groups. The tweets were made on January 14-18, 2013. There is an arrow for each "follows," "replies-to," or "mentions" relationship in a tweet. There is a circle/loop for each tweet that is not a "replies-to" or "mentions."

While the frequently mentioned URLs in each of the largest groups in the #CMGRChat network are different, there is little evidence of a divided focus as seen in a Polarized Crowd. Many of the URLs point to resources related to a range of social media related topics, but the topics are not in conflict with one another – See Figure 13.

Figure 13: Contrasting URLs frequently used in the three large 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/

A similar structure 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) – Figure 14.

Figure 14: Top Hashtags by frequency of mention in the largest 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

Examination of the structures of linkage between groups in Figure 15 shows that there is significant cross connection, indicating the presence of a single community, rather than a divided Polarized Crowd.

Figure 15: Sharing in a Tight Crowd

The % of connections that are shared in the #CMGRChat conversations inside groups and among groups—relatively high number connect across boundaries
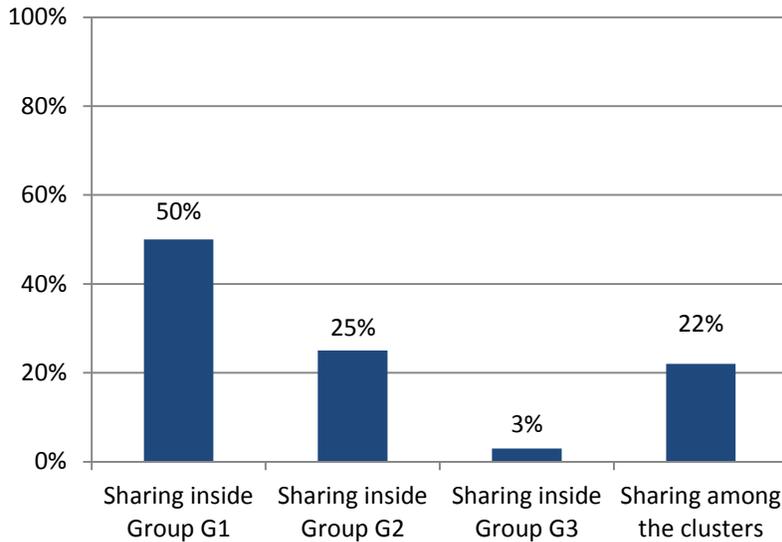
Source NodeXL Twitter data collected January 14-18, 2013. Analysis of links among groups. In all, there are 4,342 connections within and between the major groups in this map. These columns represent the portion of connections that are in-group versus shared among the groups.

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MLA13

The #MLA13 hashtag, used in conjunction with the Modern Language Association conference, is another example of a Tight Crowd social media network. The Modern Language Association annual conference attracts many scholars who study culture and language. Like "#CMgrChat," the "#MLA13" topic network in Twitter is a Tight Crowd with few isolates and a few small groups with significant interconnections.

Figure 16 below is the network map that represents the connections among 599 Twitter users whose recent tweets contained "mla13." The dataset for this file is available from: http://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2274.
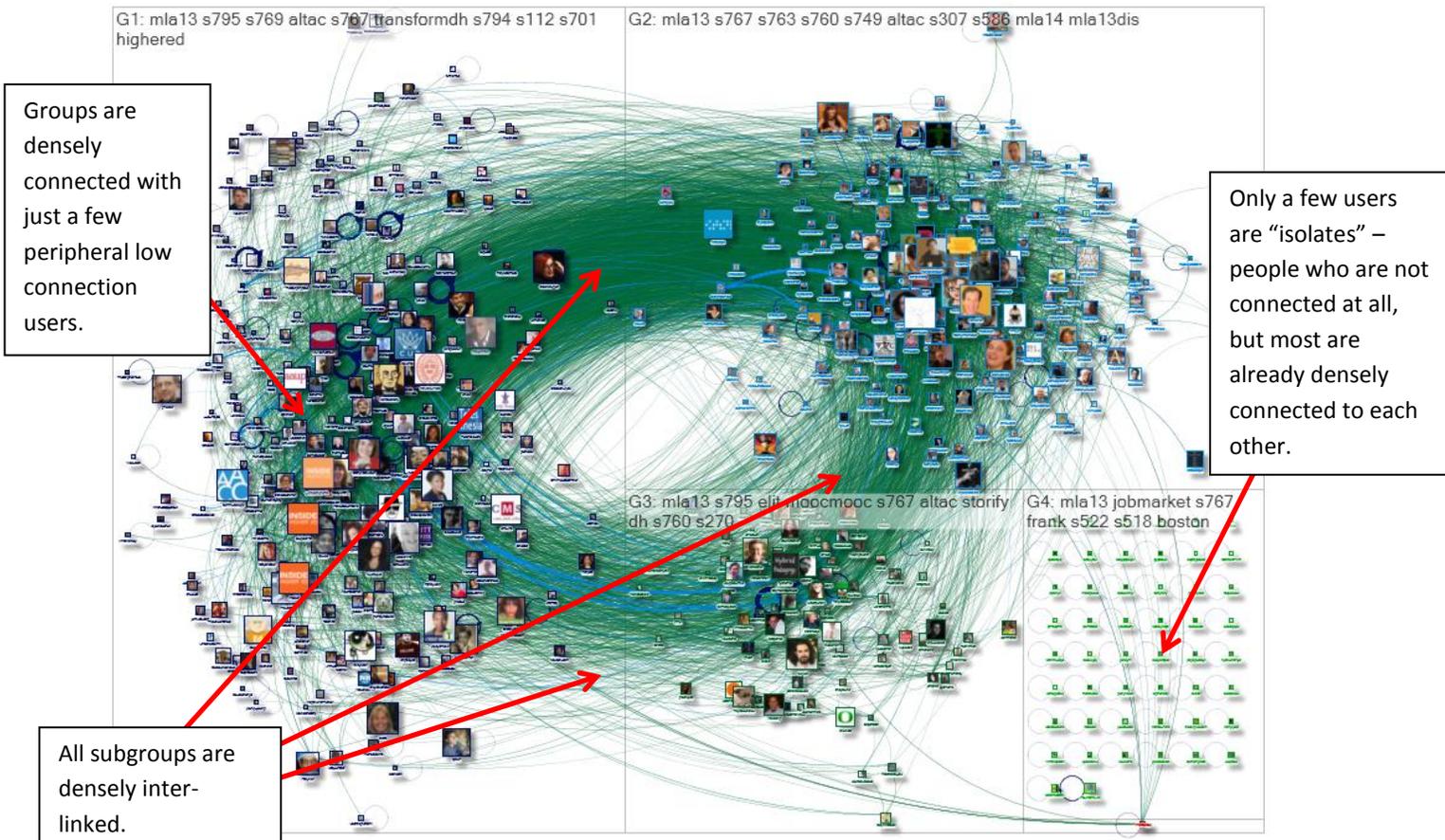
Figure 16: Network graph of 599 Twitter users whose tweets contained "mla13" on January 6, 2013. There is a green line or "edge" for each follows relationship. There is a blue edge for each "replies-to" and "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions."

This is a Tight Crowd structure because 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 the people who mentioned the event had no connections at all to the others talking about the conference. These "isolates" are an indication that news of the event was reaching new communities of people.

The dense connections among most people talking about "#MLA13" suggest that this is a Tight Crowd community. 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 #MLA13 network are displayed in Figure 17. The overlap among these lists is an indication that groups share 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 #MLA13 network, all the sub groups linked to common articles on the InsideHighEd, 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 and topic interest rather than major divisions. These groups are lobes of a common group rather than separate disconnected entities.

Figure 17: Contrasting URLs frequently used in the three largest groups discussing #MLA13.

Top URLs in Tweets in Group 1	Top URLs in Tweets in Group 2	Top URLs in Tweets 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/

The common focus between the groups in the MLA13 network is also reflected in the most frequently used hashtags as displayed in Figure 18 below. The top hashtags in each group refer to the conference sessions that 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 session hashtag that was unique to it.

Figure 18: Top Hashtags by frequency of mention in the three largest groups in the #MLA13 Twitter Network

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

The connections people create can stay within their group or cross boundaries to connect to someone in another group. The measure of these intergroup connections reflects the Tight Crowd or Polarized Crowd character of a network. The rate of internal connection is plotted in Figure 19. The high level of cross group linkage is a strong indicator that the MLA13 network is a Tight Crowd network.

Figure 19: In a Tight Crowd network people link to people in
other groups

*The % of connections that are shared between Twitter users in major network groups
using the hashtag #MLA13.*
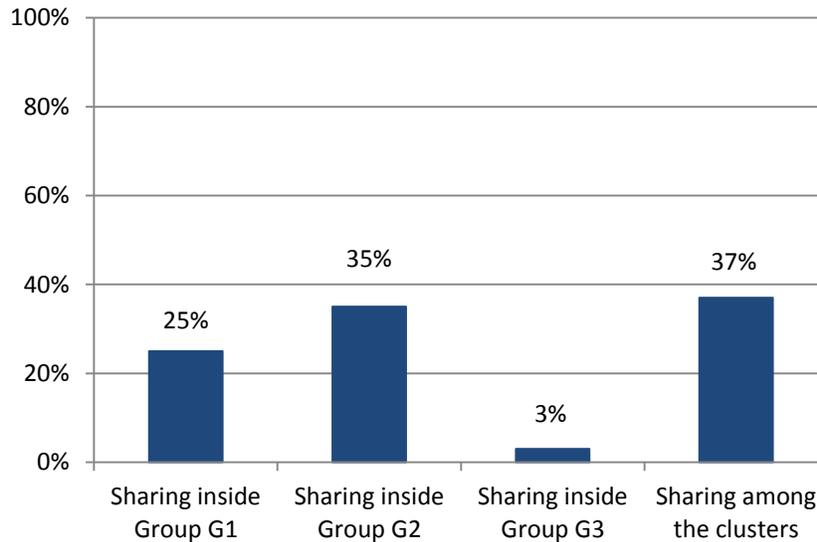
Source NodeXL Twitter data collection January 6, 2013. In all, there are 17,447connections within
and between the entire three largest groups. These are the portions of connections that are in-
group and shared among the groups.

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

Network Type 3: Brand Clusters: Discussions of popular products and events

People who tweet about brands and other public topics often form a network structure that is different from either the Tight Crowd or Polarized Crowd network communities. Brand Cluster networks often have very low density and many isolated participants. In a Brand Cluster network many people are likely to mention the brand without having any connection to other people who also mention the brand. Advertised products, public events, and major news events are likely to have this structure.

Apple

An example of a Brand Clusters network is Apple. The Apple social media network data set is available from: http://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=4681

All globally recognized firms have a distinctive structure of connection and conversation among the people who mention them. The Brand Clusters Twitter network map features large populations of people who have no ties at all to the others who are tweeting about the same subject. In the Apple Brand Clusters network in Figure 20, most users do not follow, reply to 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 they lack any connection to one another.

This network structure is common when a topic or term is widely known. Some small groups are present in a Brand Clusters network, visible in the upper right corner of the network in the map below. In this case, these groups are composed of small collections of users who discuss features and new releases of Apple devices with one another.
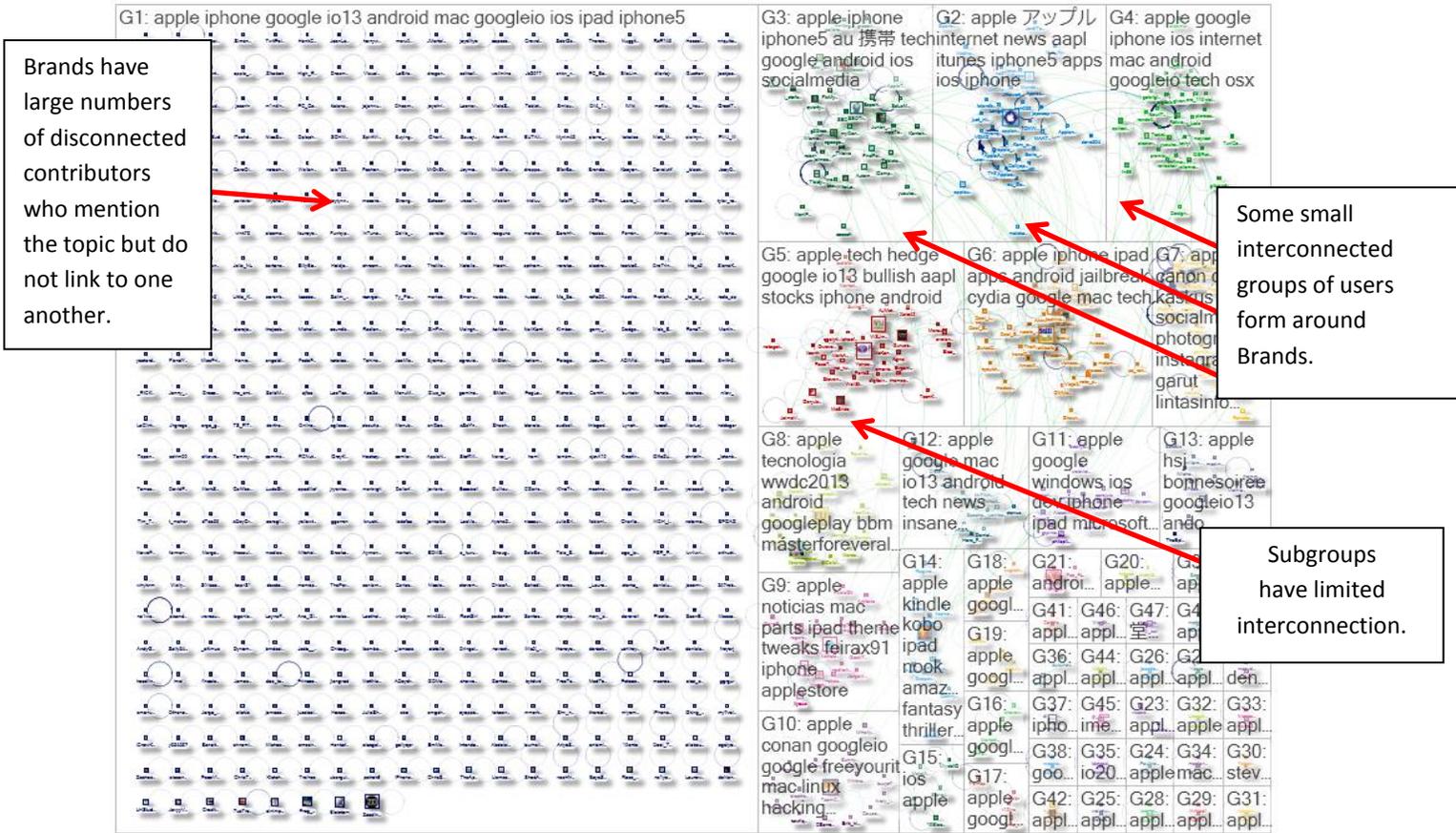
Figure 20: Network graph of 834 Twitter users whose tweets contain the word "Apple" or "#Apple," collected on May 15, 2013. There is a blue line or "edge" for each "replies-to" or "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions."

In the Twitter networks that form around Brand Clusters, there is limited interaction between users and little overlap in terms of the content that is shared and the resources to which they link.

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 – Figure 21.

Figure 21: Contrasting the most commonly used URLs in the five largest 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

Users in each group also made use of different hashtags in their tweets. The table below displays the frequently mentioned hashtags in the largest groups in the Apple network. The different use of hashtags in each sub-group suggests that each group is devoted to a discussion of different aspects of Apple: Some discuss individual Apple products (iTunes, iPhone), others discuss investment in Apple, and still others compare Apple and Android mobile devices – Figure 22.

Figure 22: Top Hashtags by frequency of mention in the largest groups in the #Apple Twitter Network
*The word "Apple" in Japanese; ** The word "mobile" or portable in Chinese*

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
アップル*	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

Mentions of Brands in Twitter generate Brand Cluster networks composed of many disconnected individuals and some small groups. These groups are relatively interconnected, suggesting that Brand Cluster conversations in Twitter are not in the form of a Polarized Crowd. The rates of connections between groups discussing Apple in the figure below illustrate this limited level of interconnection – Figure 23.

Figure 23: Considerable in-group sharing, but limited sharing between groups in a Brand network

The % of connections that are shared between Twitter users in groups using the words "Apple" or "#Apple" – and the relatively sparse sharing among groups
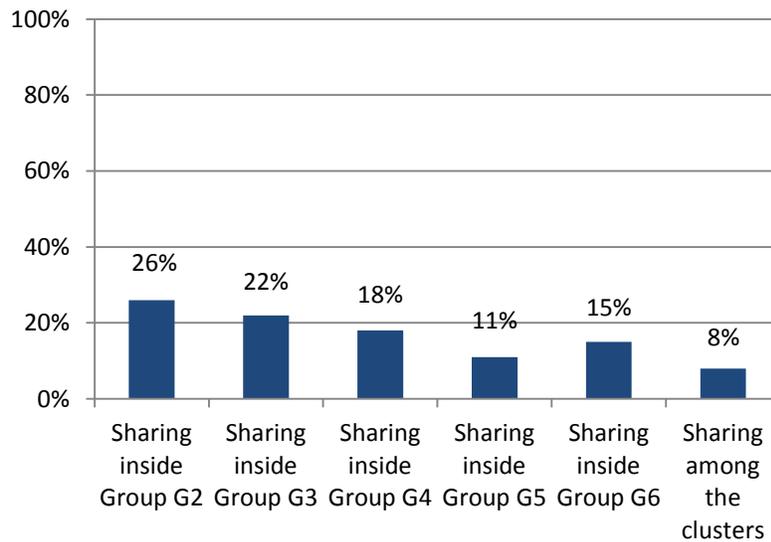
Source NodeXL Twitter data collection May 15, 2013. In all, there are 740 connections within and between the major groups in this map. These are the share of connections that are in-group versus shared between the groups.

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Cisco

Cisco—another major brand that produces network technology that powers the internet—shares the Brand Clusters structure created by Apple. There is a large group of people that mentioned Cisco on Twitter, but they are largely disconnected from one another. In their conversations, these people all mention Cisco but do not connect to anyone else (see Figure 24 below). Alongside this large population of disconnected isolates, smaller clusters of connected users have formed in the Cisco Brand Clusters network. These small connected groups of people have few linkages to other groups. Analysis of the content in the messages in these groups shows that each group references a different set of URLs and hashtags.
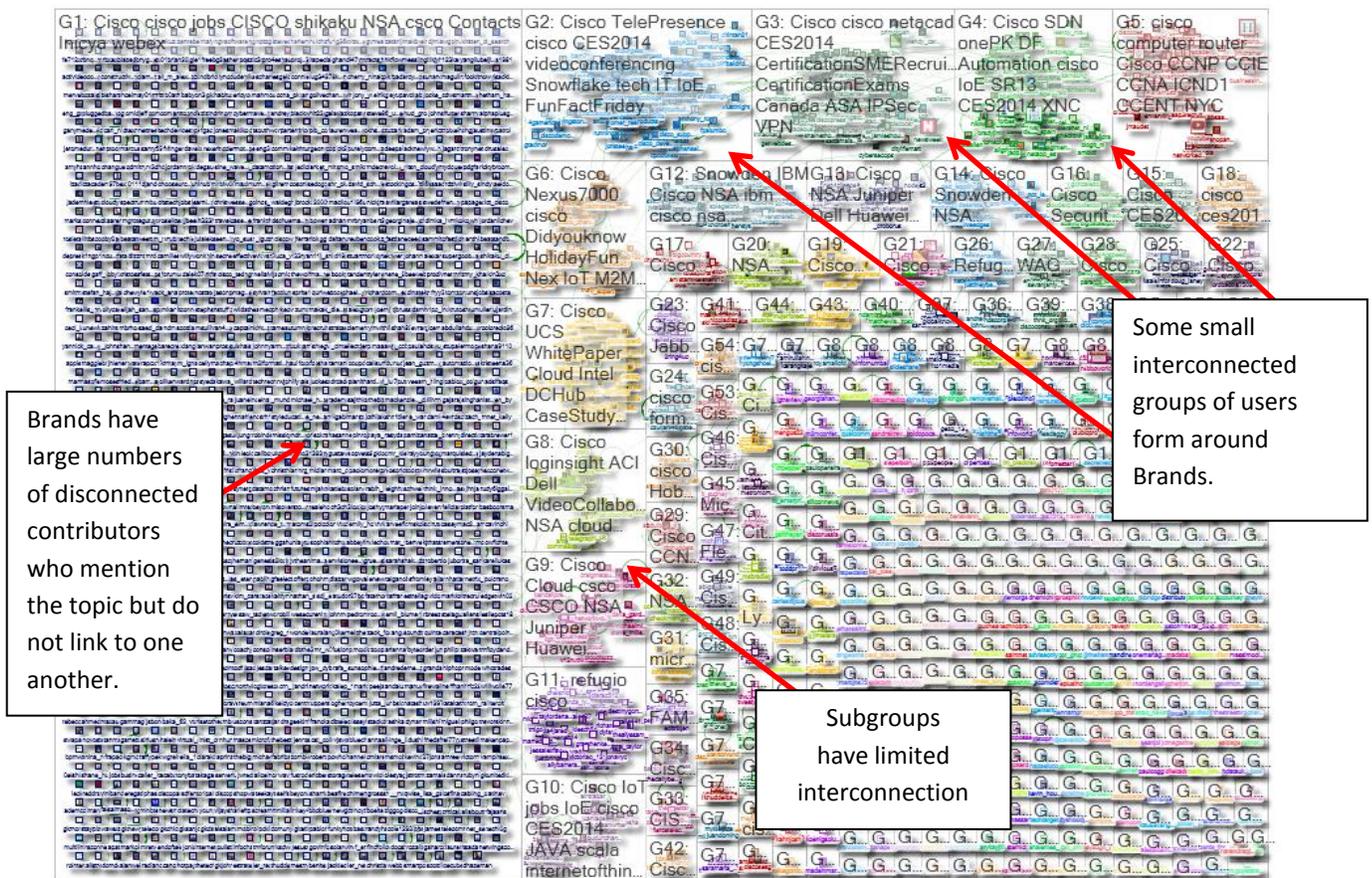
Figure 24: Network graph of 2808 Twitter users whose tweets contain the hashtag #cisco collected on January 9, 2014. There is a line or "edge" for each "replies-to" or "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions."

The URLs used in each of the largest connected groups are very distinct with limited overlap. This suggests each group was focused on different topics and interests related to the Cisco brand – Figure 25.

Figure 25: Contrasting the most commonly used URLs in the largest groups discussing #cisco.

Top URLs in Group 2	Top URLs in Group 3	Top URLs in Group 4	Top URLs in Group 5
http://ec2-184-72-243-192.compute-1.amazonaws.com//6012dKl4	http://ec2-184-72-243-192.compute-1.amazonaws.com//ls6t	http://www.sdncentral.com/education/cisco-onepk-glue-networks-demo/2013/12/	http://rover.ebay.com/rover/1/711-53200-19255-0/1?ff3=2&toolid=10039&campid=5337408883&item=290984521010&vectorid=229466&lgeo=1
http://ec2-184-72-243-192.compute-1.amazonaws.com//6013dpQx	http://www.cisco.com/en/US/solutions/collateral/ns1015/ns1247/at_a_glance_c45-729648.pdf	http://www.sdncentral.com/channel/cisco	http://rover.ebay.com/rover/1/711-53200-19255-0/1?ff3=2&toolid=10039&campid=5337408883&item=181260153295&vectorid=229466&lgeo=1
http://ec2-184-72-243-192.compute-1.amazonaws.com//6018bLEo	http://www.telecompaper.com/news/cisco-selected-as-official-supplier-of-rio-olympics-2016--985154	http://www.sdncentral.com/cisco-onepk-demo-glue-networks/?utm_source=DF	http://rover.ebay.com/rover/1/711-53200-19255-0/1?ff3=2&toolid=10039&campid=5337408883&item=151160828072&vectorid=229466&lgeo=1
http://blogs.cisco.com/news/transforming-child-safety-through-mobility/	http://ec2-184-72-243-192.compute-1.amazonaws.com//6015d9Ac	http://www.forbes.com/sites/connieguglielmo/2014/01/07/ces-live-cisco-ceo-chambers-to-deliver-keynote/	http://rover.ebay.com/rover/1/711-53200-19255-0/1?ff3=2&toolid=10039&campid=5337408883&item=171194995760&vectorid=229466&lgeo=1
http://ec2-184-72-243-192.compute-1.amazonaws.com//6019dXjJ	http://ec2-184-72-243-192.compute-1.amazonaws.com//6018deU2	http://www.checktwice.nl/2013/12/cisco-steunt-3fm-serious-request-voor-het-zevende-achtereenvolgende-jaar-met-netwerkapparatuur/	http://rover.ebay.com/rover/1/711-53200-19255-0/1?ff3=2&toolid=10039&campid=5337408883&item=131078292658&vectorid=229466&lgeo=1

The hashtags used in each of the largest groups in the Cisco network also illustrate the ways each group is focused on distinct topics and interests related to Cisco – Figure 26.

Figure 26: Top Hashtags by frequency of mention in the largest groups in the #cisco Twitter Network

Top Hashtags in Group 2	Top Hashtags in Group 3	Top Hashtags in Group 4	Top Hashtags in Group 5
Cisco	Cisco	Cisco	Cisco
TelePresence	netacad	SDN	computer
CES2014	CES2014	onePK	router
videoconferencing	CertificationSMERecruitment	DF	CCNP
Snowflake	CertificationExams	Automation	CCIE

The linkages between groups are sparse in this network – few people in one group mention the names of people in other groups – Figure 27.

Figure 27: In a Brand Network, the central organization or idea stands out and there is little sharing across groups

The % of connections that are shared between Twitter users in groups using the hashtag #cisco – highlights the relatively sparse sharing among groups
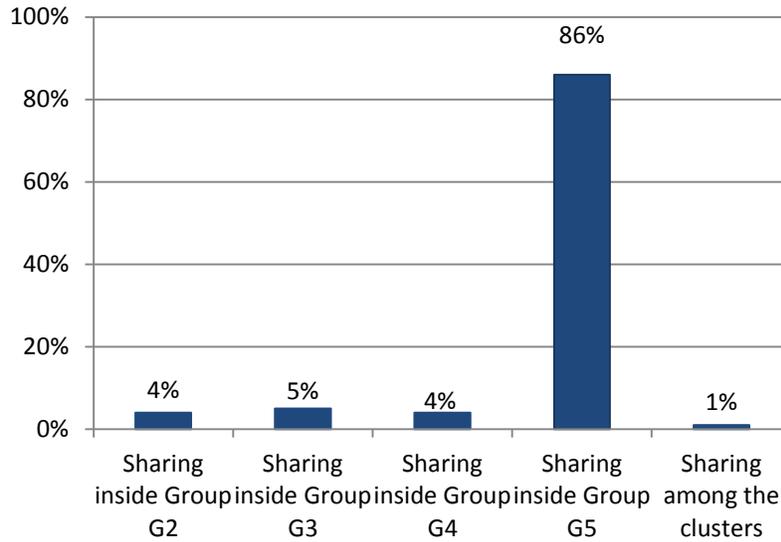
Source, NodeXL Twitter data collection January 9, 2014. In all, there are 4,056 connections within and between the major groups in this map. These are the share of the connections that are in-group versus shared between the groups.

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Network Type 4: Community Clusters

When groups of people in Twitter form networks with several evenly sized sub-groups, a structure different from the Brand Clusters network emerges. Community Clusters are the defining quality of these networks: they feature a collection of medium sized groups, rather than a crowd of mostly unconnected Twitter users.

Flotus

An example comes in Figure 28 below, a discussion of the First Lady Michelle Obama's Twitter hashtag "#Flotus," the hashtag for the "**F**irst **L**ady **o**f **t**he **U**nited **S**tates." The data set is available from: https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2440

While many of the Twitter contributors in this discussion network are isolates, which demonstrates the Brand Clusters quality of this topic, there are also several densely connected groups of relatively equal size in a Community Clusters network. 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.

Community Clusters have large numbers of disconnected contributors who mention the topic but do not link to one another.

Bigger, more interconnected groups distinguish a Community Cluster conversation from a Brand.

Subgroups have heavier interconnections than in a Brand.
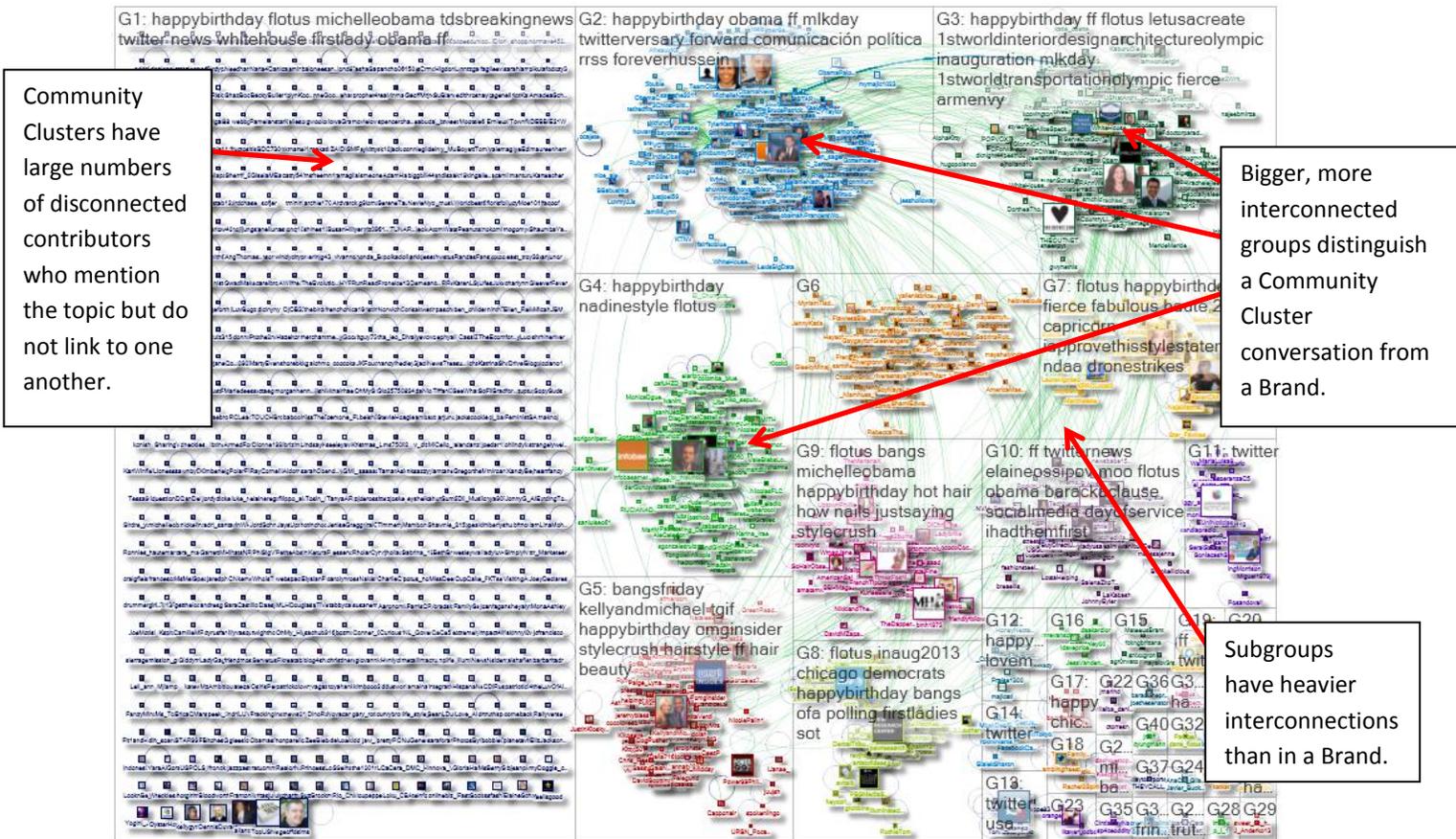
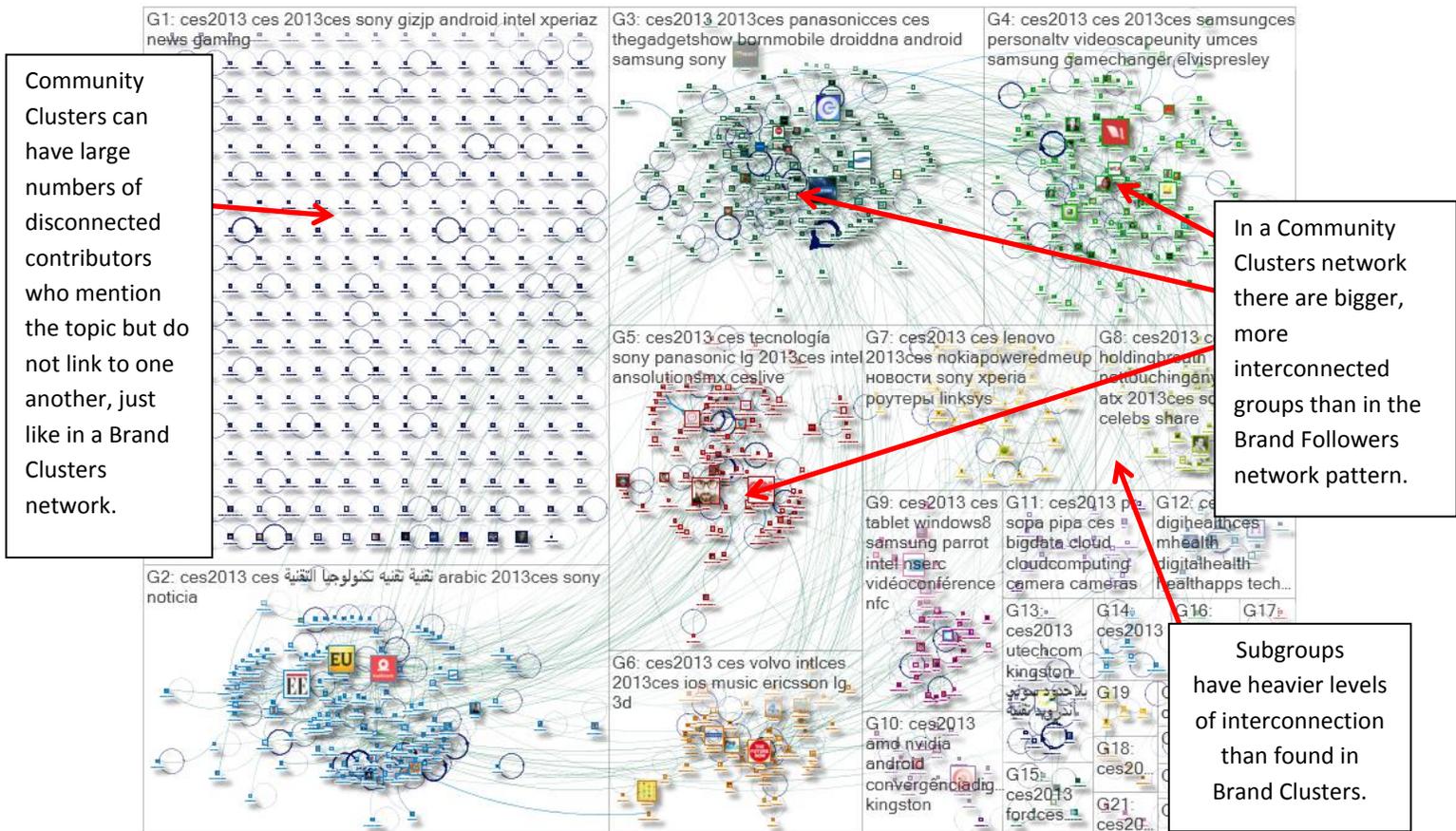*Figure 28: Network graph of 1,260 Twitter users whose tweets contained "Flotus" or "#Flotus," collected on January 18, 2013. There is a green line or "edge" for each follows relationship. There is a blue edge for each "replies-to" or "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions."*

There was more than the usual amount of social media activity related to Michelle Obama that day because the Obama Administration and activists were eager to create messages that mentioned her birthday and to generate attention for her work. At the same time, people made reference to the First Lady in different ways. Some mentioned her birthday, while others focused on the activities of President Obama's allies. These topics are reflected in the different URLs that were cited in each group (Figure 29) and the different hashtags in each group (Figure 30).

Figure 29: Contrasting URLs frequently used in the largest 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=twitterfeed&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

Figure 30: Top Hashtags by frequency of mention in the largest 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

At the same time, there was some, but not overwhelming, overlap among the groups because they shared a common interest in the First Lady. That is evident in the link-count analysis in Figure 31 below. In networks with the Community Clusters structure, 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.

Figure 31: In contrast with Brand Clusters there are more connections inside Community Cluster conversations in Twitter

The % of connections that are shared between Twitter users in groups using the words "Flotus" or "#Flotus" – there are just a few connections that cross boundaries.
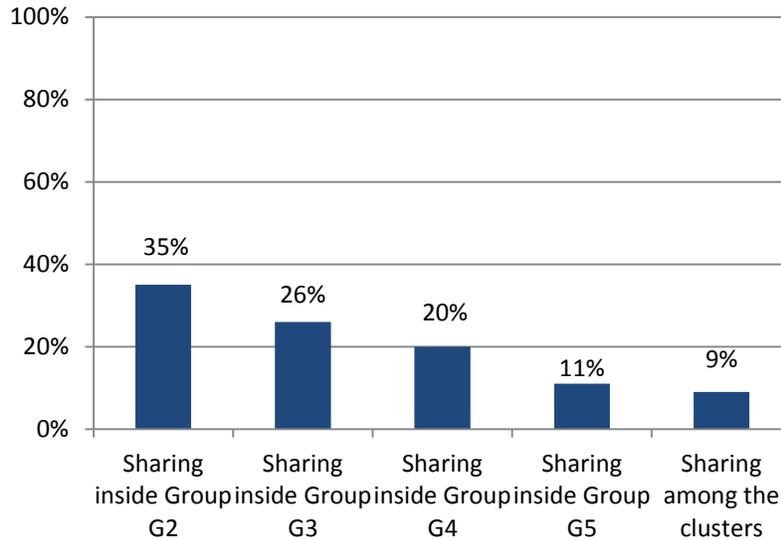
Source NodeXL collection January 18, 2013. In all, there are 1,608 connections within and between the major groups in this map and these columns are the portion of connections that are in-group and shared among the groups.

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CES2013

Another example of the Community Clusters network structure can be found in the connections among the 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 in Las Vegas, Nevada. The map is Figure 32 below. These data can be found at:
https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2275

Community Clusters can have large numbers of disconnected contributors who mention the topic but do not link to one another, just like in a Brand Clusters network.

In a Community Clusters network there are bigger, more interconnected groups than in the Brand Followers network pattern.

Subgroups have heavier levels of interconnection than found in Brand Clusters.

Figure 32: Network graph of 1,260 Twitter users whose tweets contained "ces2013" or "#ces2013," collected on January 8, 2013. There is a green line or "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."

The people tweeting in the groups in a Community Clusters network share a common topic but often have a very different focus. These networks are like conversational bazaars, where interests vary from stall to stall, as reflected in the contrasts between the most popular URLs in each cluster (Figure 33) and the different hashtags (Figure 34).

Figure 33: Contrasting URLs frequently used in the largest 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-ver-sus-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=twitterfeed	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/

Figure 34: Top Hashtags by frequency of mention in the largest groups in the CES2013 Twitter Network
*In Arabic, "Technique", "Tech," "Technology," "Technical," respectively.*

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
تقنية *	panasonicces	samsungces	Tecnología
تقنيه *	thegadgetshow	personaltv	Sony
تكنولوجيا *	bornmobile	videoscapeunity	Panasonic
التقنية *	droiddna	umces	Lg
arabic	android	samsung	Intel

There is overlap among the groups in a Community Clusters style Twitter conversation. People in each cluster do not just link to and talk to people within their own group, they have at least modest levels of connection to people in other clusters, as shown by Figure 35.

Figure 35: Sharing inside and out Community Clusters on Twitter

The % of connections that are shared between Twitter users in groups using the hashtag "#CES2013."
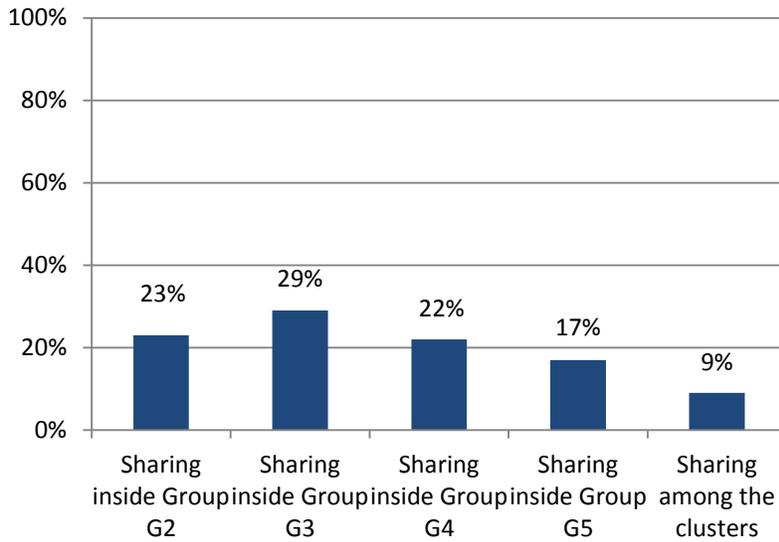
Source NodeXL Twitter data collection January 8, 2013. In all, there are 1,942 connections within and between the major groups in this network map. These are the portions of connections that are in-group and shared among the groups.

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Network Type 5: Broadcast Networks

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

Krugman

An example is the conversation about *New York Times* columnist Paul Krugman's article that appeared on January 11, 2013 – Figure 36 below. The op-ed piece criticized Republicans for their position in the ongoing debate over raising the debt ceiling. Krugman favorably discussed the idea that the U.S. Treasury Department should mint a $1 trillion platinum coin as a way to allow the government to continue borrowing money if there were no solution to the congressional stalemate.

The NodeXL map below contains people who linked to this column on Twitter. All the data contained in this network map are available at: https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2313
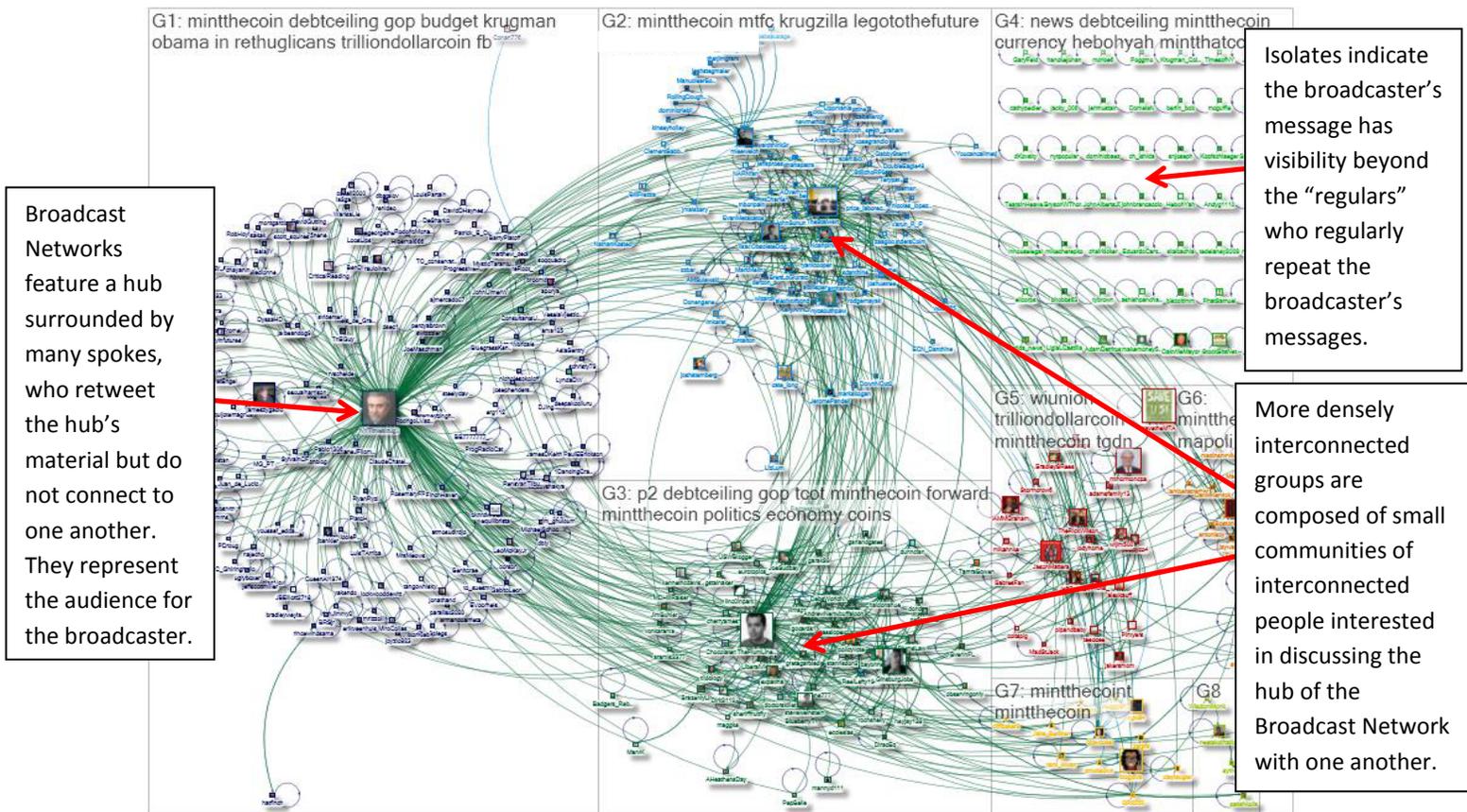
Figure 36: Network graph of 399 Twitter users whose tweets contained a URL to a New York Times article by Paul Krugman captured on January 11, 2013. There is a green line or "edge" for each follows relationship. There is a blue edge for each "replies-to" and "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions."

In this Broadcast Network there is an audience of people who are linked only to Krugman's account. They are visible in Group 1. At the same time Group 2 and Group 3 contain denser collections of people who could be considered parts of different communities interested in discussing Krugman's article with one another. The collection of isolates in group four suggests that the article was visible to a variety of people, even if they were not actively discussing it with other members of the Krugman discussion community or directly repeating Krugman himself.

In Broadcast Networks, there is common use of central URLs – the content that is driving the Twitter chatter (Figure 37).

Figure 37: Contrasting URLs frequently used in the largest groups discussing a New York Times article by Paul Krugman.
Links appearing only once were removed.

Top URLs in Tweet in Group 1 *	Top URLs in Tweet in Group 2	Top URLs in Tweet in 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/

Another hallmark of Broadcast Network maps is that Twitter users in different groups use similar hashtags and words – because their conversations start with the words and references of the broadcaster (Figure 38). There is some notable overlap among the groups, as seen in Figure 39, the bar chart below.

Figure 38: Top hashtags by frequency of mention in the largest groups in the Twitter network for a Paul Krugman column

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

Figure 39: Conversations between groups in a Broadcast
Network: groups that share — to a degree

The % of connections that are shared between Twitter users in major network groups that linked to a Paul Krugman column.
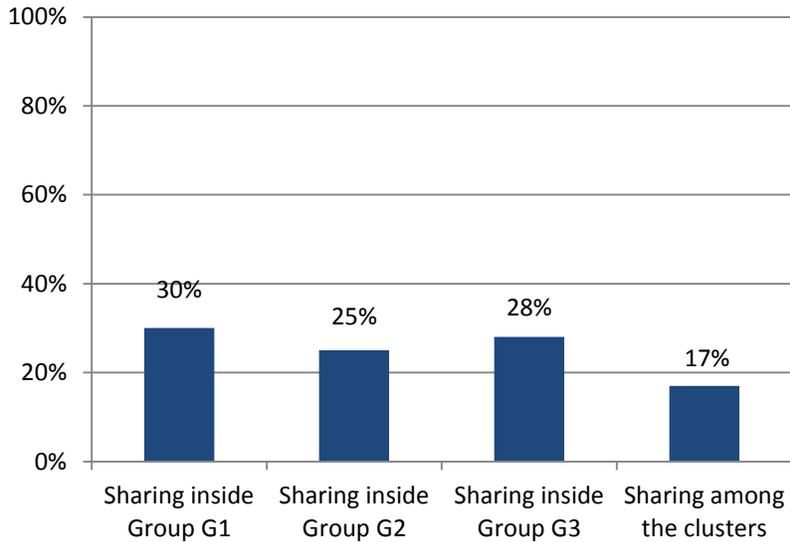
Source NodeXL collection January 11, 2013. In all, there are 1,072 connections within and between the major groups in this map. These are the portions of connections that are in-group and shared among the groups.

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#KilltheTrade

Advocacy organizations also often generate a Broadcast network structure on Twitter. For example, the "#KilltheTrade" Twitter discussion (Figure 40) focuses on the restriction of trade in endangered animal products. The data for this network map can be found at:

http://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2483
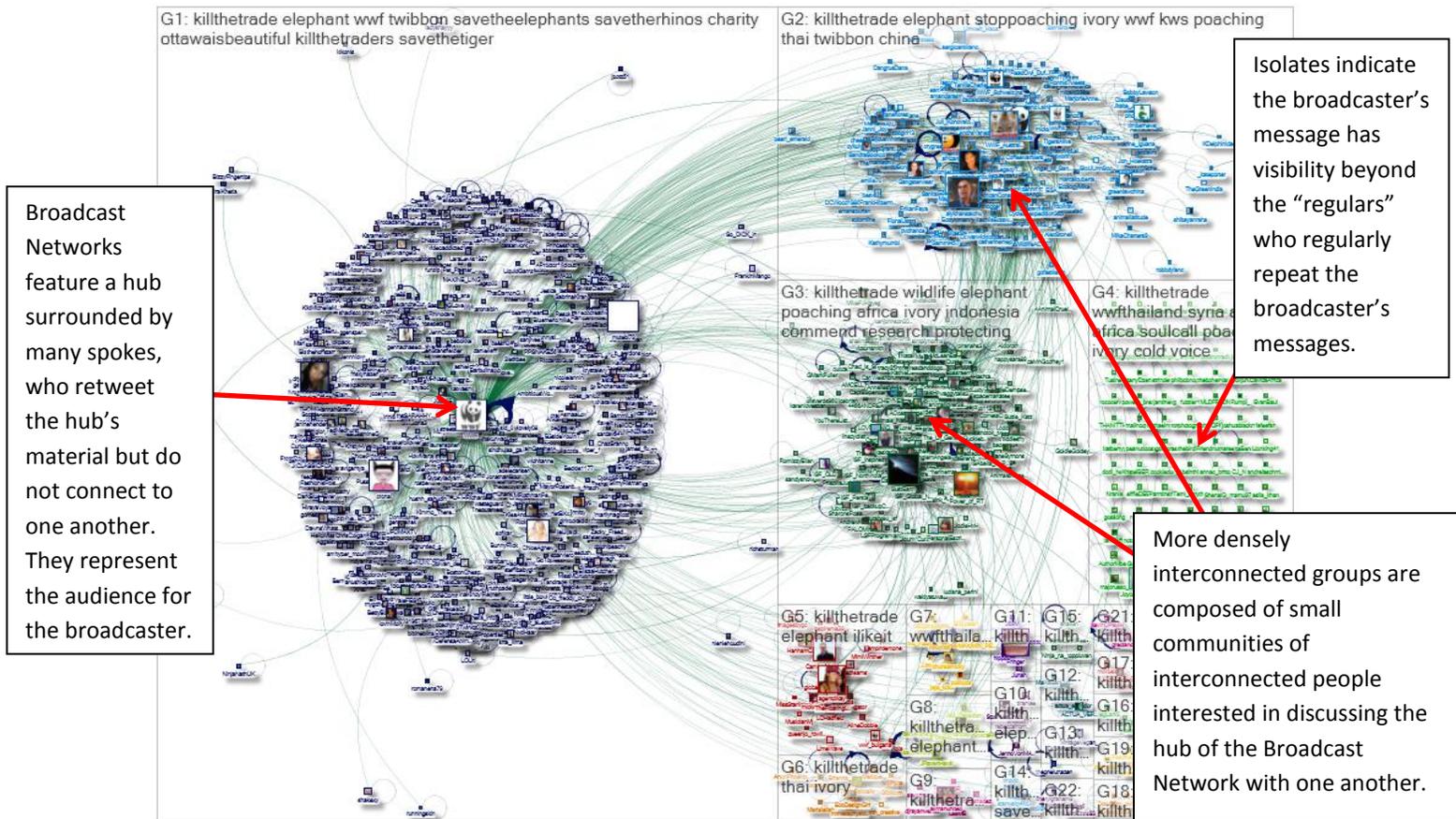
Figure 40: This is the network of connections among 1,196 Twitter users who tweeted about #killthetrade over the period January 19-21, 2013. There is a green line or "edge" for each follows relationship. There is a blue edge for each "replies-to" and "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions."

At the center of the largest "#killthetrade" 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 and are discussing the material tweeted around this subject.

A Broadcast Network often has one or two large hubs with many spokes while the other groups are relatively small and internally densely connected.

The groups in a Broadcast Network are often discussing the same information, according to the top links that are listed in each of the main groups. Figure 41 below shows this overlap.

Figure 41: URLs frequently used in the largest 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/

In the groups in a Broadcast Network there is often a similarity in the use of language, even if some of the common words in each group are not identical, as Figure 42 below shows.

Figure 42: Top Hashtags by frequency of mention in the largest 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

There is also a significant amount of sharing across groups (Figure 43).

Figure 43: Broadcast Network conversations connect across interest groups

The % of connections that are shared between Twitter users in major network groups that used the #KilltheTrade hashtag promoted by World Wildlife Federation.
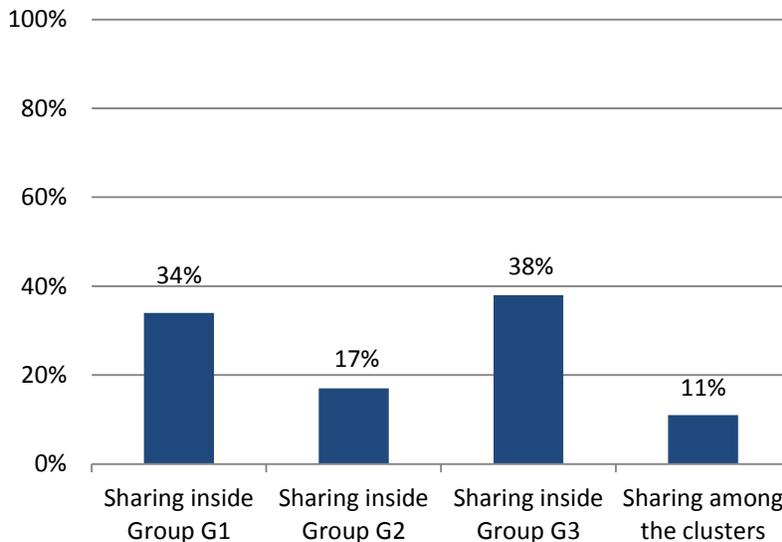
Source NodeXL Twitter data collection January 19-21, 2013. In all, there are 4,314 connections within and between the major groups in this map. These are the portions of connections that are in-group and shared among the groups.

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Network Type 6: Support Network

Many large companies provide customer support via Twitter, maintaining a user account to listen to and reply to user complaints and issues. This account is often set up to reply to whoever tweets about the company, especially when service issues are cited. In this Twitter Support Network structure, the central account reaches out to many other accounts, but those other accounts are not usually linked to one another directly. It is a structure built on outflow more than on in-bound conversation.

DellListens or DellCares

The map below (Figure 44) is an example of the Support Network conversational structure in Twitter. It examines those tweeting "DellListens" or "DellCares" – the names of two accounts run by computer manufacturer Dell to do customer support. The data for this map can be found at: https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2956.

Among other things, it shows how dominant the central hub is in the Twitter conversation. That account is doing a lot of the talking and interacting with others.
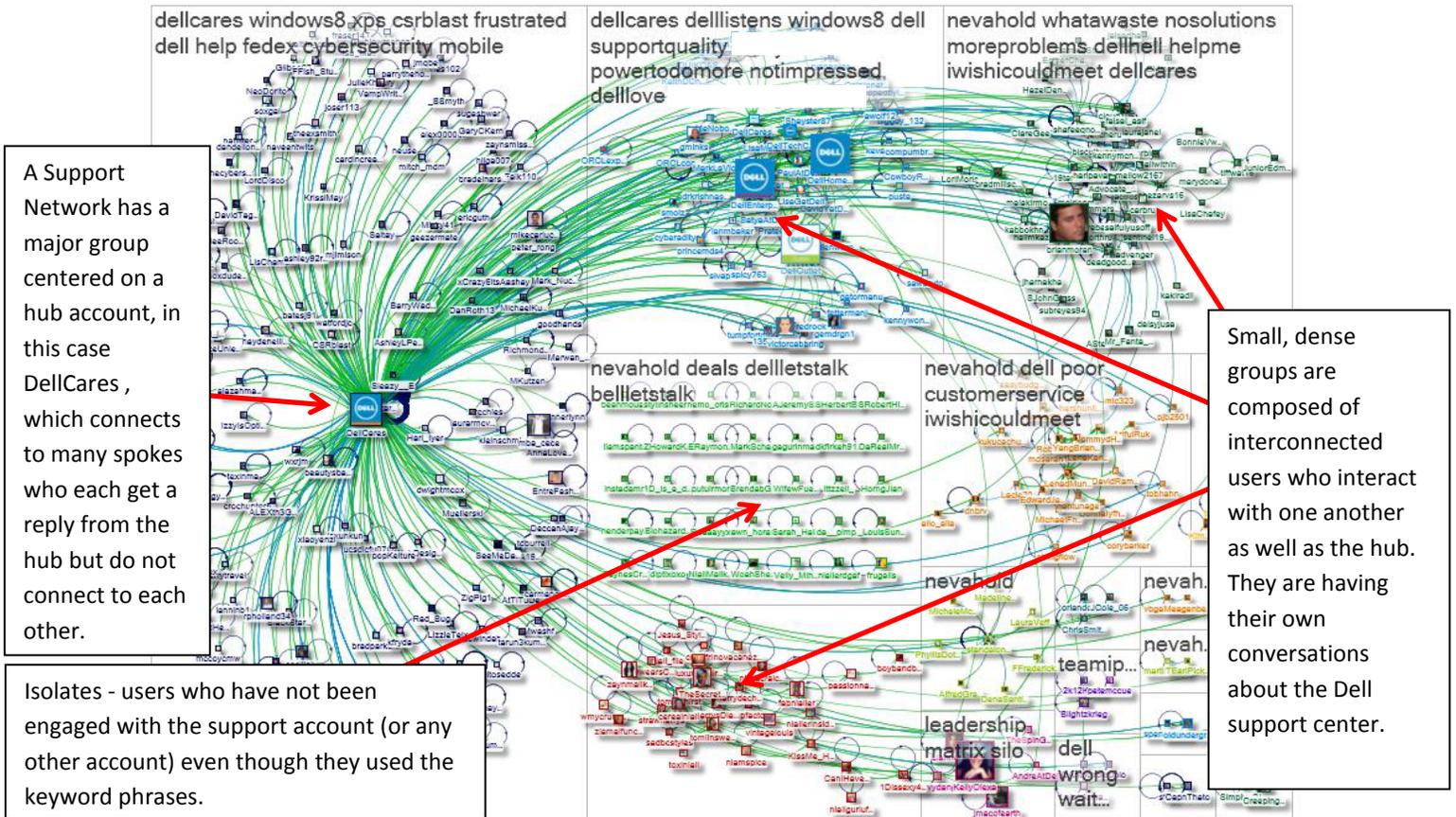
A Support Network has a major group centered on a hub account, in this case DellCares , which connects to many spokes who each get a reply from the hub but do not connect to each other.

Isolates - users who have not been engaged with the support account (or any other account) even though they used the keyword phrases.

Small, dense groups are composed of interconnected users who interact with one another as well as the hub. They are having their own conversations about the Dell support center.

Figure 44: Network graph of 388 Twitter users whose tweets contained delllistens OR dellcares collected between February 12-19, 2013. There is a green line or "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."

The interactions in a Support Network have a hub-and-spoke structure with the hub's outreach to others being the central structure. Figure 45 below shows that the URLs that are most commonly cited in the map are of the "show and tell" variety where instruction aimed at learning is a common theme. Twitter users frequently ask those at the center of Support Networks how to do things.

Figure 45: The URLs frequently used in the largest groups discussing DellCares OR DellListens.
URLs mentioned only once were removed.

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	

In addition, some groups comment on the quality of their experiences with Dell computers and the quality of Dell products. The table below (Figure 46) shows the most common hashtags mentioned by members of each cluster. There is a modest level of sharing across the major groups as Figure 47 shows.

Figure 46: Top Hashtags by frequency of mention in the largest groups in the DellCares OR DellListens Twitter Network.

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

Figure 47: Support Networks on Twitter are often dominated by one or two accounts interacting with many others

The % of connections that are shared between Twitter users in the major groups using the hashtag or words "DellListens" or "DellCares"
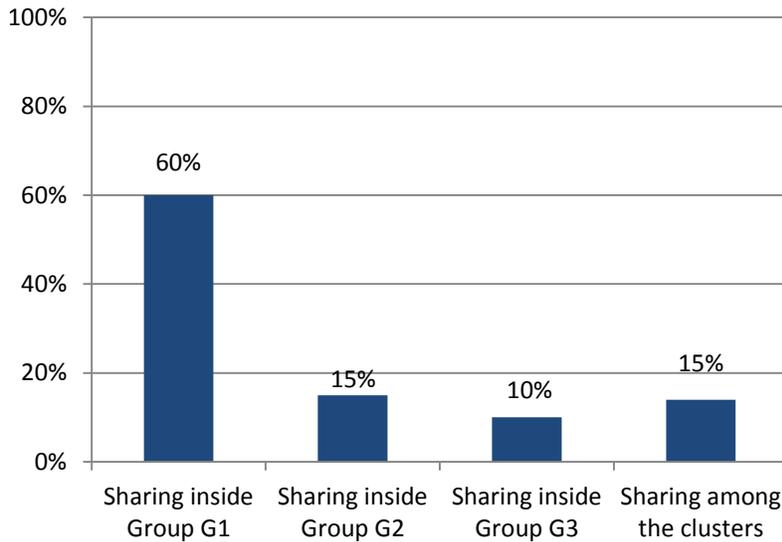
Source NodeXL Twitter data collection January 8, 2013. In all, there are 1,450 connections within and between the groups in this network map. These are the portion of connections that are in-group and shared among the groups..

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Virgin America

The support structure is also visible in the map below (Figure 48) of the Twitter conversation around the words "Virgin America". The data for this map can be found at:
https://nodexlgraphgallery.org/Pages/Graph.aspx?graphID=2414

Isolates are users who mention Virgin America but did not get a connection from the hub or any other user.

Denser groups link to the hub and to each other, focusing on industry news.

Support hub is surrounded by users who tweet customer complaints and receive replies from the Virgin America account.
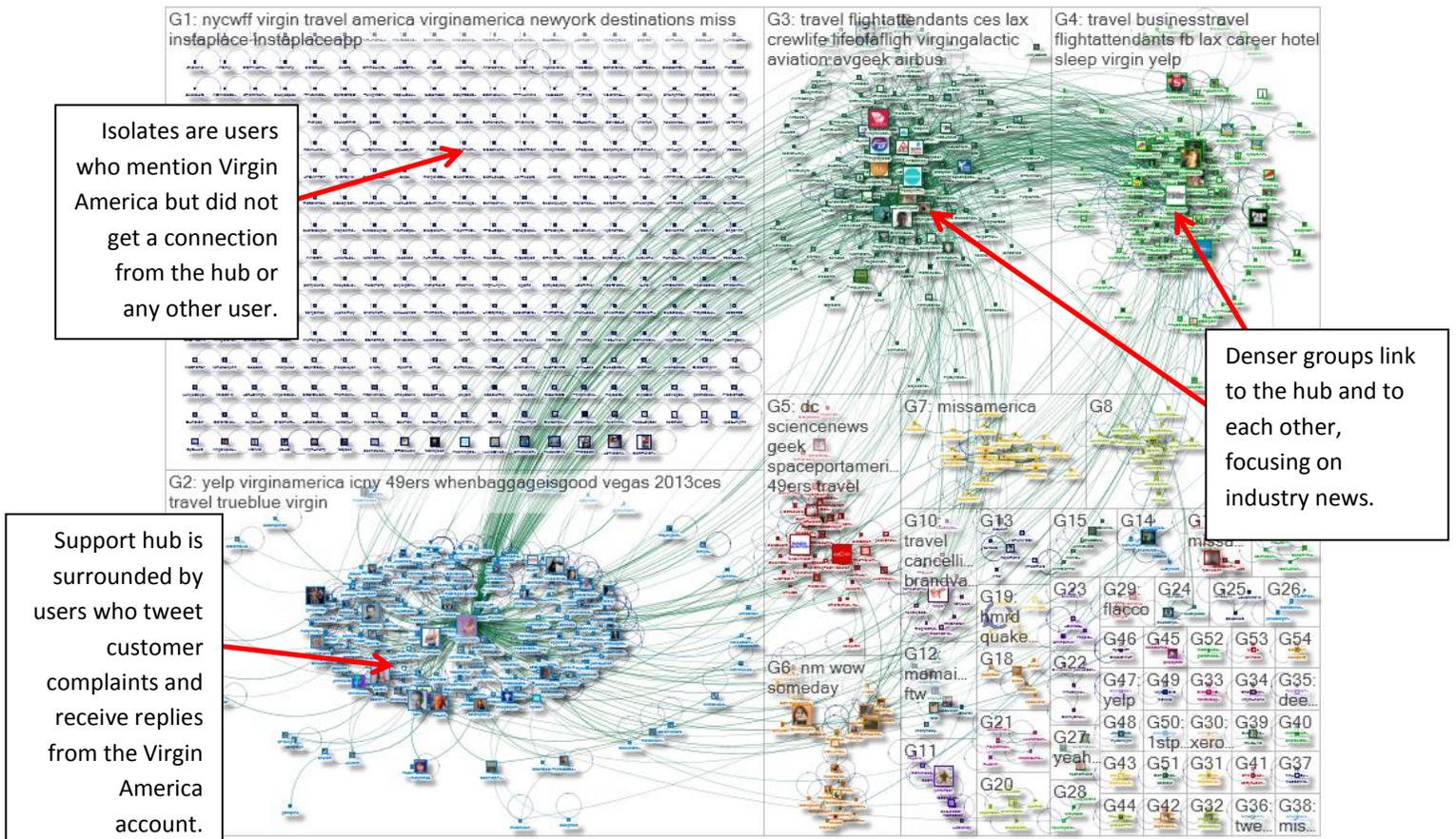
Figure 48: Network graph of 1,040 Twitter users whose tweets contained "Virgin America" collected between January 9-16, 2013. There is a green line or "edge" for each follows relationship. There is a blue edge for each "replies-to" and "mentions" relationship in a tweet. There is a self-loop edge for each tweet that is not a "replies-to" or "mentions."

This network map illustrates a hybrid structure that has Brand Clusters features as well as an out-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 Network structure discussed earlier in this report. But it is distinguished by the high rates of mutual interactions between the hub account and the disconnected spokes of customers seeking travel assistance. The graph represents a network of 1,040 Twitter users whose recent tweets contained "Virgin America." The tweets were made over the 7-day, 18-hour, 19-minute period from Wednesday, 09 January 2013 at 04:18 UTC to Wednesday, 16 January 2013 at 22:38 UTC.

This map illustrates a hybrid network structure 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 structure resembles the broadcast network pattern discussed but is distinguished by the high rates of mutual interactions between the hub account and the disconnected spokes of customers seeking travel assistance.

Figure 49: Contrasting URLs frequently used in the largest 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

Figure 50: Top Hashtags by frequency of mention in the largest 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

Figure 51: Support Networks on Twitter are often dominated by one or two accounts interacting with many others

The % of connections that are shared between Twitter users in the major groups using the words "Virgin America"
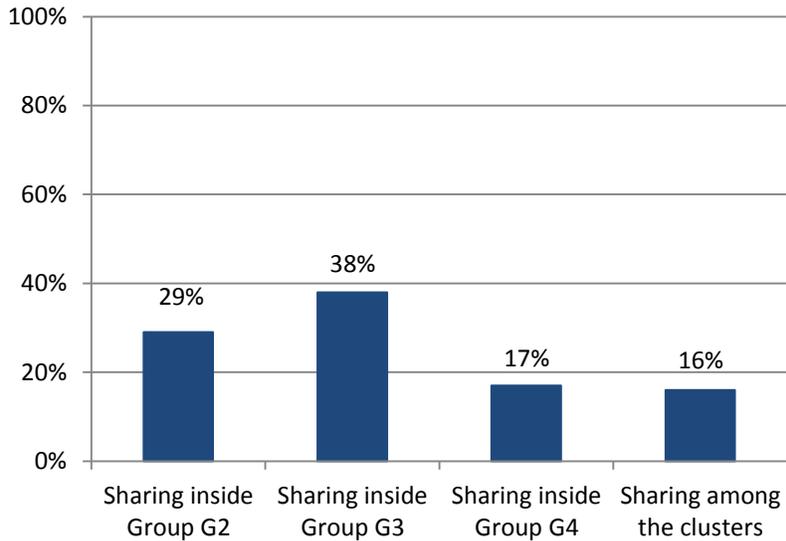
Source, NodeXL Twitter data collection January 16, 2013. Analysis of the 2,353 links between users within and between each of the three largest network groups within the "Virgin America" network. Many of the connections among those who used the hashtag crossed group boundaries.

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Conclusion

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. Our 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.

Appendix: How to analyze social media networks

See related document at: http://www.pewinternet.org/files/2014/02/How-we-analyzed-Twitter-social-media-networks.pdf

Resources and references

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This paper describes multi-criteria clustering procedures and offers a taxonomy to guide further research.

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Thorough and lucid textbook on network analysis and applications. Great starting point, yet filled with deep insights for all readers.

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This paper takes a fresh approach to finding substructures inside communities, identifying groups with meaningful properties through interactive visual analytics strategies. It also has a thorough review of previous work.

NodeXL: Network Overview, Discovery and Exploration for Excel: http://nodexl.codeplex.com

The distribution and support site for NodeXL.

NodeXL Graph Gallery: http://nodexlgraphgallery.org

The archive of shared NodeXL network data sets and visualizations.

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