

Follow Me: A Network Analysis Of Marquette University's Twitter Network

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FOLLOW ME: A NETWORK ANALYSIS OF MARQUETTE
UNIVERSITY'S TWITTER NETWORK

by

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ABSTRACT
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Marquette University, 2013

By understanding the network structure of social media usage, an organization can gain valuable insight into how to best utilize social media to reach organizational goals. Therefore, the current study seeks to be the first to conduct a network analysis on social media usage. Using Marquette University's Twitter network as a case study, the researcher was able to collect appropriate network data through observation. By conducting a network analysis of this data, the researcher was able to draw conclusions of the current social structure of this network, the diffusion of innovations process within the network, and identify the power figures within the network. These conclusions suggest that the current network is in a transition period, going from a centralized network where the main Marquette account controls the network to a network where the power is shared between various accounts. Using this information, the researcher is able to make a practical level recommendation to Marquette University regarding social media usage. This recommendation is to enact policies that will change the formal network structure from the current organic structure to a multiple hub and spoke social structure. Further network studies should be done regarding social media to gain a further understanding of social networks.

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Chapter 1: Introduction

As social media has exploded in popularity and use, communication scholars have sought to understand how digital and online media fit into the framework scholars have created for understanding communication. With more than 70% of the population in the United States now regularly using some form of social media, research has become devoted to understanding the impact it has on business practices (Tuten, 2008). Research has found that, in recent years, there has been a steady increase in social media use for sharing user-generated content, which has had an impact on the environment in which businesses exist. Social media sites are also utilized in professional practices to establish communities, generate ideas, and implement strategies to reach business objectives. Furthermore, social media has garnered attention from academia; with most current studies seeking to understand how existing communication theories help to understand social media (Khang, Ki, & Ye, 2012).

Although social media has become a point of interest in academia, the current amount of communication research that has been published on social media is limited. In fact, Treem and Leonardi (2012) note that “scholars have suggested that social media adoption in organizations is outpacing empirical understanding of the use of these technologies” (p. 144). This could be due to many factors, including the lengthy publication process that is required of academic research or time-intensive research methods. Practitioner literature is not constrained by these limitations, so it has been possible to compile information and publish a relatively large number of social media books addressing the impact social media has on organizational life. At this point, there is still more practitioner and trade information available right now than scholarly literature. Therefore, this study draws from these as well as the available scholarly literature.

The current academic research and trade research shows that research in this area would benefit from expanding the methods used to study social media, especially when studying social structure and the interconnective nature of social media. Network studies allow for both structure

and interconnectivity to be measured, so this study will seek to test network studies as a method for studying social media use within organizations using Marquette University's Twitter network as a case study. By first understanding the impact that trade publications have noticed social media having on organizations, this study will show a more comprehensive picture of social media use within organizations.

Social Media within Organizations

Social media can be understood as a technologically-based form of communication that is designed to engage the public and create social impact (Lester, 2012). It is often characterized by "participation, openness, conversation, community, and connectedness" (Lester, 2012, p. 118). Examples of social media include blogs, microblogs, such as Twitter, video-sharing sites, such as YouTube, social networking sites, such as Facebook, and other interactive forms of media. Social media are being used as a communication tool in many different departments within organizations. By understanding the role of social media in various organizational areas, the role of social media use within an organization can be further understood.

In order to understand the communication structure social media creates within an organization, it is critical to understand how this structure differs from communication structures within organizations without the use of social media. In order to understand this, one must understand how social media has changed communication throughout organizations. Typical approaches to various organizational goals have changed as social media has expanded the possibilities for communication. By highlighting different areas that social media has impacted within organizations, one can more thoroughly understand the changes social media has caused and why.

Community relations is one area that social media has impacted within organizations. Community relations is "the state of relations between the company and the communities in which it has a presence or impact" (Burke, 1999, p. xvi). Traditionally, community relations

required a company to reach out to and participate in the geographic communities they are associated with in order to foster positive sentiment among community members toward the organization (Burke, 1999). Whereas communities traditionally were determined by geographic boundaries, “cyber communities” created via social media can be worldwide. Furthermore, contrary to traditional geographic communities, cyber communities do not exhibit the same decision-making characteristics, have an established leadership pattern, or have an established structure (Burke, 1999). Finally, as these communities are formed through online interaction, cyber communities can be formed easily and spread quickly, making online communities more dynamic than geographically bound communities. (Kane, Gichman, Gallagher, & Glaser, 2009).

Market research is another area that is impacted by the rise of social media usage. Market research is the act of obtaining marketing intelligence or “provid[ing] management with the facts, information, and insights it needs to rapidly make the best, most efficient business decisions” (Smith, 2007, p. 3). With the introduction of the Internet and social media sites, the platforms researchers can use to conduct market research have expanded. Blogs were the first social media tool to become widely used by market researchers (Poynter, 2010). Researchers have primarily used blogs in two ways to conduct market research. The first is to observe existing blogs to “explore some aspect of participants’ lives in more depth than would be the case with more traditional forms of research” (Poynter, 2010, p. 166). The second is by recruiting respondents to record a blog as part of an active research process (Poynter, 2010). Market researchers have since expanded from blogs to use other social media tools for market research, including Twitter, Facebook, and location based services (Poynter, 2010). Finally, social media has become a “location” for ethnographic research, allowing ethnographic research to be done instantly in many circumstances via archived data (Poynter, 2010).

The role of a public relations (PR) practitioner has also been impacted by the rise of social networking tools. Public relations is “a strategic communication process that builds mutually beneficial relationships between organizations and their publics” (www.prsa.org). To

accomplish this goal, public relations practitioners manage relations with media, government, stakeholders, communities, investors, and employees (Crawford & Macnamara, 2010). As technology has shifted, various changes in the PR practitioner's role have emerged. One change is that PR practitioners are no longer relied on by media sources and no longer have third party credibility as they did in the past (Croft, 2008). Information is also expected to be available to the public immediately, changing the definition and purpose of a press release (Verhoeven, Trench, Zerfass, Moreno, & Vercic, 2012). Finally, technology has shifted the theoretical role of those working in public relations from a role of gathering and disseminating information to a role of building relationships through dialogue (Briones, Kuch, Liu, & Jin, 2011).

Another common role of organizations that has been affected by social networking is the process of creating brand awareness or branding. Branding is the "process of creating value through the use of a compelling and consistent offer and customer experience that will satisfy customers and keep them coming back" (Guo, 2012, p. 166). With the emergence of web 2.0, consumers are given the opportunity to create content, often known as user generated content. This change has shifted the branding power from the hands of the companies to the hands of the consumers (Simmonds, 2007). Therefore, brand managers must release control of branding and seek to merge the social media based content into the previously determined branding objectives and then monitor the development of the brand to ensure consistency (Chan-Olmsted, 2010). According to Mooney and Rollins (2008), one of the most successful ways to accomplish this is by adopting an "open brand" strategy. This strategy suggests "the key to successful branding is to engage consumers more richly, deeply, and meaningfully; that is, design branding activities that develop brand participation in a manner that is relevant to their lives" (Chan-Olmsted, 2010, p. 8).

Social media has become increasingly important to crisis communication efforts, as social media has become a place for crisis communication situations to emerge, grow, be monitored, and be responded to (Schultz, Utz, & Goritz, 2011). As consumers have become user

generators, they are given the ability to create content that may cause crisis communication situations. With the rapid-spreading flow of information via web 2.0, crisis communication situations can escalate quicker than they could in the past. Therefore, organizations must build a strong foundation within social media to support the organization while maintaining a flexible and agile design to cater to specific situations (Harrald, 2009).

To sales personnel, social media has been approached as a tool that must be considered via a “slow analysis and adjustment to the communication revolution and to the changes in buying behavior without tossing out practices [known to be] successful” (Curtis & Giamanco, 2010, p. 4). Rather than changing sales strategies, sales personnel have done this by using technology as a tool to more effectively accomplish traditional sales goals. As stated by Anneke Seley, the developer of OracleDirect, Oracle’s revolutionary sales operation, “if you know what steps are necessary to get from point to point in the sales process and you notice that you are getting bogged down in one of those places, that’s when you look at technology to help free you” (Curtis & Giamanco, 2010, p. 8). Oftentimes, this means that sales personnel are no longer spending their time finding customers, but rather establishing relationships with potential customers and making themselves available when the customer is ready to buy (Curtis & Giamanco, 2010). Furthermore, this means that customers now dictate the means by which sales personnel will communicate with them by giving customers the power to decide if they want to opt in or out of sales messages (Curtis & Giamanco, 2010). Therefore, sales must now use social media as a to build a compelling sales environment, product or organizational story, relationship with the customer, and design to be effective in sales (Pink, 2005).

The role of customer service has also shifted with the technological shifts. The main difference between customer service before and after the emergence of social media is the approach organizations must take when considering customer service. Prior to the use of social media, customer service was a reactionary system where companies responded when individuals approached them directly (Shankman, 2011). With social media, it has become both possible and

impactful for customer service representatives to approach individuals who express problems or concerns on social networks. This shift in approach due to social media use has led to the emergence of new customer service guidelines. First, the customer service representative is now responsible for finding where target consumers are and meeting them there. Second, customer service representatives must listen to complaints, compliments, and general industry discussion as it is happening. Finally, the customer service team must devise and implement a plan to engage in this conversation (Shankman, 2011).

The role of a marketing professional has also shifted through social media usage. Marketing can be broadly defined as “a set of human activities involved in creating, costing, promoting, and delivering economic and/or social outputs that are intended to satisfy the needs and desires of existing and/or potential customers, users, audiences, or beneficiaries” (Kyambalesa, 2000, p. 6). Although various marketing models have prevailed over the years, the marketing concept and holistic marketing concept are the two approaches to marketing most often adopted today. The marketing concept emerged from the beliefs that the right product must be delivered to the consumers rather than the consumers seeking them out. The marketing concept embraces the notion of consumer engagement (Keller & Kortier, 2009). The holistic concept takes the marketing concept one step further by stating that all people should be considered potential consumers and they should be approached from all angles of life (Keller & Kortier, 2009). With the marketing and holistic concepts that leading approaches to marketing today, the focus has shifted to engaging consumers. This has shifted the marketing professional’s role from pushing out messages to actively participating in social media by bringing together content, listening to community’s conversations, enabling collaboration, engaging in dialogue, and establishing relationships (Thoring, 2011). To effectively engage the consumer, the marketing professional must gain the trust of the consumer to gain their purchasing loyalty (Corbae, Jensen, & Schneider, 2003). Therefore, the “development and cultivation of long-term and profitable

relationships with loyal consumers” has become the primary objective of marketing (Corbae, Jensen, & Schneider, 2003, p. 77).

One final area that must be considered to understand the impact of social media on organizational communication is that of advertising. Advertising has traditionally been understood as “paid, one-way promotional communication in any mass media” (Tuten, 2008, p. 2). Social media has uniquely affected advertising by changing the definition of what an advertisement must be to be successful. First, advertising is no longer necessarily one-way communication from the organization to the consumer, nor paid, but rather an interactive conversation. “Earned” advertising, or advertising that is passed along or shared among friends, has been shown to lead to more ad recall, brand awareness, and purchase intent than standard paid advertisements (Khang, Ki, & Ye, 2012). This change is attributed to the rise in social media use as social media allows users to comment, like, and share all kinds of posts (Chu & Kim, 2011). Furthermore, as social media has given users the ability to be content creators, advertising professions have had to adapt to share control over the development and distribution of content with consumers (Tuten, 2008). Research has found advertising today to be most effective when embracing user-generated content and encouraging engagement rather than avoiding or ignoring this shift (Tuten, 2008).

By studying how social media use in each of these areas of business practice have influenced the communication structure within the organization, one can gain a greater understanding of the how to adapt to these changes.

Chapter 2: Literature Review

To effectively study the influence of social media on communication within organizations, various areas must be first further understood. The first of these is the literature available on communication structures. When studying communication structures, one must consider both traditional communication structures and social business structures as well as the different types of networks. To study the communication structure created through social media, a network analysis is conducted, which must be further understood. When completing a network analysis, a process called the Multitheoretical, Multilevel approach, or MTML, has emerged as the most respected approach. The reasons this is most respected as well as what the approach entails must be considered to fully understand why this approach is used in this study. When engaging in this process, four subcategories emerge. These include both the individual level analysis and global level analysis. For each of these levels, the measures applicable to studying that level must be understood to properly analyze the resulting information. Finally, the two theories used in this study, Diffusion of Innovations and A Network Theory of Power, must be understood to reap the benefits of the multitheoretical approach.

Communication Structure

One way to gain a further understanding of the impact of social media on businesses is through gaining a greater understanding of the communication structures that emerge through organizational use of social media platforms. There are three historical perspectives on emergence of structure in organizations. The first of these is the positional tradition. In the positional tradition, “organizational structure is viewed as a pattern of relations among positions” (Monge & Contractor, 2003, p. 19). This idea operates under the understanding that official positions and roles dictate who communicates with whom. Furthermore, the positional tradition assumes that individuals maintain attitudes, values, and beliefs that are in line with the

organizational position they hold. Although useful in understanding organizational communication, this viewpoint is criticized for its rigidity and for ignoring the role of the individual (Monge & Contractor, 2003).

The second historical perspective on structure is the relational tradition. The relational tradition “focuses primarily on the direct communication that establishes and maintains communication linkages” (Monge & Contractor, 2003, p. 19). Often considered the dominant perspective for considering structure in organizations, and the perspective the current study adopts, the relational tradition accounts for the dynamic quality of structure based on unique individuals (Monge & Contractor, 2003).

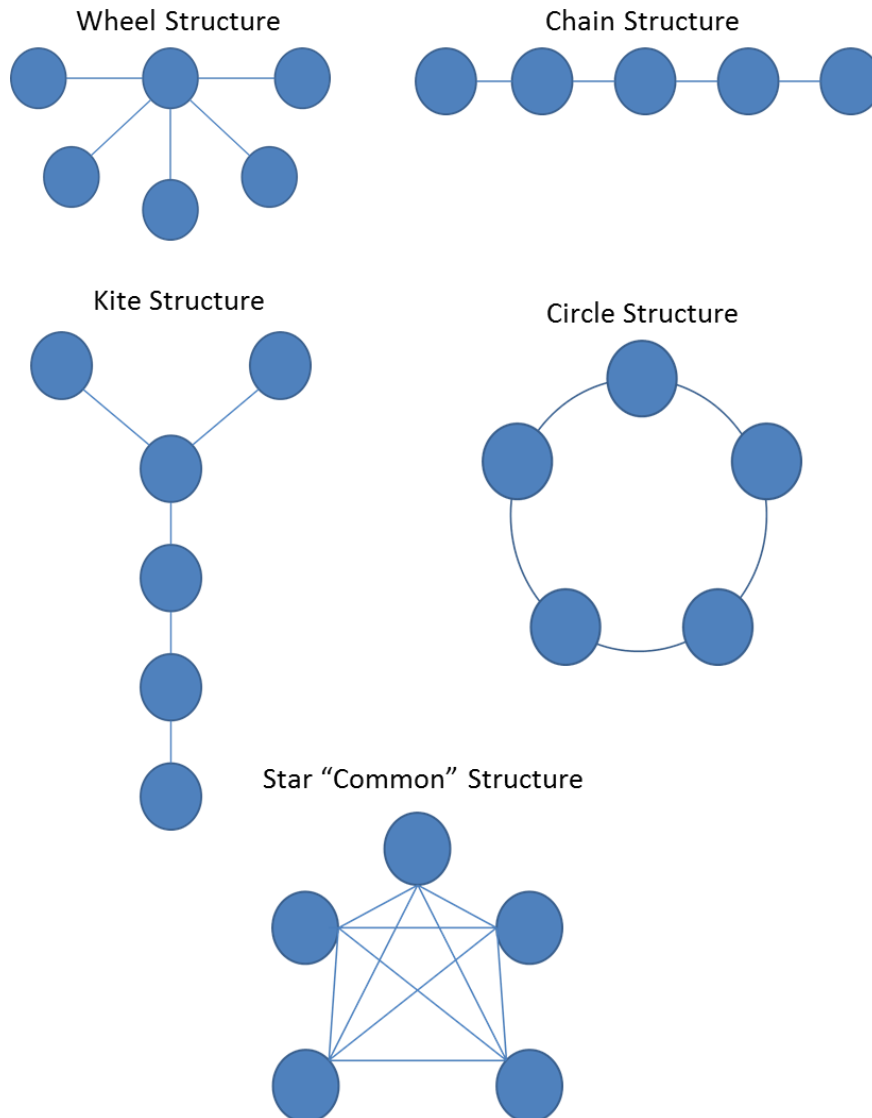
The final historical perspective on emergence of structure in organizations is the cultural tradition. The cultural tradition “examines symbols, meanings, and interpretations of messages transmitted through communication networks” (Monge & Contractor, 2003, p. 19). Research using the cultural tradition is often interested in learning more about an organizational culture. These studies show concern for the ability for communication to shift meaning, recognizing that meaning is both influenced by interaction and influences interactions (Monge & Contractor, 2003).

Studying organizational communication network structures gives scholars valuable insight into the communication process within the organization. A traditional organizational communication network is understood as “a network composed of interconnected individuals linked by patterned flows of information” (Park, 2003, p. 51). Organizational communication scholars identify typical organizational communication structures to more thoroughly understand the communication within an organization. Typical organizational communication structures are shown in Figure 1. One of the typical organizational communication structures is commonly referred to as a wheel, which is a highly structured pattern where all members are only connected through one person or group. Other common centralized structures are the kite structure and the

chain structure. A circle structure and star structure are examples of decentralized organizational communication structures (Arunachalam, 2004).

Figure 1

Traditional Organizational Communication Structures



Network systems research has rapidly developed and become increasingly specified in recent decades. One area where network system has emerged as a useful area of study is in the study of a specific type of network called a hyperlink network. A hyperlink network is known as

“an extension of traditional communication networks in that it focuses on the structure of a social system based on the shared hyperlinks among websites” (Park, 2003, p. 51). More specific than a typical internet network, a hyperlink network makes it possible for individuals or groups from anywhere in the world to directly communicate with one another (Park, 2003). Social media platforms are designed for this purpose, making this an appropriate approach to studying social media networks and the impact they have on business practices.

Table 1
Types of Networks

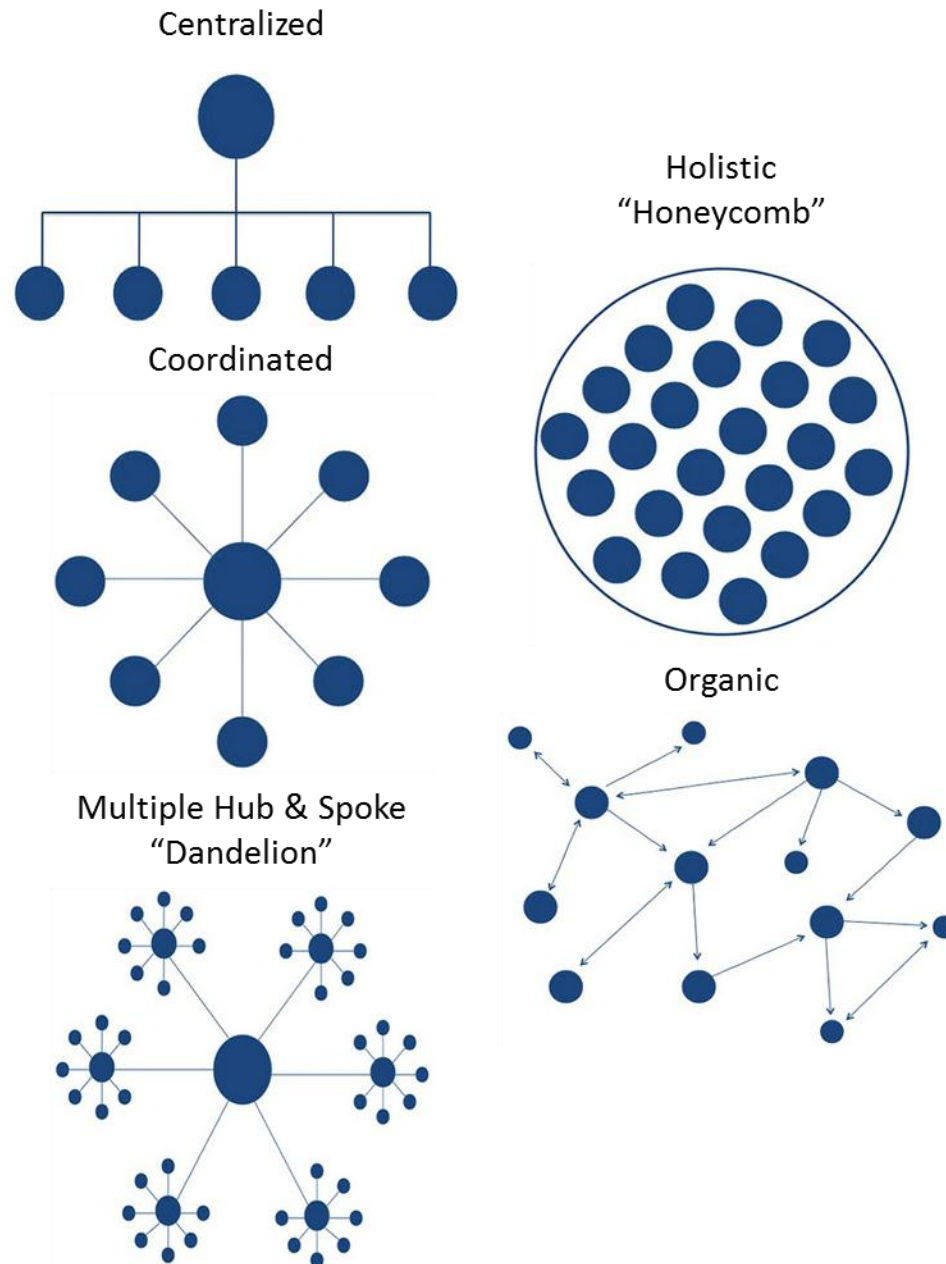
Type of Network	Definition	Content of Relation/Link
Social Network	A set of people (or organization or other social entities) connected by a set of relationships	Any kind of social relation
Communication Network	A network composed of interconnected individuals linked by patterned flows of information	Communication and information
Computer-Mediated Network	A specific type of communication network in which individuals are interconnected by computer systems	Same as above, but restricted to computer as a channel of information flow
Internet Network	A communication network connected by the Internet among computer systems	Same as above, but restricted to Internet as a channel of information flow
Hyperlink Network	An extension of traditional communication networks in that it focuses on the structure of a social system based on the shared hyperlinks among websites	Same as above, but restricted to hyperlink as a channel of information flow

(Park, 2003, p. 51)

Owyang has identified five typical frameworks of social business, which are closely related to a hyperlink network. These frameworks include centralized, coordinated, multiple hub

and spoke or “dandelion”, holistic or “honeycomb”, and organic and are shown in Figure 2 (Owyang, 2010).

Figure 2
Social Business Structures



The centralized structure occurs when one department, typically a communication department, controls all social efforts. A coordinated structure occurs when “a cross-functional team sits in centralized position and helps various notes such as business units, product teams, or geographies be successful through training, education, and support” (Owyang, 2010). This provides a holistic social experience for customers engaging with the organization.

The multiple hub and spoke or “Dandelion” social business structure is often seen in large companies where “companies within companies” act largely independently within a larger organization. Often, common threads emerge throughout all areas to encourage a common experience, but large amounts of individual freedoms are allowed (Owyang, 2010).

The Holistic or “Honeycomb” social business structure emerges when all employees or related individuals are encouraged to engage on social networks. This has been proven to be an effective customer service and support strategy when done correctly (Owyang, 2010).

Finally, the organic social business structure is created when social efforts emerge out of a product or need. This structure has the least control and consistency across social platforms and businesses today are typically transitioning away from this model (Owyang, 2010).

Understanding the structure of a specific organization’s social network can provide a tool for further understanding the use of social media in business. Therefore, the following research question is posed:

RQ1: What is the communication network structure of a Midwestern university’s officially recognized Twitter accounts?

Before continuing with a hyperlink network analysis of social media networks, it is useful to gain an understanding of what social media is and what business practitioners are viewing as social media’s impact on organizations.

Network Analysis

Social network analyses have been used in a variety of different disciplines to study interconnected networks for more than two centuries, but this approach has proven particularly useful in studying organizational communication in recent years (Mattelart, 2000; Monge & Contractor, 2003). Many of the network studies in organizational communication focus on research on interlocking board directorates, corporate alliances, value chains, network organizations, corporate intranets and extranets, e-commerce, business-to-business networks, personal and corporate networks, and virtual organizations, both in academic and popular publications (Monge & Contractor, 2003). As demonstrated, SNA have been used to study a variety of different subcategories within organizational communication. However, SNA has yet to be applied to social media use within an organization.

When using a communication network systems approach within the context of organizational communication, networks typically fall into two broad types of networks. First, organizational communication scholars use network studies to study formal networks. Formal networks are networks in which communication is imposed or mandated (Aldrich, 1976). Typically, formal networks consist of a system in which orders are sent downward and information is relayed upward through the communication system. The network studies focusing on formal networks can provide insight into the effectiveness of the formal communication network within an organization. However, formal networks do not take into consideration informal communication that takes place within any organization. Therefore, scholars began to consider ways to study the “grapevine” and informal networks within organizations and, through this process, began to recognize emergent networks (Weber, 1947).

As computer-mediated communication (CMC) has become an increasingly important part of the communication structure within organizations, network scholars have begun to consider where CMC systems fall into the traditional categories of communication networks. When

studying e-mail, studies have shown that CMC has blurred the line between formal and emergent networks. Although formal network structures remain prevalent in organizations, computer-mediated communication has allowed “networks of relations to span across the entire organization, unimpeded by preordained formal structures and fluid enough to adapt to immediate technological demands” (Krackhardt, 1994, p. 218). This fluidity of structure throughout the organization separates CMC networks from formal structures, yet does not eliminate the structure, which separates it from emergent networks. Therefore, CMC has demanded the creation of a hybrid type of network system within an organization and changed the way network scholars must approach network studies within an organizational context. As this new form of network has emerged in the organizational communication context, a new area of focus for organizational communication scholars has emerged. This focus involves using network studies to gain a greater understanding of the impact social media use within an organization has on the overall communication network within the organization.

Although a network approach is a relevant and useful method to study communication with networks, various shortcomings have been identified in the traditional network studies approach. The first shortcoming is the relatively small number of network studies with a theoretical base. Furthermore, many of the network theories studies that do incorporate theories are grounded in a singular theory. This does not allow for the depth of analysis that theoretically grounded studies are capable of. Many of the existing network studies also focus on a single level of analysis within the system, preventing the researcher from gaining a comprehensive view of the network. Therefore, prominent network studies scholars have sought to develop a framework for studying network systems that was both multitheoretical and multilevel, to allow for analysis of network evolution and dynamics. From this intention emerged the Multitheoretical, Multilevel Model, otherwise known as MTML (Monge & Contractor, 2003).

Multitheoretical, Multilevel Model (MTML)

The MTML approach was created in response to the identified shortcomings in previous network theories studies. MTML “provides an appropriate basis for studying multiple substantive theories across several analytic levels on the basis of valid statistical inference techniques” (Monge & Contractor, 2003, p. 45). Furthermore, the MTML approach “identifies theoretical mechanisms in social theories and shows how they correspond to network properties such as mutuality and density” (Monge & Contractor, 2003, p. 46). As this process addresses the shortcoming of lacking a theoretical basis, MTML connects network theories components to theoretical perspectives. This, in turn, strengthens network theories studies as a whole.

Another shortcoming identified in previous network theories studies is that the study focused primarily on a single level of the network. As network systems are multileveled and complex, this approach compromises some of the richness of systems data. Therefore, the MTML framework of studying network systems provides an opportunity to collect and analyze data from various levels of the network, which is beyond the typical individual or dyadic level of analysis in network studies (Monge & Contractor, 2003). By approaching network systems from a multilevel approach, the network can be studied more comprehensively.

Finally, network scholars have long struggled with determining a valid statistical process for analyzing network systems. Since a network is, by definition, relational, all variables would be dependent upon one another. Prior to the MTML, the majority of the statistical processes for network systems were unconnected or independent and therefore unusable by the larger research community or studies at different levels of the system (Monge & Contractor, 2003). The MTML approach seeks to standardize the statistical processes for network systems and reporting on these processes. The computer software program, UCINET, has emerged as the primary network analysis tool (Johnson, 1987).

To account for the necessity of a multilevel approach to network studies, the network will be analyzed on both an individual and global level.

Individual Level of Analysis

When using the MTML approach, various levels of a network system can be used to reach a further understanding of the network system as a whole. For the current study, the first level studied will be the individual level. There are many different measurements that can be used to quantify a network on an individual basis. Some common individual level measurements include degree, indegree, and outdegree, betweenness, reciprocity and various centrality measures (Monge & Contractor, 2003).

Any individual or node within a system can be described by degree values. A degree is the total number of ties associated with a node (Borgatti, Everett, & Freeman, 2002). When these ties are directed outward from the node, this is represented by an outdegree value. Conversely, when directional ties go to the node and terminate there, they are represented as an indegree value. When analyzing a network system, there are various ways to interpret the degree depending on the nature of the network and the study. Historically, researchers have used degree as an indicator of social capital or centrality of a node. Nodes with a degree value of zero are often categorized as isolates (Monge & Contractor, 2003). In other words, despite being considered a part of the network, they are unconnected to any other in network nodes.

A measure of betweenness can also be used to quantify an individual node within a network system. Betweenness measures the “extent to which a node is directly connected only to those other nodes that are not directly connected to each other” (Monge & Contractor, 2003, p. 38). This measure shows the extent to which that nodes serves as an intermediary and connects nodes that would otherwise not be connected. Therefore, betweenness is directly associated to a measure of power within a network system (Castells, 2011).

A measure of reciprocity is useful with a directed data set. Reciprocity looks at whether or not two nodes are mutually connected. It has been theorized that a network that consists of primarily relationships which are either non-existent or reciprocated are more stable networks than networks that primarily consist of relationships that are one sided or unreciprocated (Hanneman & Riddle, 2005).

There are many ways to study centrality at the individual level. One individual level centrality measurement is closeness centrality. Closeness centrality “focuses on the distance or number of steps between an actor and all the other actors in a network, irrespective of whether the focal actor has a direct link or is indirectly connected to the others” (Barnett, Danowski, Feeley, & Stalker, 2010, p. 391). This measure accounts for nodes that may have a low degree, but be connected to other nodes with high degree or betweenness. Closeness centrality is useful for assessing individual nodes’ ability to access information either directly or indirectly (Monge & Contractor, 2003). This value can quantitatively be considered the “sum of the distances from focal node to all other nodes in the network; the smaller the sum, the more central the node” (Tutzauer & Elbirt, 2009, p. 355).

Another individual level centrality measurement is Bonacich’s centrality or Bonacich’s power. The original degree centrality approach treats those who have a high degree, or many connections, as powerful figures within the network. The Bonacich approach, however, takes it a step further to say that the degree of those the original node is connected to influences that node’s centrality and, consequently, power. For example, say Account A is connected to ten other accounts, but those accounts are each connected to a lot of others. Account B is also connected to ten other accounts, but the people Account B is connected to are connected to very few others. In this case, the original degree centrality approach would say they are equally powerful in terms of centrality. However, Bonacich would make an argument that Account A is more central because “one’s centrality is a function of how many connections one has, and how many connections the actors in the neighborhood had” (Hanneman & Riddle, 2005). Furthermore, Bonacich, unlike the

original approach, draws a distinction between centrality and power. In the previous example, although the traditional approach to central power would say Account A is both more central and more powerful, Bonacich would say Account B is more powerful. Bonacich argues that “being connected to others that are not well connected makes one powerful, because these other actors are dependent on you – whereas well connected actors are not” (Hanneman & Riddle, 2005).

Table 2
Social Network Measures Assigned to Individuals

Measure	Definition
Degree	- Number of direct links with other actors. - (Twitter) Number of in network Twitter accounts either following or being followed by a specific account
In-degree	- Number of directional links from the actor from other actors (incoming links). - (Twitter) Number of in network Twitter accounts following a specific account
Out-degree	- Number of directional links from the actor to other actors (outgoing links). - (Twitter) Number of in network Twitter accounts being followed by a specific account
Centrality	- General term that looks at the extent to which an actor is central to a network. Various measures have been used as indicators of centrality. Some measures of centrality weight an actor’s links to others by attributes of those others.
Bonacich’s Power Centrality	- A centrality measure that is a function of how many connections an actor has within the network, while also considering the degree of the nodes the actor is connected to
Closeness Centrality	- A centrality measure that emphasizes the distance of an actor to all others in the network by focusing on the distance from each actor to all others
Betweenness Centrality	- A centrality measure that looks at the extent to which an actor mediates or falls between any other two actors on the shortest path between those actors. Usually averaged across all possible pairs in the network.
Reciprocity	- Extent to which an actor who is outwardly connected to another actor is then inwardly connected to that same actor

(Adapted from Monge & Contractor, 2003, p. 32, Hanneman & Riddle, 2005)

Global Network Level of Analysis

Various measures can also be used to quantify a network from a global network level. Some of the more commonly used measurements include size, betweenness, density, distance, and various measures of centrality. Some measures overlap with individual measurements because the same concept can be used to quantify each individual node and the network as a whole.

The first global level measurement is simply size. Size is simply the total number of nodes within the network being studied. The second global level measurement is betweenness. Betweenness “measures the extent to which a node is directly connected only to those other nodes that are not directly connected to each other” (Monge & Contractor, 2003, p. 38). Betweenness is often used as a measure of power as nodes acting as an intermediary between other nodes have the ability to control the information that is passed between those nodes and all other indirect ties that node controls (Monge & Contractor, 2003).

Density is another global measurement that will be used in the current study. The density of the network is “the proportion of all possible ties that are actually present” (Hanneman & Riddle, 2005). Density is computed by dividing the sum of the ties present in the network by the total number of possible ties in the network. This value gives the researcher insight into the rate of diffusion within the network and “the extent to which actors have high levels of social capital and/or social constraint” (Hanneman & Riddle, 2005). In a network with high density, information is often assumed to diffuse within the network faster than a network with low density (Hanneman & Riddle, 2005). This leads to the second research question:

RQ2: What is the density of the defined network?

Distance is another useful measurement when quantifying a network as a whole. Distance is often, quite simply, referred to as “the number of links between two nodes” (Monge &

Contractor, 2003, p. 41). When considering distance, the links that are counted are the links present in the geodesic, or the shortest distance between the two nodes (Monge & Contractor, 2003). If node A is connected directly to B, nodes A and B have a distance of one. If node A is connected to node B who is connected to node C, A is connected to C by a distance of two. For example, if @MarquetteU is following @FvrythingPR, they are connected by a distance of one. If @MarquetteU is following @FvrythingPR who is following @DoctorDUrso, @MarquetteU and @DoctorDUrso are connected by a distance of two, even though they are not directly connected to one another.

Finally, degree centrality is often found to be a useful value when seeking to understand a network on a global level. Global degree centrality emerges out of individual degree centrality values. Although the individual level centrality measurements looked at in this study are closeness centrality and Bonacich centrality, global centrality is often derived from individual degree centrality. On a global level, network is “an umbrella concept that examines the variation in individuals’ centralities within a network” (Monge & Contractor, 2003, p. 44). In other words, if one or a couple nodes have significantly higher individual level centrality scores, the network is considered a highly centralized network. If this is not true, the network is decentralized (Monge & Contractor, 2003). Each of these measurements help to understand a global network quantitatively and lead to the third research question:

RQ3: What is the network centrality of the defined network?

Table 3
Social Network Measures Assigned to Global Network

Measure	Definition
Size	Number of actors in the network
Betweenness	The extent to which nodes in a network are directly connected only to those other nodes that are not directly connected to each other
Density	Ratio of the number of actual links to the number of possible links in the network
Distance	The average number of links between two nodes in the network
Centralization	The difference between the centrality scores of the most central actor and Those of all other actors in a network is calculated, as used to form a ratio of the actual sum of the differences to the maximum sum of the differences

(Adapted from Monge & Contractor, 2003, p. 33)

To account for the necessity of a multitheoretical approach to network studies, as explained by MTML, both the diffusion of innovations theory and theory of power will be used.

Diffusion of Innovations

For the current study, the diffusion of innovations theory will serve as a theoretical framework to help provide insight into how information flows through communication networks created via social media. The diffusion of innovations theory looks at the process in which a new innovation is communicated to members of a society through various channels of communication (Rogers, 1995).

There are four main elements within the diffusion of innovations theory. These include the innovation, the communication channels, time, and the social system. An innovation is “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (Rogers, 1995, p. 11). When adopting this definition of an innovation, the issue of time becomes prevalent. Therefore, it is important to note that, for the sake of the diffusion of innovations model, chronological newness is not relevant. Rather, it is important that the potential adopter has

not yet determined a favorable or unfavorable attitude toward the innovation. Therefore, the newness of an innovation must be determined by considering knowledge, persuasion, or a decision to adopt (Rogers, 1995).

The diffusion of innovations process looks at the adoption or lack thereof of the innovation within the social system. From this starting point, research has veered off in a variety of directions. First, researchers are interested in the differences between those who are early adopters and those who are late adopters, focusing on those factors that may determine the likelihood of a person adopting a given innovation. Another direction researchers have taken diffusion of innovations research in is to use it to study how the attributes of the innovation itself impact the adoption rate (Rogers, 1995). Researchers have found there to be five attributes of innovations that have the greatest impact on adoption rates. The first of these is relative advantage or the extent to which the new innovation is considered to be better than what it is replacing. Another is compatibility or the extent to which the innovation is in line with the existing values, experiences, and needs of the social system. Complexity, or the extent to which the innovation is difficult to understand, is another attribute of innovations that contributes to adoption rates. Trialability, or the extent to which an idea can be tested with limited commitment, and observability, or the extent to which the results of adopting the innovation are visible to others are the final two attributes that should be understood (Backer & Rogers, 1998). Finally, researchers are interested in studying why diffusion often follows an S-shaped diffusion curve (Rogers, 1995). In other words, researchers study why new ideas are typically adopted slowly at the beginning, then, if perceived as advantageous, adopted more quickly before leveling off as less people remain to adopt the idea.

When considering the diffusion of innovations model, it is important to remember various characteristics of innovation adoption. First, one must remember that adopted innovations are not always an improvement upon the previous system and not all positive innovations are adopted by a social system (Monge & Contractor, 2003). There are often situations in which an

innovation is advantageous to one group or social system, but not to another. It is also possible that practical obstacles, such as time or cost, prohibit certain portions of the social system to adopt the innovation. However, previous research has suggested that innovations that are “perceived by individuals as having greater relative advantage, compatibility, trialability, observability, and less complexity will be adopted more rapidly than other innovations” (Rogers, 1995, p. 16).

The diffusion of innovations theory is applied to the context of social media in two primary ways. The first is studying the adoption of new technology used for or with social media. This can be the hardware that is used to participate in social media, such as a mobile device or participation in new social networking media platforms, such as Twitter. The second area the diffusion of innovations model can be applied to social media is in considering the flow of a piece of information through a social media network. The diffusion of innovations model provides researchers with a structure to help identify the process in which a new innovation is communicated to members of a communication network. This allows a researcher the ability to gain a further understanding of the information infrastructure of the system created through social media networks (Rogers, 1995). This second application of the diffusion of innovation model to social media is the application that will be used for the current study.

RQ4: How is information diffused within the defined network?

A Network Theory of Power

Although the diffusion of innovations theory provides a valuable framework for understanding the diffusion process within a social network, the use of an additional theory provides an opportunity for a deeper analysis. By considering the power structure within the network and the impact this has on the flow of information, the researcher may gain further

insight on the full network structure. A Network Theory of Power provides a framework by which to gain a further understanding of the impact of power on the network (Castells, 2011).

Understanding where the power lies in a network is critical to understanding the function of a social network, “as institutions and norms are constructed to fulfill the interests and values of those in power” (Castells, 2011, p. 773). With that being said, counterpower, or the push to resist the structure of the network on behalf of the interests, values, and goals of the marginalized group within the network, is also a driving force of network structure. Together, the interaction between the power structures and counterpower structures within a communication network determine the shape and qualities of the network (Castells, 2011). In order to reach the level of understanding necessary for deeper analysis of power within communication networks, each type of power must be further understood.

The Network Theory of Power defines power within a network in four different ways. These realizations of power are called networking power, network power, networked power, and network-making power. Broadly speaking, networking power is the power of those within the network over those who are not included in the network. Networking power can also be considered the power of the network among other networks. Network power results from the rules of inclusion in the network. In other words, network power is given to those who choose who to include or exclude from the network. Networked power is the power individual actors within the system have over other actors within the system. Oftentimes, networked power is closely connected to those who control the information flow in the network. Finally, network-making power is the power to program or create networks and to create alliances both within existing networks and in the network creation process. Also critical to understanding the Network Theory of Power is a basic understanding of counterpower, or the power by which programs in specific networks are changed or switches that represent dominant interests are disrupted and replaced (Castells, 2011).

Networking power, as mentioned before, deals with the power in-network actors have over out-of-network actors. Therefore, networking power operates on the basis of inclusion versus exclusion. Studies have shown that the cost of exclusion from a network is exponentially greater than the benefit of inclusion, which both increase with the size of the network (Tongia & Wilson, 2007). Therefore, those who are in a position to manage who is or is not excluded from the network hold a higher level of power than those who do not have this privilege.

Network power emerges from the coordinating standards or norms within a network. As explained by Grewal (2008), this can then be further broken down into two specific ideas. The first of these is that this power is increased, similar to networking power, by the size of the network, as coordinating standards gain value based on the number of individuals acting within the constraints of these standards. Second, through the establishment of network standards, the opportunity for group members to exercise free choice and choose actions alternate actions to network standards are diminished. This power in this regard is exercised through the imposition of these standards on in-network individuals rather than exclusion, as is the case in networking power. In other words, network power is the power to impose network standards over the individuals or organizations within the network (Grewal, 2008).

Networked power is power within the network on an individual basis. For the concept of networked power, power is defined as “the relational capacity to impose an actor’s will over another actor’s will on the basis of the structural capacity of domination embedded in the institutions of society” (Castells, 2011, p. 775). Although nearly impossible to analyze on a global level, networked power can be understood through the analysis of specific networks. By determining how the individual network defines power based on its goals, a researcher can construct a picture of the networked power for that specific network.

Finally, network-making power must be considered. Castells (2011) outlines two basic mechanisms that network-making power exists within:

- (a) the ability to constitute network(s) and to program/reprogram the network(s) in terms of the goals assigned to the network; and (b) the ability to connect and ensure the cooperation of different networks by sharing common goals and combining resources while fending off competition from other networks by setting up strategic cooperation (p. 776).

The individuals engaged in the first of these two mechanisms can be named “programmers”.

Programmers play a powerful role within the network because network programming is the initial phase of becoming an efficiently run network and, ultimately, reaching network goals.

Individuals involved in the second of the two mechanisms can be referred to as “switchers” (Castells, 2011).

By effectively engaging in the process of facilitating the relationship between likeminded networks and competition networks, a network can increase the likelihood of obtaining network goals (Castells, 2011). By understanding various realizations of power within the network, a more comprehensive understanding of the network structure can be gained. As demonstrated by the multiple measures of network theories that measure for aspects of power, including degree, centrality, betweenness, and others, power structure is closely related to network structure. Therefore, the Theory of Network Power provides a critical framework for network structure analysis and leads to the last research questions:

RQ5: Who holds the power in the defined network?

By considering each of these questions, the researcher will gain a more thorough view of the communication patterns created through the use of Twitter at Marquette University. By effectively engaging in this process, researchers gain a new tool by which to evaluate the use of social media in organizations.

Chapter 3: Method and Analysis

Network Analysis

The current study seeks to examine the network structure of social media use within an organization. To do this, Marquette University is used as a case study. Through the case study, the researcher sought to understand the communication network created by Twitter accounts officially recognized by Marquette University, as described below. These relationships were examined through a network analysis. Network analysis is “a set of research procedures for identifying structures, or regular patterns in the relations among interacting units...of a social system” (Yuan & Ksiazek, 2011, p. 183). Among communication studies, network relationships are most often interested in defining the network based on the quantity of information flow among individuals or organizations within the network, which is also the case in the current study (Barnett, Danowski, Feeley, & Stalker, 2010).

Marquette University was chosen for this study for a variety of reasons. With social media, specifically Twitter, typically being primarily used by individuals age 18-29, a university is a place rich with data for a study such as the current study (Brenner, 2013). Marquette University is also ranked 74th on a list of top 100 social media schools by Student Advisor, further making it a viable place to collect social media data (Student Advisor, 2013). Universities are typically bureaucratic and rigid organizations, whereas Twitter is inherently flexible, making the contrast interesting and study worthy. Finally, the researcher was familiar with the Marquette University Twitter network going into the study from being a graduate student at Marquette.

Twitter

For this study, Twitter was the only social networking platform studied, though others exist. This constraint allows for the study to be more focused. Further research would need to be done on the network structure of social media use within an organization using other social

networking forums to gain a more comprehensive understanding of the role social media plays in communication networks in organizations.

Twitter is an online social media forum that allows online communication, participation, and collaboration. Twitter is often referred to as a microblog where users are enabled to share information by posting short Tweets and subscribing to the Tweets of other users, also known as following a user (Thoring, 2011). However, Twitter has also developed social networking features and, therefore, “not only creates new networks around interests and – most importantly – expertise, but also represents existent offline social networks” (Thoring, 2011, p. 142). Twitter users share information by posting Tweets, which are limited to 140 characters and can be accompanied by links or imaging. To encourage interactivity and personal conversation, Twitter offers specific types of Tweets such as Replies and Retweets. Replies are messages that respond to an individual Tweet. A Retweet is “someone else’s Tweet that you choose to share with all of your followers” (Twitter.com, 2012). Twitter is used by many individuals, businesses, and celebrities and for various purposes, as mentioned before, including marketing, public relations, advertising, etc.

Data Collection

To study the network, the network had to first be defined and each component was be conceptualized. To create the network list, all lists Marquette University subscribed to as of January 7th, 2013 were considered (found at <http://twitter.com/MarquetteU/lists>). From these, accounts or lists that do not focus primarily on Marquette University were not included. An example of these would be a list entitled “Jesuit Friends” which includes “Universities, organizations and individuals with Jesuit affiliations.” Each of the Twitter accounts were considered a node in the network. A node is said to interact with another node, for the sake of this study, if they “follow” the other one.

The researcher then gathered various relevant information for each of these accounts. For each account, the basic information included the date they joined Twitter, their frequency of tweets, what organization they represent, the number of followers they had and the number of accounts they were following as of January 6, 2013, the number of in-network Twitter followers they had and the number of in-network Twitter accounts they were following. A few websites were used to help gather this information, as cited with the full information in Appendix D, E, and F. Lists of the specific in-network accounts each account was following and being followed by were also collected on January 6, 2013, and entered into a 156 x 156 matrix. From this matrix, the data could be entered into UCINET for analysis. UCINET is the primary software used for network analyses. UCINET works in conjunction with the software NetDraw, which creates visual representations of the network (Borgatti, Everett, & Freeman, 2002; Borgatti, 2002).

Each of the nodes were also assigned a category. The main MarquetteU was a category of its own, Main. Any organization that a paid university member is responsible for managing aside from residence life and academic entities were grouped as Campus Organizations. Anything referring to residence life fell into the Residence Hall category. All academic functions were listed as Academic. Student organizations are organizations that are officially recognized by Marquette but exist exclusively through student efforts. Fraternities, sororities and related organizations fell under the Greek category. Alumni and related organizations were listed under the Alumni category. Any account relating to a person who is employed by Marquette University was categorized as Faculty. All accounts that dealt primarily with particular athletic teams at Marquette University or with Marquette Athletics as a whole were categorized as Athletics. Finally, any organization or person who did not fall into one of these categories was grouped together in a category called Other. These categories were used while computing the following measurements.

When considering the individual level of analysis, as mentioned, there are five important measurements that must be considered. These include degree, indegree and outdegree,

betweenness, and closeness. For the current study, each of these measurements must be defined in terms of the network being studied. The first of these measures is degree. Degree is the total number of ties associated with a node. For the current study, the degree will be defined as the total number of in-network Twitter accounts that are either following or being followed by the account that is being considered. The indegree value of the node, or the number of ties directed inward, will be defined as the total number of in-network Twitter accounts following that specific node. The outdegree value, or the number of ties directed outward, will be defined as the total number of in-network Twitter accounts that specific node is following.

The second individual level measure is betweenness. In the current study, betweenness will be quantified as the number of in-network Twitter accounts the Twitter account being focused on connects that are not directly connected to one another. This is calculated by counting the number of geodesics, or link paths, that pass through a given node (appropriately weighted if there are multiple geodesics between a given pair of nodes) via networking software analysis, which will be discussed further (Tutzauer & Elbirt, 2009).

Closeness is an additional individual level measurement that is critical to network analysis of the current study. After betweenness and degree values have been determined for each node, those values can be used to compute the closeness value of the node. For example, if a node has a degree of two, but is connected to a node that has a degree of 25 and a betweenness value of 10 and another node that has a degree of 40 and a betweenness value of 4, the original node would be assigned a closeness value of 79. These will also be computed via networking software analysis.

When considering the global network level of analysis, two further measurements emerge that are necessary for the network analysis process. The first of these is density. This will be computed by comparing the true number of relations within the network to the total possible number of relations.

Finally, each of the measurements used in the individual levels of analysis are used to determine the global measure of network centrality. By computing each of these measures, each node is awarded a centrality score. For example, a high degree value is an indication of a high centrality score. Betweenness and closeness scores on the individual level of analysis are also used to determine centrality of individual nodes. Individual centrality measurements are then used to compute the global network measure of centrality. A network with a small number of nodes with considerably higher centrality score than the others is considered highly centralized. Consequently, a network where the nodes all have relatively similar centrality scores is considered decentralized (Monge & Contractor, 2012).

There are many approaches to centrality, but the current study will use the Bonacich approach. The original degree centrality approaches treats those who have a high degree, or many connections, as powerful figures within the network. The Bonacich approach, however, take it a step further to say that the degree of those the original node is connected to influences that node's centrality and, consequently, power. For example, say Account A is connected to ten other accounts, but those accounts are each connected to a lot of others. Account B is also connected to ten other accounts, but the people Account B is connected to are connected to very few others. In this case, the original degree centrality approach would say they are equally powerful in terms of centrality. However, Bonacich would make an argument that Account A is more central because "one's centrality is a function of how many connections one has, and how many connections the actors in the neighborhood had" (Hanneman & Riddle, 2005). Furthermore, Bonacich, unlike the original approach, draws a distinction between centrality and power. In the previous example, although the traditional approach to central power would say Account A is both more central and more powerful, Bonacich would say Account B is more powerful. Bonacich argues that "being connected to others that are not well connected makes one powerful, because these other actors are dependent on you – whereas well connected actors are not" (Hanneman & Riddle, 2005).

Therefore, this study will use Bonacich's centrality measurement to measure individual member's centrality value.

Each of the theories, Diffusion of Innovations and the Theory of Network Power, allow for additional measurements and analysis. First, Diffusion of Innovations can be measured by analyzing various network measurements. The individual measurements of closeness and centrality, along with the global measurements of connectivity, density, distance, and connectedness, will be used to determine the diffusion of innovations within the network.

Finally, the Theory of Network Power can be used to compute measurements of the power of the network as a whole. This can be done by defining the different forms of powers in terms of this study. Networking power refers to the power of those within the network over those who are not included in the network. Without studying other networks aside from the Marquette network, this cannot be computed in this study. Network power refers to the power to coordinate social interaction in the networks. This can be computed by determining who is central within the network, as they control information flow. Networked power is also related to both centrality and betweenness, as it considers power of individuals within the network over other individuals within the network. Finally, network-making power includes two basic mechanisms. The first mechanism states "the ability to constitute network(s) and to program/reprogram the network(s) in terms of the goals assigned to the network" (Castells, 2011, p. 776). Therefore, this measure focuses on the ability to define the network. In this study, Marquette University holds this network-making power, as Marquette University manages the network via their online compilation of Marquette University affiliated Twitter accounts. The second mechanism of network-making power is "the ability to connect and ensure the cooperation of different networks by sharing common goals and combining resources while fending off competition from other networks by setting up strategic cooperation" (Castells, 2011, p. 776). For the current study, this can be considered in two distinct ways. The first is to consider the ability to link the Marquette University Twitter network with other networks. The second is to link distinct categories within

the Marquette University Twitter network to one another. The second of these will be focused on for the current study.

The values for each of these measures will be calculated using the networking analysis software package UCINET. Developed by Dr. Linton Freeman, UCINET has been identified as the primary network analysis package (Johnson, 1987). This program was created based on the work of scholars that has moved network theory studies to a multidisciplinary approach and, therefore, is complimentary to that approach in its capabilities (Johnson, 1987).

Chapter 4: Results

Using UCINET and NetDraw, various network measurements were computed to address each of the research questions. For many of the research questions, multiple measurements were used to determine the result (Borgatti, Everett, & Freeman, 2002; Borgatti, 2002). Both the reasoning for this and the resulting responses to each of the posed research questions are explained below.

Research Question One:

The first research question sought to gain further understanding of the communication network structure of Marquette University's officially recognized Twitter account network. As previously mentioned, the traditional categories of communication network structure include formal and emergent networks. As the communication network structure emerged of Marquette University's officially recognized Twitter accounts, the graphics show the structure to fit the definition of an emergent structure.

NetDraw was used to group nodes categorically into each of these ten categories and the scrunch factor was increased to 50. Scrunch is a process that pulls together the nodes of the same category. This was used to allow the current structure to visually appear (Borgatti, 2002).

When comparing the social business structure of Marquette University (See Figure 3), this figure most closely matches the organic social business structure. Therefore, the communication network structure of Marquette University's officially recognized Twitter accounts is an emergent, organic social business structure.

Table 4
Network Density Values

Category	Density	Number of Ties	Average Degree
Greek	0.733	22	3.667
Residence Hall	0.712	94	7.833
Alumni	0.583	7	1.75
Academic	0.487	76	5.846
Campus Organizations	0.356	613	14.595
Athletics	0.220	29	2.417
Student Organizations	0.198	236	6.743
Faculty	0.121	67	2.792
Main*	N/A	N/A	N/A

* Density cannot be computed for category because category represents only one account

Research Question Three:

The third research question seeks to understand the centrality of the network. Various centrality measures are often used in network analyses. For this particular study, Bonacich's approach to degree centrality is regarded as the primary centrality measurement. The Bonacich centrality measures for the top 25 accounts based on normalized Bonacich centrality are shown in Table 5 and will also be referred to in research questions four and five.

Table 5
Bonacich's Centrality Measures

Account	Power	Normalized Power
MarquetteU	144	3.602
MUCollegeofComm	105	2.627
MUannex	93	2.327
MarquetteMedia	92	2.302
MarquetteGlobal	91	2.277
MUBackOut	89	2.226
MarquetteRHA	88	2.201
MarquetteCrew	86	2.151
MUChicagoAlumni	86	2.151
LateNightMU	78	1.951
muathletics	75	1.876
MU_OSD	74	1.851
Mu_Rec_sports	72	1.801
MUGospelChoir	71	1.776
MU_GoldinPR	70	1.751
MUGoldNBlues	70	1.751
FatherMarquette	68	1.701
MUGradSchool	67	1.676
MarquetteITS	66	1.651
MU_Peacemaking	65	1.626
SEACMarquette	65	1.626
MUAdmissions	64	1.601
mutribune	62	1.551
MUMashudaHall	59	1.476
MUEducation	58	1.451
MUHungerCleanUp	58	1.451

A global network can also be measured by a centrality figure. However, due to the nature of Bonacich's approach to centrality, Bonacich's centrality does not offer a global centrality figure. Therefore, the global centrality figure will be computed using the traditional degree centrality measurement (Borgatti, Everett, & Freeman, 2002). The global centrality measurements show that the network centralization (OutDegree) value is 74.897%. The network centralization (InDegree) value is 43.527%. For comparison purposes, the full individual level degree centrality figures are attached as Appendix A.

Research Question Four:

The fourth research question looks at how information is diffused within the Marquette University Twitter network. To understand diffusion within the network, five main measurements are used. These include various centrality values, betweenness, distance, reciprocity and density.

When considering centrality, various measurements can be used to create a full numeric illustration of the network. The first is individual level Bonacich centrality values. These values are listed in Table 5 and show MarquetteU with a drastically higher power value than all other accounts. The second measurements to be considered are the global level degree network centrality figures for outdegree and indegree. These values show the Network Centralization (Outdegree) value to be 74.897% and the Network Centralization (Indegree) value to be 43.527%.

Betweenness is a value similar to centrality, which is also useful to understanding the diffusion of innovations process within the network. Betweenness values for the top 25 accounts based on degree are listed in Table 6. Full individual level betweenness values are listed in Appendix C.

Table 6
Individual Level Betweenness

Account Name	Betweenness	Normalized Betweenness
MarquetteU	3524.776	14.767
MUCollegeofComm	2071.982	8.68
MUannex	543.497	2.277
MarquetteMedia	420.802	1.763
MarquetteGlobal	684.767	2.869
MUBackOut	210.338	0.881
MarquetteRHA	293.976	1.232
MarquetteCrew	224.228	0.939
MUChicagoAlumni	362.594	1.519
LateNightMU	745.195	3.122
muathletics	1115.6	4.674
MU_OSD	722.23	3.026
Mu_Rec_sports	116.72	0.489
MUGospelChoir	223.749	0.937
MU_GoldinPR	221.956	0.93
MUGoldNBlues	330.076	1.383
FatherMarquette	322.626	1.352
MUGradSchool	201.351	0.844
MarquetteITS	379.979	1.592
MU_Peacemaking	194.943	0.817
SEACMarquette	115.57	0.484
MUAdmissions	432.691	1.813
mutribune	880.689	3.69
MUMashudaHall	118.151	0.495
MUEducation	274.06	1.148

Density is an additional measurement useful for understanding the diffusion of innovations within the network. See RQ 2 (Table 4) for density data.

A reciprocity value is helpful when seeking to understand the flow of information through the network. Reciprocity data for this network shows that the full data reciprocity value is 0.4559, or almost half of the accounts that are directly following another account are being followed back by that account.

Distance is the final measurement this study will consider when seeking to understand how information is diffused throughout the network. Table 7 shows the frequencies of distances, with a missing value meaning the node is liked to other nodes by more than four links.

Table 7
Distance Frequencies

Value	Frequency	Proportion
Missing	1531	0.063
1	4586	0.19
2	16134	0.667
3	1914	0.079
4	15	0.001

Research Question Five:

The final research question looks at how power is distributed among the network created by officially recognized Marquette University Twitter accounts. This information is also understood by considering multiple measures. Global density values, betweenness values, Bonacich's power centrality and degree measures are all used to understand power within a network. Global density values can be found under RQ 2, Table 4. Bonacich's power centrality values can be found under RQ 3, Table 5. Individual level betweenness values are also useful when considering the power distribution within the network. Individual level betweenness values can be found for the top 25 accounts in RQ 4, Table 6 and full individual level betweenness values can be found in Appendix C.

Finally, a simple individual degree measure can be useful in measuring power within a network. In Table 8, the individual degree values for the top 25 accounts, based on degree, are listed. The global degree network centralization values are 43.527% for indegree and 74.897% for outdegree. The full table of individual degree values is shown in Appendix A.

By reviewing these results, the researcher can gain insight into the current communication structure at Marquette University. This allows the researcher to evaluate the effectiveness of this structure, opportunities for engagement and future directions.

Table 8
Individual Degree Values

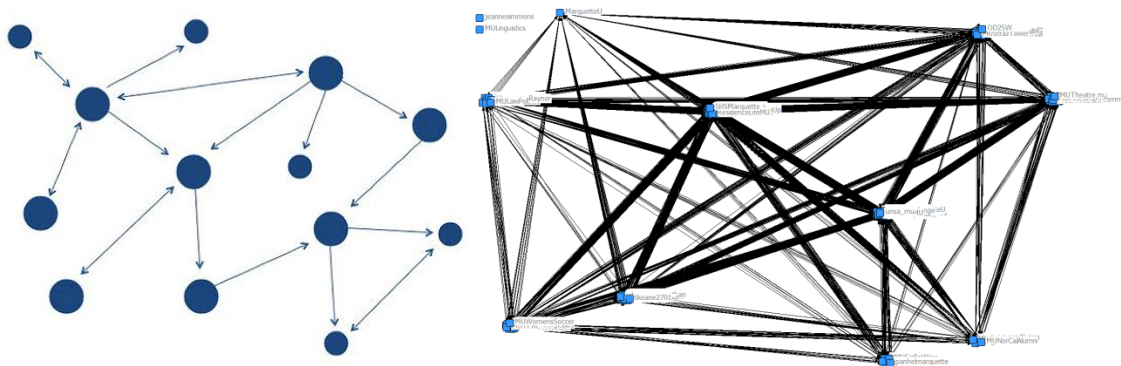
Account Name	OutDegree	InDegree	Normalized OutDegree	Normalized InDegree
MarquetteU	144	59	92.903	38.065
MUCollegeofComm	105	96	67.742	61.935
MUannex	93	65	60	41.935
MarquetteMedia	92	51	59.355	32.903
MarquetteGlobal	91	47	58.71	30.323
MUBackOut	89	40	57.419	25.806
MarquetteRHA	88	59	56.774	38.065
MarquetteCrew	86	40	55.484	25.806
MUChicagoAlumni	86	36	55.484	23.226
LateNightMU	78	85	50.323	54.839
muathletics	75	79	48.387	50.968
MU_OSD	74	91	47.742	58.71
Mu_Rec_sports	72	33	46.452	21.29
MUGospelChoir	71	53	45.806	34.194
MUGoldNBlues	70	50	45.161	32.258
MU_GoldinPR	70	45	45.161	29.032
FatherMarquette	68	54	43.871	34.839
MUGradSchool	67	38	43.226	24.516
MarquetteITS	66	64	42.581	41.29
MU_Peacemaking	65	57	41.935	36.774
SEACMarquette	65	25	41.935	16.129
MUAdmissions	64	83	41.29	53.548
mutribune	62	94	40	60.645
MUMashudaHall	59	36	38.065	23.226
MUHungerCleanUp	58	62	37.419	40

Chapter 5: Discussion and Recommendations

The objective of this study was to explore and analyze from a network perspective the social network created by the Marquette University affiliated Twitter accounts. The posed research questions worked toward this ultimate goal by addressing social structure, density, centrality, diffusion of innovations, and network power. A result of the study suggests that Marquette University currently has an organic social structure (RQ1) and allow the researcher to determine whether this is the ideal social structure for this organization. The findings of the current study provide Marquette University with a new perspective of the institution's use of Twitter while also providing other organizations a new way to study their own social media networks and analyze effectiveness.

The first research question seeks to understand the current social structure of the Marquette University Twitter network. By visually comparing the social structure protocols with the social structure that emerged through the Marquette University data, as shown in the Results section, Marquette University's Twitter network most closely resembles the organic social structure, shown comparatively in Figure 4.

Figure 4
Social Structure Comparison



Comparison of organic social structure (left) and Marquette University's Twitter network (right).

According to Owyang (2010), each of the primary social structures has both advantages and disadvantages. Owyang (2010) also specifies that each model tends to be best suited for a particular type of organization. The organic social structure is beneficial because it often appears the most natural, leading to consumers easily trusting networks organized in this fashion (Owyang, 2010). However, due to the lack of control exercised in this social structure, it can often offer an inconsistent voice and overall experience to those who are interacting with the organization. For this reason, most companies that are currently structured this way are working to transition out of this model. By considering the results of each of the posed research questions, the researcher will be able to determine if this is the best social structure for Marquette University and make a recommendation of future actions.

Centrality figures for the Marquette University Twitter network offer insight into the social structure for the university Twitter network (RQ 3). Within the studied network, the main account, MarquetteU, emerges as the most centralized account by a significant margin (n Centrality=3.602). Although not all categories are represented in the top of the centrality measure, a variety of them are, ranging in centrality values from MUCollegeofComm at 2.627 to MUChicagoALumni at 2.151. MUCollegeofComm, the second most centralized account, represents the academic category. The third most centralized account is MUannex, representing the campus organizations category. The fourth and fifth most centralized accounts also represent the campus organizations category. The sixth most centralized account, MUBackOut, represents the student organization category, the seventh most centralized account, MarquetteRHA, represents the residence hall category, the eighth most centralized account, MarquetteCrew, represents the athletic category, and the ninth most centralized account, MUChicagoAlumni, represents the alumni category. In other words, of the eight specific categories, six categories are represented in the top ten most centralized accounts in the network. This indicates that natural categorical hubs are emerging.

The global level centrality figures offer additional insight useful to managing social media within the Marquette University Twitter network. Global centrality measures show that the network centralization when looking at specifically outdegree is 74.897%. This measure looks at the extent to which this network is well connected when pushing information out and indicates that this is a strength of the network. However, the network centralization when looking specifically at indegree is only 43.527%. Indegree centrality looks at the rate and frequency of information coming in. In social media, this is often interpreted as engagement. Research has shown that the higher the engagement, the more successful an organization is likely to be in their social media marketing and advertising efforts (Keller & Kortier, 2009; Tuten, 2008). Therefore, Marquette should make efforts to increase this figure.

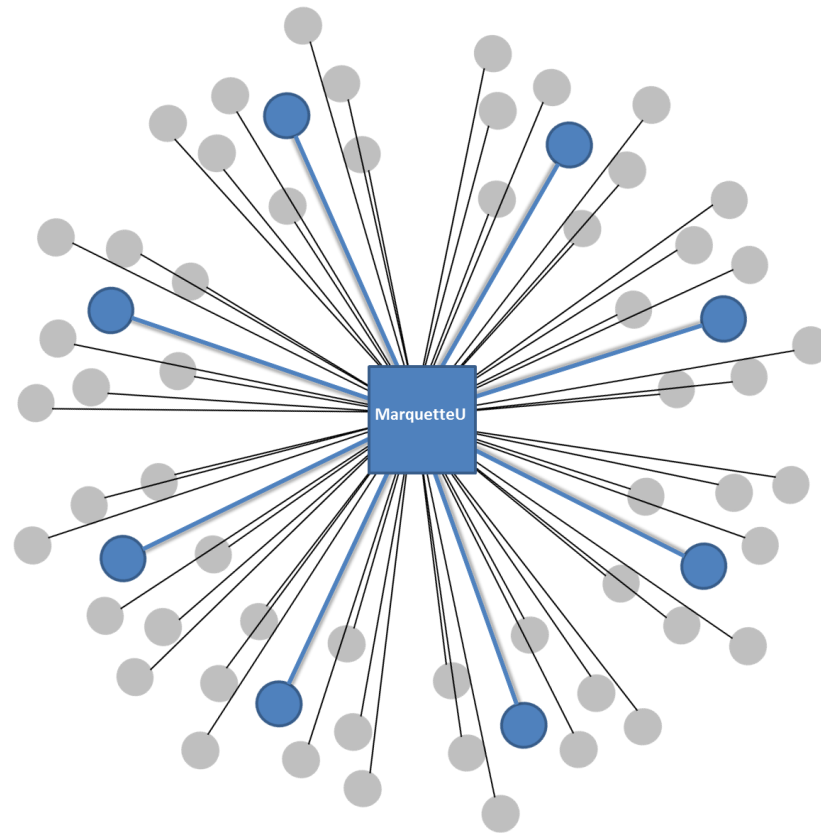
When considering the overall flow, or diffusion, of information through the network, various measurements were used. These include various centrality values, betweenness, distance, density, and reciprocity. The first centrality value used to understand the diffusion process is the Bonacich centrality values, which are used to indicate power. These values show that the main MarquetteU account has a drastically higher power value than all other accounts ($nPower = 3.602$ compared to $nPower = 2.627$ for the second highest Bonacich value). This shows that MarquetteU is uniquely positioned to both be connected to a large number of in network nodes, but is also connected to nodes that are highly connected to other in network nodes, increasing the reach of MarquetteU.

The second centrality value that must be considered is the global level degree centrality figures. These figures show that, when sending information out, the network is highly centralized (74.897%). This shows that one main account, presumably the MarquetteU account, is significantly better positioned to send information out to the rest of the network than all other network players. However, when receiving information inward, the network is less centralized (43.527%). Although still relatively high, this shows that a few accounts are best positioned to send information into the middle of the network.

Betweenness is useful in supporting these ideas. Betweenness values show that MarquetteU is a powerful connector of other nodes, with an nBetweenness value of 14.767. The second most powerful connector is MUCollegeofComm, with an nBetweenness value of 8.680, significantly lower than that of MarquetteU. By combining this information with an understanding of the density values, as explained earlier in this section, one can begin to understand the network. However, further information further solidifies understanding.

Two final measurements help create a final illustration of the network in terms of information diffusion. These values are distance and reciprocity. Distance shows that most nodes in the network are connected by an average of two steps. This, combined with the knowledge that the network as a whole is not densely connected, can help form a structural idea of the network and how information is diffused within the network. Reciprocity values show us that a little less than half the accounts that are following another account are also followed by that account (reciprocity=0.4559). This explains the disparity in indegree and outdegree centralization values. Using a combination of these measurements, I believe that the following illustration helps to understand how information may be diffused within this network.

Figure 5
Illustration of Current Network Diffusion



This illustration is a simplified version of how the data suggest information may be currently diffused within the Marquette University Twitter network. MarquetteU is highly centralized, as shown by Bonacich power values and betweenness. MarquetteU has the highest degree (degree = 144), showing that MarquetteU is connected directly to almost the entire network. This, combined with the MarquetteU's high betweenness value, explains the average distance of two steps, showing most nodes can reach all other nodes by connecting to MarquetteU and then to that other node. However, the density values show that the network is most densely organized around categories and not dense overall (full data density = 0.190). Therefore, it is logical to assume that there are primary nodes in various categories, yet all nodes are still primarily dependent on the MarquetteU account.

Finally, the idea of power is considered. A Network Theory of Power defines power in four different ways. Since the current study only looks at one network, networking power and network-making power cannot be fully understood based on the data in this study. The data in the study also does not fully support the means by which to make any conclusions on network power. However, the study does allow networked power, or the power individuals within the network have over others in the network, to be used to better understand the network (Castells, 2011).

By considering global density, betweenness, Bonacich's power centrality, and degree values, networked power can be identified within the Marquette University network. Combined, these values clearly show MarquetteU, the main Twitter account for the University, to hold the highest amount of networked power within this particular network. The MarquetteU main account also holds network-making power, to the extent that this study can show, as it is the account that has the power to constitute the network when using the network defining method used in this study. However, it is also important to consider who else holds networked power in this network. When considering the next highest networked power holders in the network, accounts like MUCollegeofComm, MUAthletics, MUTribune, LateNightMu, and others show up among the various measurements. These accounts each come from a different category within the network, further supporting Figure 5. Using this information, the researcher is able to make recommendations on a practical level.

Practical Application

The results of this study can give organizations using social media insight into how to best utilize social media in their organization. Using the data gathered in this study, it is shown that the Marquette University Twitter network is currently organized with an organic social structure. However, the primary application to emerge from this study, based on the data, is a recommendation to engage in efforts to change the social structure of the Twitter network at Marquette University. Due to the nature of Twitter and social media in general, an informal

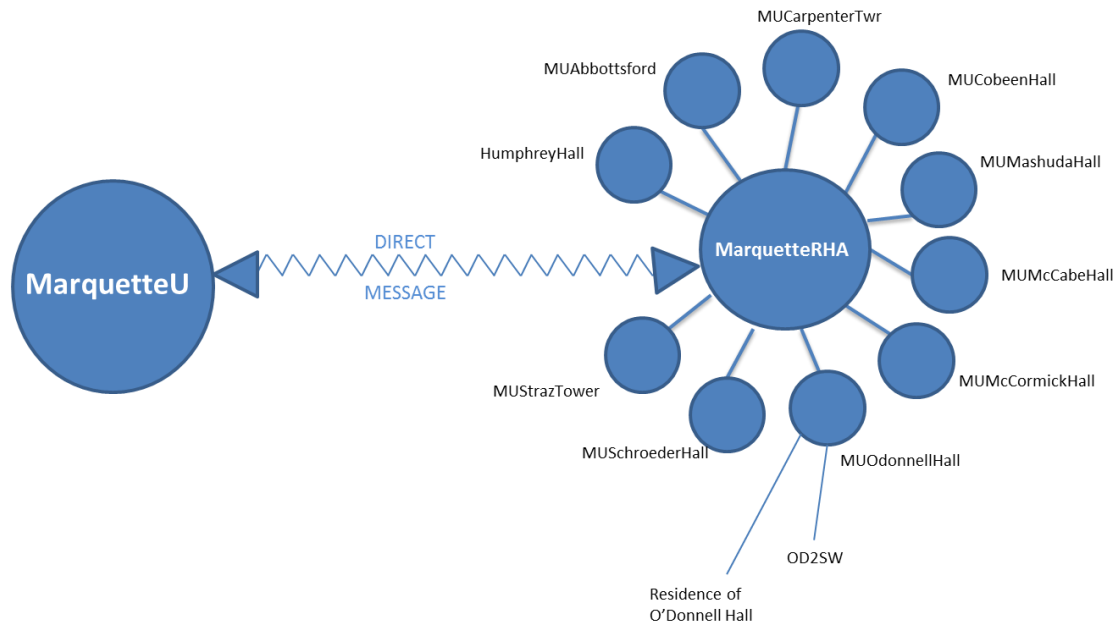
network structure will continue to exist organically. However, this study suggests that a restructuring of Marquette University's formal Twitter network would be advantageous, for the following reasons. This change would improve the diffusion of innovations process within the network by dispersing the network power.

Each of the social business networks, as mentioned earlier, has both advantages and disadvantages. The Centralized model offers a consistent consumer experience, but often appears scripted and inauthentic (Owyang, 2010). The Centralized model is best used by highly regulated industries. The Coordinated model also provides a unified experience for consumers, but is costly by requiring the active participation by many areas within the organization and centralized support. This model is popular because it provides some control while also meeting the needs of each individual category within the organization. The Holistic model often feels personable and takes advantage of the entire workforce, but is highly susceptible to crisis communication situations. The Holistic model is hard to implement and is typically only successful in a corporate culture that naturally lends itself to this model. Finally, the Multiple Hub & Spoke model is beneficial for providing targeted information that is still loosely controlled, but requires a dedicated staff to enact. This model is often "most suited for large, multi-national corporations with multiple product lines" (Owyang, 2010). I would also argue that the Multiple Hub & Spoke model is ideal for universities, such as Marquette University, due to the high quantity of information of a large variety of topics.

One set of data that suggests a Multiple Hub & Spoke model would be appropriate for Marquette University's Twitter network is network density (RQ2). For the full data, the network density is 0.19, which is relatively low. However, categories such as Greek and Residence Halls have high densities at 0.733 and 0.712 respectively. Although the data do not extend to the next level, it is logical to assume that the accounts that make up each of these categories would each have their own network. For example, the Residence Hall category would likely be centered on the Residence Hall Association. From there, the extending spokes would likely be specific

Marquette University Residence Halls. One could assume that each residence hall is largely followed by and interacted with by residence of that building. By sharing information directly between MarquetteU and MarquetteRHA, this could be easily transformed into a branch of the network that would likely resemble Figure 6.

Figure 6
Adapted Hub and Spoke Branch



An example of a plausible Hub & Spoke organization within the Marquette University Twitter network.

The application of a Hub & Spoke social structure would be a process of dispersing power. To restructure, MarquetteU would forge an active relationship with the person who controls the hub of each categorical branch. In the above example, this would mean that MarquetteU and MarquetteRHA would have an active relationship with one another. Once this is forged, MarquetteU would empower MarquetteRHA by direct messaging or e-mailing MarquetteRHA with information relevant to Marquette residence halls and allowing MarquetteRHA to be the source of this information on Twitter. Likewise, MarquetteRHA would work to direct information relevant to the full student body to the MarquetteU account.

There are various advantages to seeking to adopt a Multiple Hub & Spoke model at Marquette University. The first is that the current structure of the Marquette University Twitter network is already naturally leaning this direction within various categories, as indicated by the density values of the network. This suggests that the model would not feel forced or artificial for this network. Second, this model disperses the responsibilities of Marquette's social media manager. In a large and multi-faceted organization, such as a university, it is unreasonable to expect one person to be able to effectively manage all aspects of social media due to the large quantity of information the network is responsible for. With such a large amount of information being managed by one main account, it is likely that the account will only have the capacity to manage information that aligns with their individual mission. This may result in a lack of diffusion for information that is not directly relevant to the main account, but may be relevant to a subsection of the network. With this model, Marquette's social media manager would be responsible for training each of the actors in the "hub" positions of the network. In the Residence Hall example, Marquette's social media manager would seek to train the person(s) responsible for managing the Marquette Residence Hall Association account. This person would then be entrusted to train and monitor those responsible for the accounts of each individual residence hall. This way, Marquette's social media manager can expand his or her influence while still maintaining some control and continuity throughout the social network.

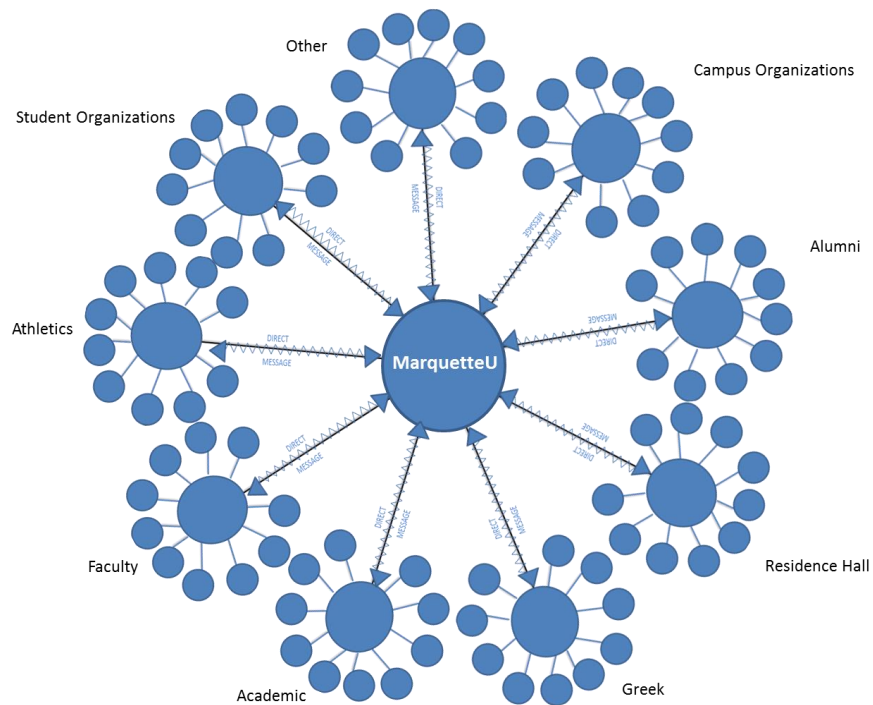
In the current network, information is primarily sent from the main MarquetteU account directly out to all members of the network. There are three main problems with information being diffused in this way. The first of these problems is logistical. As one account, the MarquetteU account is not able to properly balance the large quantities of information it is currently responsible for. In other words, those managing this account must make content decisions in order to maintain the structural position of this account. These decisions result in valuing some content more than others, which gets at the second problem. The second problem with this diffusion structure is a lack of voice. With most accounts only getting information from other

areas through the filter of the MarquetteU account, this information is often relayed to them in the voice of MarquetteU. This dilutes the strength of individuality within the network. Finally, this diffusion structure leaves little room for feedback. Not indicated in Figure 5 is directionality, but the global degree centrality figures illustrate this, showing MarquetteU to be a highly centralized figure when dispersing information out, but not as strong at receiving information. Therefore, while this diffusion structure works well at sending information out, it is largely ineffective at receiving information. This is largely due to a lack of resources to properly manage all information in both directions, but does not allow for a strong Twitter community of feedback and response or productive engagement.

Once again, the hub and spoke model provides a logical reorganization pattern to alleviate many of these concerns. By reorganizing into a hub and spoke social structure, a variety of accounts take on the responsibility of managing the information within the network, rather than just one account. This allows content that is rejected by one network leader to be accepted by another network leader, resulting in less lost content within the network. Second, the hub and spoke model allows this information to be sent out in a variety of voices rather than only the voice of the main MarquetteU account. This would give the network more individuality, which may result in a more diverse audience, network growth, and additional trust in the network. Finally, this reorganization would allow a variety of network leaders to take on the responsibility of not only sending information out, but also receiving feedback. With this responsibility more evenly spread out, the likelihood of feedback being heard and appropriately responded to increases.

By engaging in this restructuring process, the network would transition from the current formal network, demonstrated in Figure 4, to resembling the formal network shown in Figure 7.

Figure 7
Adapted Full Hub and Spoke Structure



Limitations

While completing this study, four main limitations emerged. The first of these is the amount of information available through Twitter. Originally, the researcher sought to track individual conversation streams. However, due to the nature of Twitter, this was not possible, limiting the conclusions that could be made on how information flows through the network.

A second limitation that emerged is the uncertainty of reliability of some outside websites used to gather information. The website tweepdiff.com, in particular, was used to obtain lists of which accounts each individual followed that was in network and which accounts each individual was followed by that were in network. There was a lack of literature available showing the

reliability of this site, so that must be considered when considering the reliability of the data as a whole.

The third limitation to this study is the complex nature of network studies in general. In network studies, a large number of factors can have influence on any one aspect of the network. It is nearly impossible to account for all of the third variables. Therefore, it is possible that these variables had an impact on the network that was not taken into consideration. This must be remembered when considering the results of the study.

Finally, due to the nature of a graduate thesis, time restrictions acted as a limitation to this study. Although this study could have continued to expand, the scope had to be set where it was in order for it to be possible to complete the full study before deadlines.

Future Directions

To this point, social media have not been studied from a network theories perspective. This leaves many different areas that this direction could go in the future. Although the possibilities are limitless, three main areas emerge where this type of research could be expanded.

The first area that this type of research could expand to in the future, in no particular order, is to looking at social networks using social networking sites other than Twitter. By studying this, researchers could gain insight into the networking qualities of each social networking site and how they compare to one another.

Future research could also consider how whole social networks interact with other whole social networks. This could be done by comparing Marquette University's Twitter network to other university or organization Twitter networks. This could also be done by comparing two different social networks within the same organization. For example, a study could be done on Marquette University's social network on Facebook and that could then be compared to the results from the current study.

Finally, future research could use different theories when engaging in the MTML network studies approach. The current study only used the diffusion of innovations theory and the network power theory. Using other theories could expand on the insight gained from the study. As mentioned, these are not the only directions future research could go, they are simply some of the main, broad areas.

Conclusion

The purpose of this research was to provide an introductory look at the communication systems created via social media platforms to gain insight into the information diffusion process and power within the network. The resulting data led the researcher to recommend a restructuring of the formal structure of Twitter usage within the Marquette University Twitter network. The most important result of this study, however, is the introduction of social media analyses to network studies. This study shows that a network analysis can be a useful and worthwhile approach to understanding social media use within an organization on both a theoretical and applied level.

At a theoretical level, this study supports the recently proposed power theory. This theory states makes the claim that “communication networks are the fundamental networks of power making in society” (Castells, 2011, p. 785). By drawing a connection between network structure and various realizations of power, one can begin to understand which roles within the network give that individual power in different senses. By recognizing the close relationship between power and network structure, individuals in powerful roles may seek to influence the network structure to more effectively accomplish network goals (Castells, 2011).

As illustrated early in this study, social media are an integral part of businesses today. Social media are used as a business tools for areas ranging from advertising and marketing to brand awareness and community relations. However, with technology growing and changing rapidly, many organizations have only been able to establish their presence on these networks and

have not been able to study the finer details of how social media are impacting their business.

This research arms businesspeople seeking to gain a further understanding of the impact of social media on their business an additional tool to gain this information.

With knowledge comes power and that is the true strength of this study. By equipping researchers, businesspeople, and others with a method to gain knowledge about the work they are doing, these people gain the power to more effectively use social platforms. As communication scholars, it is important to continually study how to more effectively understand the world around us and to seek new ways to gain this knowledge.

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Appendix A
Full Individual Level Degree Centrality

Account Name	OutDegree	InDegree	Normalized OutDegree	Normalized InDegree
MarquetteU	144	59	92.903	38.065
MUCollegeofComm	105	96	67.742	61.935
MUannex	93	65	60	41.935
MarquetteMedia	92	51	59.355	32.903
MarquetteGlobal	91	47	58.71	30.323
MUBackOut	89	40	57.419	25.806
MarquetteRHA	88	59	56.774	38.065
MarquetteCrew	86	40	55.484	25.806
MUChicagoAlumni	86	36	55.484	23.226
LateNightMU	78	85	50.323	54.839
muathletics	75	79	48.387	50.968
MU_OSD	74	91	47.742	58.71
Mu_Rec_sports	72	33	46.452	21.29
MUGospelChoir	71	53	45.806	34.194
MUGoldNBlues	70	50	45.161	32.258
MU_GoldinPR	70	45	45.161	29.032
FatherMarquette	68	54	43.871	34.839
MUGradSchool	67	38	43.226	24.516
MarquetteITS	66	64	42.581	41.29
MU_Peacemaking	65	57	41.935	36.774
SEACMarquette	65	25	41.935	16.129
MUAdmissions	64	83	41.29	53.548
mutribune	62	94	40	60.645
MUMashudaHall	59	36	38.065	23.226
MUHungerCleanUp	58	62	37.419	40
MUEducation	58	72	37.419	46.452
JoeyTrentMUSG	57	24	36.774	15.484
MUHealthEd	57	34	36.774	21.935
MU_YAA	55	62	35.484	40
MUStrazTower	55	53	35.484	34.194
MUCobeenHall	53	53	34.194	34.194
MarquetteCRE	51	43	32.903	27.742
MUSchroederHall	49	45	31.613	29.032
MUSafety	49	37	31.613	23.871
MUMcCormickHall	48	53	30.968	34.194
MUCAC	46	40	29.677	25.806
MUSpiritShop	45	63	29.032	40.645
mujournalism	45	27	29.032	17.419
MUTheatre	44	62	28.387	40
MURASelection	42	24	27.097	15.484
MUSG	42	87	27.097	56.129
marquetteradio	42	65	27.097	41.935
SeniorChallenge	41	30	26.452	19.355
MUAdClub	40	50	25.806	32.258
InterculturalMU	40	47	25.806	30.323

MarquetteNurses	40	27	25.806	17.419
SHSMarquette	39	40	25.161	25.806
MUCSCJobs	39	59	25.161	38.065
MU_Active_Minds	39	21	25.161	13.548
MUBizCareers	38	18	24.516	11.613
MarquetteMBA	37	40	23.871	25.806
MUBusiness	36	53	23.226	34.194
marquetteecon	35	29	22.581	18.71
mugoggetters	34	42	21.935	27.097
herbertlowe	34	26	21.935	16.774
MUCarpenterTwr	33	28	21.29	18.065
MUNRHH	33	33	21.29	21.29
MarquetteDining	33	20	21.29	12.903
MUAbbottsford	32	33	20.645	21.29
BestBuddies_MU	32	31	20.645	20
MUFootball	32	12	20.645	7.742
MarquetteUnivTV	32	68	20.645	43.871
MarquettePRSSA	31	41	20	26.452
MULegalClinic	31	9	20	5.806
museac	31	39	20	25.161
NABJ_MarquetteU	30	34	19.355	21.935
MUservelearn	29	13	18.71	8.387
MUCircleK	28	9	18.065	5.806
FvrythingPR	27	48	17.419	30.968
MUMcCabeHall	27	29	17.419	18.71
MUTVSports	26	46	16.774	29.677
MUEntrepreneur	25	45	16.129	29.032
OttWC	25	33	16.129	21.29
ResidenceLifeMU	25	24	16.129	15.484
mutribune_vp	25	11	16.129	7.097
MUKappaSig	25	24	16.129	15.484
MU_CSC	24	84	15.484	54.194
EmilyBaseheart	24	6	15.484	3.871
MarquetteSigs	22	17	14.194	10.968
HumphreyHall	21	38	13.548	24.516
MarquetteGSO	20	18	12.903	11.613
MarquetteBioSci	20	12	12.903	7.742
drkatiberg	19	20	12.258	12.903
musuperfans	19	51	12.258	32.903
MarquetteRaynor	17	26	10.968	16.774
MUSocInnovation	16	18	10.323	11.613
marquettesoccer	16	46	10.323	29.677
mu_orchestra	16	28	10.323	18.065
MUCampusMin	15	61	9.677	39.355
MUNorCalAlumni	15	6	9.677	3.871
AXiD_ThetaEp	15	0	9.677	0
MUChorus	15	17	9.677	10.968
panhelmarquette	15	19	9.677	12.258
MUITSO	14	19	9.032	12.258
MU_mardigras	14	17	9.032	10.968
maryingles	13	18	8.387	11.613

MU_COESC	13	4	8.387	2.581
MUAspin	13	9	8.387	5.806
HypeMarquette	12	10	7.742	6.452
Dean_Chioma	12	8	7.742	5.161
MUBizAbroad	12	12	7.742	7.742
MarquetteU_CTL	12	4	7.742	2.581
unsa_mu	11	2	7.097	1.29
MUMSComp	11	13	7.097	8.387
SlowFoodMU	11	24	7.097	15.484
MU_Bayanihan	10	10	6.452	6.452
ErikUgland	10	16	6.452	10.323
MUWTTC	10	9	6.452	5.806
MUTrib_sports	9	15	5.806	9.677
MU_ClubTennis	9	4	5.806	2.581
MULawAdmissions	9	8	5.806	5.161
MU_IBSA	9	11	5.806	7.097
muopusdean	9	15	5.806	9.677
catkinson_sa	9	4	5.806	2.581
MUtaekwondo	9	4	5.806	2.581
MUEngineers	8	15	5.161	9.677
MUSigEpWiz	8	11	5.161	7.097
PHNettleton	8	10	5.161	6.452
DebraKrajec	8	8	5.161	5.161
erinheff	7	8	4.516	5.161
MarquetteMBO	7	10	4.516	6.452
MUWatumishi	6	17	3.871	10.968
MUWomensSoccer	6	38	3.871	24.516
casey_flanagan	6	4	3.871	2.581
MUCycling	6	3	3.871	1.935
srbyers	5	17	3.226	10.968
mulaw	5	70	3.226	45.161
MarquetteAIM	5	20	3.226	12.903
BSOFashionShow	4	8	2.581	5.161
OD2SW	4	6	2.581	3.871
MUOdonnellHall	4	27	2.581	17.419
DoctorDUrso	4	10	2.581	6.452
MULawPoll	3	8	1.935	5.161
EdwardMathieSJ	3	2	1.935	1.29
Loobe21	3	5	1.935	3.226
mutribune_arts	3	9	1.935	5.806
AlphaPhiEtaMu	2	20	1.29	12.903
MULundaRoom	2	9	1.29	5.806
MUTFXC	2	9	1.29	5.806
MUEnviroLaw	2	2	1.29	1.29
MUFatherFred	2	22	1.29	14.194
MUSailing	2	4	1.29	2.581
agaudynski	2	3	1.29	1.935
MUclubDC	2	15	1.29	9.677
deahlr	2	2	1.29	1.29
GilkersonNathan	2	2	1.29	1.29
MURunningClub1	1	4	0.645	2.581

MarquetteStyle	1	1	0.645	0.645
jeangrow	1	12	0.645	7.742
MULinguistics	0	0	0	0
MUeLIMO	0	11	0	7.097
jeannesimmons	0	0	0	0
scottonj	0	3	0	1.935
Haggerty_Museum	0	34	0	21.935
tkeane2701	0	7	0	4.516
marquettelax	0	19	0	12.258

Appendix B

Full Closeness Centrality Values (By degree highest to lowest)

Account Name	inFarness	outFarness	inCloseness	outCloseness
MarquetteU	1339	628	11.576	24.682
MUCollegeofComm	1292	668	11.997	23.204
MUannex	1326	682	11.689	22.727
MarquetteMedia	1341	681	11.559	22.761
MarquetteGlobal	1345	681	11.524	22.761
MUBackOut	1353	683	11.456	22.694
MarquetteRHA	1331	687	11.645	22.562
MarquetteCrew	1352	689	11.464	22.496
MUChicagoAlumni	1357	689	11.422	22.496
LateNightMU	1305	699	11.877	22.175
muathletics	1319	698	11.751	22.206
MU_OSD	1300	706	11.923	21.955
Mu_Rec_sports	1360	700	11.397	22.143
MUGospelChoir	1338	706	11.584	21.955
MU_GoldinPR	1345	704	11.524	22.017
MUGoldNBlues	1340	709	11.567	21.862
FatherMarquette	1336	704	11.602	22.017
MUGradSchool	1354	705	11.448	21.986
MarquetteITS	1326	711	11.689	21.8
MU_Peacemaking	1334	711	11.619	21.8
SEACMarquette	1369	707	11.322	21.924
MUAdmissions	1308	710	11.85	21.831
Mutribune	1295	715	11.969	21.678
MUMashudaHall	1359	713	11.405	21.739
MUEducation	1318	720	11.76	21.528
MUHungerCleanUp	1329	718	11.663	21.588
JoeyTrentMUSG	1371	722	11.306	21.468
MUHealthEd	1359	715	11.405	21.678
MU_YAA	1329	724	11.663	21.409
MUStrazTower	1339	725	11.576	21.379
MUCobeenHall	1339	725	11.576	21.379
MarquetteCRE	1349	724	11.49	21.409
MUSafety	1356	723	11.431	21.438
MUSchroederHall	1348	729	11.499	21.262
MUMcCormickHall	1338	732	11.584	21.175
MUCAC	1352	734	11.464	21.117
mujournalism	1367	727	11.339	21.32
MUSpiritShop	1328	734	11.672	21.117
MUTheatre	1329	734	11.663	21.117

marquetteradio	1325	736	11.698	21.06
MURASelection	1373	730	11.289	21.233
MUSG	1302	734	11.905	21.117
SeniorChallenge	1362	739	11.38	20.974
InterculturalMU	1345	732	11.524	21.175
MarquetteNurses	1371	737	11.306	21.031
MUAdClub	1339	734	11.576	21.117
MU_Active_Minds	1378	733	11.248	21.146
MUCSCJobs	1333	741	11.628	20.918
SHSMarquette	1353	741	11.456	20.918
MUBizCareers	1379	734	11.24	21.117
MarquetteMBA	1352	744	11.464	20.833
MUBusiness	1340	744	11.567	20.833
marquetteecon	1367	744	11.339	20.833
herbertlowe	1366	746	11.347	20.777
mugoggetters	1349	748	11.49	20.722
MarquetteDining	1378	739	11.248	20.974
MUCarpenterTwr	1375	740	11.273	20.946
MUNRHH	1365	749	11.355	20.694
BestBuddies_MU	1362	744	11.38	20.833
MarquetteUnivTV	1322	749	11.725	20.694
MUAbbottsford	1362	741	11.38	20.918
MUFootball	1391	748	11.143	20.722
MarquettePRSSA	1350	751	11.481	20.639
MULegalClinic	1403	742	11.048	20.889
Museac	1353	753	11.456	20.584
NABJ_MarquetteU	1357	751	11.422	20.639
MUservelearn	1385	743	11.191	20.861
MUCircleK	1398	744	11.087	20.833
FvrythingPR	1341	745	11.559	20.805
MUMcCabeHall	1366	746	11.347	20.777
MUTVSports	1344	761	11.533	20.368
MUEntrepreneur	1347	754	11.507	20.557
MUKappaSig	1384	763	11.199	20.315
mutribune_vp	1387	748	11.175	20.722
OttWC	1359	755	11.405	20.53
ResidenceLifeMU	1385	749	11.191	20.694
EmilyBaseheart	1394	748	11.119	20.722
MU_CSC	1305	759	11.877	20.422
MarquetteSigs	1388	750	11.167	20.667
HumphreyHall	1356	764	11.431	20.288
MarquetteBioSci	1385	752	11.191	20.612
MarquetteGSO	1378	764	11.248	20.288
Drkatiberg	1378	773	11.248	20.052

musuperfans	1339	763	11.576	20.315
MarquetteRaynor	1373	761	11.289	20.368
marquettesoccer	1346	758	11.516	20.449
mu_orchestra	1364	769	11.364	20.156
MUSocInnovation	1381	756	11.224	20.503
AXiD_ThetaEp	24180	603	0.641	25.705
MUCampusMin	1331	784	11.645	19.77
MUChorus	1375	770	11.273	20.13
MUNorCalAlumni	1396	757	11.103	20.476
panhelmarquette	1382	791	11.216	19.595
MU_mardigras	1380	758	11.232	20.449
MUITSO	1374	776	11.281	19.974
Maryingles	1373	780	11.289	19.872
MU_COESC	1405	794	11.032	19.521
MUAspin	1385	759	11.191	20.422
Dean_Chioma	1392	760	11.135	20.395
HypeMarquette	1398	760	11.087	20.395
MarquetteU_CTL	1439	760	10.771	20.395
MUBizAbroad	1391	761	11.143	20.368
MUMSComp	1385	776	11.191	19.974
SlowFoodMU	1367	775	11.339	20
unsa_mu	1427	761	10.862	20.368
ErikUgland	1382	797	11.216	19.448
MU_Bayanihan	1396	792	11.103	19.571
MUWTTC	1395	784	11.111	19.77
catkinson_sa	1440	770	10.764	20.13
MU_ClubTennis	1406	764	11.024	20.288
MU_IBSA	1390	765	11.151	20.261
MULawAdmissions	1403	764	11.048	20.288
muopusdean	1378	782	11.248	19.821
MUtaekwondo	1412	790	10.977	19.62
MUTrib_sports	1379	793	11.24	19.546
DebraKrajec	1399	764	11.079	20.288
MUEngineers	1384	784	11.199	19.77
MUSigEpWiz	1398	764	11.087	20.288
PHNettleton	1391	764	11.143	20.288
Erinheff	1386	785	11.183	19.745
MarquetteMBO	1392	793	11.135	19.546
casey_flanagan	1434	766	10.809	20.235
MUCycling	1436	769	10.794	20.156
MUWatumishi	1385	817	11.191	18.972
MUWomensSoccer	1355	816	11.439	18.995
MarquetteAIM	1379	848	11.24	18.278
Mulaw	1321	827	11.734	18.742

Srbyers	1387	802	11.175	19.327
BSoFashionShow	1399	831	11.079	18.652
DoctorDUrso	1391	810	11.143	19.136
MUOdonnellHall	1377	775	11.256	20
OD2SW	1406	773	11.024	20.052
EdwardMathieSJ	1451	848	10.682	18.278
Loobe21	1407	843	11.016	18.387
MULawPoll	1398	775	11.087	20
mutribune_arts	1390	776	11.151	19.974
Agaudynski	1436	895	10.794	17.318
AlphaPhiEtaMu	1379	900	11.24	17.222
Deahlr	1452	777	10.675	19.949
GilkersonNathan	1412	771	10.977	20.104
MUClubDC	1385	773	11.191	20.052
MUEnviroLaw	1455	778	10.653	19.923
MUFatherFred	1370	840	11.314	18.452
MULundaRoom	1387	800	11.175	19.375
MUSailing	1422	773	10.9	20.052
MUTFXC	1396	773	11.103	20.052
Jeangrow	1391	917	11.143	16.903
MarquetteStyle	1486	779	10.431	19.897
MURUnningClub1	1414	779	10.962	19.897
Haggerty_Museum	1204	24180	12.874	0.641
jeannesimmons	24180	24180	0.641	0.641
marquettelax	1226	24180	12.643	0.641
MUeLIMO	1247	24180	12.43	0.641
MULinguistics	24180	24180	0.641	0.641
Scottonj	1295	24180	11.969	0.641
tkeane2701	1238	24180	12.52	0.641

Appendix C
Individual Level Betweenness Values

Account Name	Betweenness	Normalized Betweenness
MarquetteU	3524.776	14.767
MUCollegeofComm	2071.982	8.68
muathletics	1115.6	4.674
Mutribune	880.689	3.69
LateNightMU	745.195	3.122
MU_OSD	722.23	3.026
MarquetteGlobal	684.767	2.869
MUannex	543.497	2.277
MUAdmissions	432.691	1.813
FvrythingPR	422.228	1.769
MarquetteMedia	420.802	1.763
MarquetteITS	379.979	1.592
MUChicagoAlumni	362.594	1.519
MUGoldNBlues	330.076	1.383
FatherMarquette	322.626	1.352
MUSG	302.42	1.267
MarquetteRHA	293.976	1.232
MUEducation	274.06	1.148
MU_YAA	255.343	1.07
MUHungerCleanUp	244.593	1.025
MarquetteCrew	224.228	0.939
MUGospelChoir	223.749	0.937
MU_GoldinPR	221.956	0.93
MUBackOut	210.338	0.881
MUGradSchool	201.351	0.844
MU_Peacemaking	194.943	0.817
MUBusiness	178.287	0.747
MUSpiritShop	172.599	0.723
casey_flanagan	152.169	0.637
MUTheatre	137.397	0.576
marquetteradio	135.167	0.566
MarquetteUnivTV	134.655	0.564
MUCobeenHall	133.607	0.56
MUAdClub	131.819	0.552
MarquetteCRE	130.453	0.547
MarquetteSigs	122.993	0.515
InterculturalMU	118.476	0.496
MUMashudaHall	118.151	0.495
Mu_Rec_sports	116.72	0.489

MU_CSC	116.564	0.488
SEACMarquette	115.57	0.484
marquettesoccer	113.773	0.477
MUCSCJobs	99.351	0.416
MUStrazTower	91.96	0.385
MUMcCormickHall	90.683	0.38
JoeyTrentMUSG	89.912	0.377
mujournalism	87.701	0.367
MarquetteMBA	76.583	0.321
MUSafety	71.499	0.3
maryingles	67.751	0.284
marquetteecon	66.773	0.28
MarquettePRSSA	66.285	0.278
herbertlowe	64.642	0.271
MUSchroederHall	60.549	0.254
MUCampusMin	58.797	0.246
mugogetters	54.641	0.229
MUHealthEd	53.749	0.225
MUTVSports	53.41	0.224
MUAbbottsford	53.104	0.222
SHSMarquette	51.683	0.217
MUSigEpWiz	50.131	0.21
MUEntrepreneur	49.077	0.206
Drkatiberg	48.515	0.203
MUCAC	47.697	0.2
MU_Active_Minds	46.937	0.197
mulaw	37.343	0.156
MURASelection	34.017	0.143
museac	31.247	0.131
mutribune_vp	30.387	0.127
MarquetteGSO	30.309	0.127
MarquetteNurses	27.701	0.116
MUCarpenterTwr	27.087	0.113
OttWC	26.279	0.11
musuperfans	25.207	0.106
NABJ_MarquetteU	25.085	0.105
SeniorChallenge	23.99	0.101
BestBuddies_MU	23.707	0.099
MUWomensSoccer	22.852	0.096
MUBizCareers	22.531	0.094
MarquetteDining	22.227	0.093
MUKappaSig	21.75	0.091
MUNRHH	20.883	0.087
MUITSO	20.018	0.084

DebraKrajec	19.077	0.08
HumphreyHall	18.237	0.076
MUMcCabeHall	17.201	0.072
MUservelearn	15.227	0.064
panhelmarquette	13.347	0.056
MUSocInnovation	12.301	0.052
ErikUgland	12.173	0.051
MarquetteBioSci	11.064	0.046
MUOdonnellHall	10.983	0.046
MULawPoll	10.19	0.043
ResidenceLifeMU	9.288	0.039
MU_Bayanihan	7.927	0.033
PHNettleton	7.509	0.031
MUCircleK	7.345	0.031
MUW TTC	6.88	0.029
MarquetteRaynor	6.655	0.028
mu_orchestra	6.368	0.027
MU_mardigras	6.227	0.026
MULegalClinic	6.124	0.026
jeangrow	5.847	0.024
MUMSComp	5.562	0.023
MU_IBSA	5.502	0.023
MUFootball	5.375	0.023
Dean_Chiona	5.284	0.022
mutribune_arts	5.247	0.022
SlowFoodMU	5.21	0.022
MUAspin	4.696	0.02
AlphaPhiEtaMu	4.653	0.019
EmilyBaseheart	3.427	0.014
MUChorus	3.408	0.014
erinheff	3.385	0.014
srbyers	3.053	0.013
muopusdean	3.025	0.013
MUClubDC	2.91	0.012
MULawAdmissions	2.837	0.012
MUBizAbroad	2.766	0.012
HypeMarquette	2.443	0.01
MUTrib_sports	2.331	0.01
MarquetteU_CTL	2.298	0.01
MU_ClubTennis	1.735	0.007
MarquetteAIM	1.691	0.007
MUNorCalAlumni	1.501	0.006
Loobe21	1.482	0.006
OD2SW	1.402	0.006

DoctorDUrso	1.342	0.006
MUTFXC	1.145	0.005
MUEngineers	1.019	0.004
unsa_mu	0.619	0.003
MUCycling	0.564	0.002
MarquetteMBO	0.435	0.002
MUWatumishi	0.303	0.001
MURunningClub1	0.27	0.001
BSOFashionShow	0.256	0.001
MUSailing	0.192	0.001
MUtaekwondo	0.177	0.001
GilkersonNathan	0.163	0.001
MUEnviroLaw	0.112	0
catkinson_sa	0.042	0
MUFatherFred	0.028	0
MULundaRoom	0	0
EdwardMathieSJ	0	0
agaudynski	0	0
MUeLIMO	0	0
AXiD_ThetaEp	0	0
MULinguistics	0	0
scottonj	0	0
Haggerty_Museum	0	0
MarquetteStyle	0	0
jeannesimmons	0	0
deahlr	0	0
MU_COESC	0	0
tkeane2701	0	0
marquettelax	0	0

Appendix D
Full Network Data: Part 1

Twitter Handle	Represents	Category
agaudynski	Professor - Dr. Alan Gaudynski	Faculty
AlphaPhiEtaMu	Alpha Phi Eta	Greek
AXiD_ThetaEp	Alpha Xi Delta, Theta Epsilon	Greek
BestBuddies_MU	Best Buddies	Student Organization
BSOFashionShow	Bayanihan Student Organization Fashion Show	Student Organization
casey_flanagan	Part-Time Faculty - Lecturer – Mr. Casey Flanagan	Faculty
catkinson_sa	Coordinator for Residence Life Operations – Colin Atkinson	Faculty
deahlr	Dean - College of Professional Studies – Dr. Robert Deahl	Faculty
Dean_Chiona	Dr. Chioma Ugochukwu – Assistant Dean of College of Communication	Faculty
DebraKrajec	Artistic Director - Debra Krajec	Faculty
DoctorDUrso	Professor - Dr. Scott D'Urso	Faculty
drkatiberg	Professor - Dr. Kati Berg	Faculty
EdwardMathieSJ	Jesuit - Rev. D. Edward Mathie, S. J.	Faculty
EmilyBaseheart	Assistant Director of Development Annual Giving, East Coast at MU – Emily Baseheart	Faculty
ErikUgland	Professor - Dr. Erik Ugland	Faculty
erinheff	Assistant Editor on the Arts and Entertainment desk of the MU Tribune and Vice Chair of the MU College Democrats	Other
FatherMarquette	Jesuit	Other
FvrythingPR	Professor - Dr. Gee Ekachai	Faculty
GilkersonNathan	Assistant Professor - College of Communication - Dr. Nathan Gilkerson	Faculty
Haggerty_Museum	Haggerty Museum of Art	Other
herbertlowe	Professional in Residence – College of Communication - Mr. Herbert Lowe	Faculty
HumphreyHall	University owned Apartment Building	Residence Hall
HypeMarquette	Student Organization - Hip Hop Crew	Student Organization
InterculturalMU	Intercultural Engagement	Campus Organization
jeangrow	Associate Professor - College of Communication - Dr. Jean Grow	Faculty
jeannesimmons	Assistant Professor - Marketing – Dr. Jeanne Simmons	Faculty

LateNightMU Loobe21	Late Night Marquette Head Coach of MU Men's Soccer team – Louis Bennett	Campus Organization Athletics
MarquetteAIM	Undergraduate Program – Applied Investment Management (AIM)	Academic
MarquetteBioSci marquetteecon MarquetteCRE	Marquette Dept. of Biological Sciences Economics Marquette University Center for Real Estate: Building Professionals	Academic Student Organization Academic
MarquetteCrew MarquetteDining MarquetteGlobal	Marquette University's Club Rowing Team Marquette Dining Services Marquette Global Program - Study abroad to international advising	Athletics Campus Organization Campus Organization
MarquetteGSO MarquetteITS	Marquette Graduate Student Organization Marquette Program - Technology leadership and quality services	Student Organization Campus Organization
marquettelax MarquetteMBA MarquetteMBO	Men's Lacrosse Team Marquette Grad School of Management Student Organization - Multicultural Business Organization	Athletics Academic Student Organization
MarquetteMedia MarquetteNurses MarquettePRSSA	Marquette Program - Media Marquette Student Nurses' Association Marquette Chapter of Public Relations Student Society of America	Campus Organization Student Organization Student Organization
marquetteradio MarquetteRaynor MarquetteRHA MarquetteSigs marquettesoccer MarquetteStyle MarquetteU MarquetteU_CTL MarquetteUnivTV maryingles	Student Run Radio Station Marquette Raynor and Memorial Libraries Marquette Residence Hall Association Sigma Chi Fraternity Marquette Men's Soccer Student organization - MU Style Club Marquette University main account Marquette Center for Teaching and Learning Student run TV station Part-Time Faculty - Lecturer – Ms. Mary Ingles	Campus Organization Other Residence Hall Greek Athletics Student Organization MAIN Campus Organization Student Organization Faculty
MU_Active_Minds MU_Bayanihan MU_ClubTennis MU_COESC	Student Organization - MU Active Minds Student Organization - Bayanihan Club Tennis Team Marquette College of Education Student Council	Student Organization Student Organization Athletics Campus Organization
MU_CSC MU_GoldinPR MU_IBSA MU_mardigras	Marquette Career Services Student-Run PR Firm International Business Student Association Service Organization - Serves New Orleans	Campus Organization Student Organization Student Organization Student Organization

mu_orchestra	Marquette Symphony Orchestra	Campus Organization
MU_OSD	Marquette Office of Student Development	Campus Organization
MU_Peacemaking	Marquette Center for Peacemaking – Exploring the Power of Nonviolence	Campus Organization
Mu_Rec_sports	Marquette Rec Sports	Campus Organization
MU_YAA	Marquette Young Alumni Association	Alumni
MUAbbottsford	Residence Hall - Abbottsford Hall	Residence Hall
MUAdClub	Marquette Ad Club	Student Organization
MUAdmissions	Marquette Office of Undergraduate Admissions	Campus Organization
MUannex	Marquette Union Sports Annex	Campus Organization
MUAspin	Political Internship Program – Marquette Les Aspin Center	Campus Organization
muathletics	Marquette Athletics Main Account	Athletics
MUBackOut	Marquette Backout Before Blackout campaign	Student Organization
MUBizAbroad	Business Study Abroad	Campus Organization
MUBizCareers	Marquette Business Career Center	Campus Organization
MUBusiness	Marquette College of Business Administration and Graduate School of Management	Academic
MUCAC	Colleges Against Cancer – Marquette Relay for Life	Student Organization
MUCampusMin	Marquette Campus Ministry	Campus Organization
MUCarpenterTwr	Residence Hall - Carpenter Hall	Residence Hall
MUChicagoAlumni	Alumni Group - Marquette Club in Chicago	Alumni
MUChorus	Marquette Chorus	Campus Organization
MUCircleK	Service Organization - Circle K Chapter	Student Organization
MUClubDC	Marquette Club of Washington, D.C.	Alumni
MUCobeenHall	Residence Hall - Cobeen Hall	Residence Hall
MUCollegeofComm	Marquette College of Communication	Academic
MUCSCJobs	Marquette Career Services	Campus Organization
MUCycling	Cycling Club at Marquette	Athletics
MUEducation	Marquette College of Education	Academic
MUeLIMO	Marquette first all-electric shuttle van	Other
MUEngineers	Marquette College of Engineering	Academic
MUEntrepreneur	Encourage entrepreneurial thinking at Marquette	Student Organization
MUEnviroLaw	Environmental Law Society at Marquette Law School	Student Organization
MUFatherFred	Assistant to the VP for University Advancement - Frederick Zagone	Faculty
MUFootball	Student organization - Marquette Club Football Team	Student Organization
Mugogetters	Business Club	Student Organization
MUGoldNBlues	Student organization - coed acapella group	Student Organization

MUGospelChoir	Marquette Gospel Choir	Campus Organization
MUGradSchool	Marquette Graduate School	Academic
MUHealthEd	Marquette Center for Health Education	Campus Organization
MUHungerCleanUp	Service Project - Hunger Clean-Up	Campus Organization
MUITSO	Marquette Information Technology Student Organization	Student Organization
mujournalism	Journalism and Media Studies Department	Academic
MUKappaSig	Xi-Xi Chapter of Kappa Sigma Fraternity	Greek
mulaw	Marquette Law School	Academic
MULawAdmissions	Office of Admissions at Marquette Law School	Campus Organization
MULawPoll	Marquette Law Poll	Other
MULegalClinic	Marquette Volunteer Legal Clinics	Student Organization
MULinguistics	Other	Other
MULundaRoom	Contemporary dining in the AMU	Campus Organization
MUMashudaHall	Residence Hall - Mashuda Hall	Residence Hall
MUMcCabeHall	Residence Hall - McCabe Hall	Residence Hall
MUMcCormickHall	Residence Hall - McCormick Hall	Residence Hall
MUMSComp	Master of Science in Computing Program	Academic
MUNorCalAlumni	Alumni Group - Marquette Club of NorCal	Alumni
MUNRHH	NRHH-St. Joan of Arc	Campus Organization
MUOdonnellHall	Residence Hall - Odonnell Hall	Residence Hall
muopusdean	OPUS Dean of the College of Engineering – Dr. Robert H. Bishop	Faculty
MURASelection	Marquette RA Selection	Campus Organization
MURunningClub1	Running Club	Athletics
MUSafety	Marquette Department of Public Safety and Student Safety Programs	Campus Organization
MUSailing	Marquette Sailing Team	Athletics
MUSchroederHall	Residence Hall - Schroeder Hall	Residence Hall
museac MU	Student Environmental Initiative	Student Organization
MUservelearn	Marquette Service Learning	Campus Organization
MUSG	Marquette Student Government	Campus Organization
MUSigEpWiz	Sigma Phi Epsilon Wisconsin Zeta Chapter	Greek
MUSocInnovation	Partner with @ashukau as a hub for teaching and promotion of social entrepreneurship	Student Organization
MUSpiritShop	Marquette Spirit Shop	Campus Organization
MUStrazTower	Residence Hall - Straz Tower	Residence Hall
musuperfans	Marquette SuperFans - Spirit group	Student Organization
MUtaekwondo	Marquette Club Tae Kwon Do	Athletics
MUTFXC	Marquette Track & Field/Cross Country	Athletics
MUTheatre	Department of Digital Media and Performing Arts	Academic
MUTrib_sports	Marquette Tribune Sports	Campus Organization
nutribune	Marquette Tribune	Campus Organization

mutribune_arts	Marquette Tribune Marquee Section	Campus Organization
mutribune_vp	Marquette Tribune Viewpoints	Campus Organization
MUTVSports	Marquette TV Sports Department	Campus Organization
MUWatumishi	Student Organization - Watumishi Marquette – HIV/AIDS Awareness	Student Organization
MUWomensSoccer	Marquette Women's Soccer Team	Athletics
MUW TTC	Carole Burns - Wakerly Center	Faculty
NABJ_MarquetteU	NABJ-Marquette University student chapter	Student Organization
OD2SW	O'Donnell Hall 2SW	Residence Hall
OttWC	Marquette Writing Center	Campus Organization
panhelmarquette	Greek - Panhellenic Association	Greek
PHNettleton	Assistant Professor - College of Communication - Dr. Pamela Hill Nettleton	Faculty
ResidenceLifeMU	Marquette Residence Life	Campus Organization
scottonj	Associate Professor - College of Communication - Dr. James Scotton	Faculty
SEACMarquette	Students for an Environmentally Active Campus	Student Organization
SeniorChallenge	Seniors	Student Organization
SHSMarquette	Student Health Services	Campus Organization
SlowFoodMU	Student Organization - food and making change	Student Organization
srbyers	Assistant Professor - College of Communication - Dr. Stephen Byers	Faculty
tkeane2701	Director of the Golden Angels Network and Entrepreneur in Residence - Tim Keane	Faculty
unsa_mu	United Nations Student Alliance Center	Student Organization

Appendix E
Full Data Part 2

Twitter Handle	Date Joined Twitter	Frequency of Tweets (Times per day)
agaudynski	6/16/2009	0.1
AlphaPhiEtaMu	5/1/2009	0.1
AXiD_ThetaEp	2/14/2011	0.8
BestBuddies_MU	8/5/2010	0.1
BSOFashionShow	8/8/2009	0.3
casey_flanagan	1/6/2009	0.6
catkinson_sa	1/12/2012	0.1
deahlr	7/26/2012	0.1
Dean_Chroma	7/24/2011	0.2
DebraKrajec	1/22/2012	0.6
DoctorDUrso	4/7/2009	0.3
drkatiberg	3/3/2010	1
EdwardMathieSJ	1/23/2012	0
EmilyBaseheart	8/22/2011	0.1
ErikUgland	9/2/2008	0.1
erinheff	11/14/2010	0.3
FatherMarquette	1/17/2012	3.6
FvrythingPR	10/21/2007	6.8
GilkersonNathan	11/5/2012	0.2
Haggerty_Museum	11/24/2008	0.2
herbertlowe	11/23/2009	6.4
HumphreyHall	9/29/2010	0
HypeMarquette	11/8/2011	0.6
InterculturalMU	7/27/2011	0.7
jeangrow	7/8/2009	0.1
jeannesimmons	11/25/2009	0.1
LateNightMU	4/17/2009	1.5
Loobe21	8/18/2012	1.3
MarquetteAIM	1/13/2009	0.5
MarquetteBioSci	2/20/2012	0.3
marquetteecon	10/31/2010	0.4
MarquetteCRE	8/18/2010	0.7
MarquetteCrew	4/28/2009	0.7
MarquetteDining	6/26/2012	0.6
MarquetteGlobal	6/3/2011	0.7
MarquetteGSO	2/16/2011	0.1
MarquetteITS	3/22/2009	0.6
marquettelax	3/7/2009	0.8
MarquetteMBA	11/19/2009	0.6
MarquetteMBO	3/29/2010	0

MarquetteMedia	3/16/2011	0.8
MarquetteNurses	5/4/2010	0.1
MarquettePRSSA	10/19/2008	0.8
marquetteradio	9/3/2009	0.5
MarquetteRaynor	11/12/2008	0.2
MarquetteRHA	8/28/2010	0.3
MarquetteSigs	12/10/2009	0.2
marquettesoccer	5/21/2009	1.9
MarquetteStyle	8/29/2012	0.7
MarquetteU	10/14/2008	14
MarquetteU_CTL	9/17/2012	0
MarquetteUnivTV	2/27/2009	0.8
maryingles	4/19/2009	0.3
MU_Active_Minds	9/6/2011	0.2
MU_Bayanihan	10/4/2010	0.2
MU_ClubTennis	4/30/2012	0.4
MU_COESC	9/24/2010	0.2
MU_CSC	5/12/2009	0.8
MU_GoldinPR	11/30/2010	0.5
MU_IBSA	10/12/2009	0.1
MU_mardigras	5/15/2011	0.5
mu_orchestra	9/5/2009	0.2
MU_OSD	12/9/2009	1
MU_Peacemaking	8/26/2009	0.5
Mu_Rec_sports	1/13/2012	0.4
MU_YAA	5/29/2009	0.4
MUAbbottsford	7/8/2011	0.2
MUAdClub	1/16/2009	0.2
MUAdmissions	8/20/2009	1.5
MUannex	7/8/2009	2
MUAspin	2/23/2012	0.1
muathletics	2/19/2009	6.2
MUBackOut	6/6/2011	0.9
MUBizAbroad	8/2/2011	0.2
MUBizCareers	7/20/2011	0.2
MUBusiness	1/20/2011	1.6
MUCAC	9/14/2010	0.4
MUCampusMin	8/17/2009	0.6
MUCarpenterTwr	6/1/2012	0.4
MUChicagoAlumni	1/7/2010	0.3
MUChorus	3/9/2010	0.2
MUCircleK	5/15/2012	0.2
MUclubDC	11/30/2011	0.1
MUCobeenHall	8/26/2010	0.9

MUCollegeofComm	1/27/2009	1.5
MUCSCJobs	3/24/2010	0.9
MUCycling	8/30/2011	0
MUEducation	9/15/2009	4.8
MUeLIMO	11/21/2010	0
MUEngineers	4/13/2011	0.1
MUEntrepreneur	7/27/2010	0.6
MUEnviroLaw	9/11/2011	0.3
MUFatherFred	9/16/2009	0
MUFootball	4/9/2009	0
muggetters	9/2/2009	0.3
MUGoldNBlues	10/13/2010	0.3
MUGospelChoir	9/1/2010	0.2
MUGradSchool	2/14/2012	2
MUHealthEd	8/25/2011	0.5
MUHungerCleanUp	3/31/2009	0.1
MUITSO	10/14/2008	0.1
mujournalism	5/5/2012	1.8
MUKappaSig	5/5/2009	0.1
mulaw	6/11/2008	1.9
MULawAdmissions	9/13/2011	0.4
MULawPoll	12/13/2011	1
MULegalClinic	6/27/2012	0.1
MULinguistics	8/25/2010	0
MULundaRoom	7/20/2010	0
MUMashudaHall	11/3/2011	0.8
MUMcCabeHall	6/6/2012	0.5
MUMcCormickHall	4/19/2010	0.4
MUMSComp	8/10/2010	0.3
MUNorCalAlumni	10/24/2012	0.4
MUNRHH	9/3/2009	0.2
MUOdonnellHall	8/30/2011	0.1
muopusdean	8/31/2010	0
MURASelection	10/28/2011	0.1
MURUnningClub1	8/1/2012	0.2
MUSafety	8/31/2012	0.8
MUSailing	3/10/2011	0.4
MUSchroederHall	9/29/2009	0.1
museac	8/14/2009	0.3
MUservelearn	2/10/2012	0.1
MUSG	2/24/2009	1.5
MUSigEpWiz	1/24/2011	0.5
MUSocInnovation	9/9/2011	0.3
MUSpiritShop	9/8/2009	1.5

MUStrazTower	12/17/2008	0.1
musuperfans	9/1/2009	0.1
MUtaekwondo	1/25/2011	0.1
MUTFXC	4/19/2012	0.7
MUTheatre	10/9/2009	0.2
MUTrib_sports	8/29/2010	0.3
mutribune	1/27/2009	1.6
mutribune_arts	8/19/2012	0.5
mutribune_vp	8/19/2012	0.3
MUTVSports	6/14/2009	1.2
MUWatumishi	10/7/2009	0.1
MUWomensSoccer	7/20/2009	1.6
MUWTTC	7/29/2010	0.2
NABJ_MarquetteU	4/22/2010	0.7
OD2SW	8/19/2011	0.1
OttWC	9/9/2010	0.1
panhelmarquette	1/5/2011	0.2
PHNettleton	8/26/2011	1.1
ResidenceLifeMU	2/6/2012	0.2
Scottonj	3/28/2010	0
SEACMarquette	3/30/2012	0.6
SeniorChallenge	1/9/2009	0.1
SHSMarquette	3/2/2011	0.1
SlowFoodMU	3/22/2009	0.1
srbyers	7/8/2009	0.1
tkeane2701	8/29/2008	0.1
unsa_mu	9/14/2011	0

Ridley-Smith, N. (2009). When did you join Twitter? Retrieved from
<http://www.whendidyoujointwitter.com/>

Ridley-Smith, N. (2009). How often do you tweet? Retrieved from
<http://www.howoftendoyoutweet.com/>

Appendix F
Full Data Part 3

Twitter Handle	Number of Followers	Number of People Following	Number of In-Network Accounts Following	Number of In-Network Accounts Followed By
agaudynski	106	71	3	3
AlphaPhiEtaMu	393	48	2	20
AXiD_ThetaEp	287	211	15	10
BestBuddies_MU	153	86	33	32
BSOFashionShow	109	109	5	8
casey_flanagan	420	617	6	4
catkinson_sa	52	50	9	4
deahlr	22	68	2	2
Dean_Chioma	123	98	12	8
DebraKrajec	60	54	8	8
DoctorDUrso	106	44	6	10
drkatiberg	646	521	20	21
EdwardMathieSJ	7	12	3	2
EmilyBaseheart	34	77	24	6
ErikUgland	193	179	11	16
erinheff	144	299	8	8
FatherMarquette	1300	192	68	54
FvrythingPR	3249	1152	27	48
GilkersonNathan	20	18	2	2
Haggerty_Museum	969	30	1	35
herbertlowe	1648	2001	36	26
HumphreyHall	78	33	21	38
HypeMarquette	99	73	12	10
InterculturalMU	81	196	40	47
jeangrow	204	21	1	12
jeannesimmons	46	22	2	9
LateNightMU	1436	1841	81	85
Loobe21	182	117	3	5
MarquetteAIM	169	59	6	20
MarquetteBioSci	36	44	21	12
marquetteecon	126	153	37	29
MarquetteCRE	438	479	53	43
MarquetteCrew	423	671	89	40
MarquetteDining	69	64	34	20
MarquetteGlobal	272	327	94	47
MarquetteGSO	89	86	21	18

MarquetteITS	450	299	68	64
marquettelax	1208	25	0	19
MarquetteMBA	398	141	41	41
MarquetteMBO	31	13	8	10
MarquetteMedia	761	474	93	52
MarquetteNurses	143	188	41	27
MarquettePRSSA	612	467	32	41
marquetteradio	807	582	65	65
MarquetteRaynor	23	141	16	26
MarquetteRHA	267	389	90	60
MarquetteSigs	394	380	23	17
marquettesoccer	1454	237	16	46
MarquetteStyle	29	71	1	1
MarquetteU	19379	2493	146	58
MarquetteU_CTL	12	14	12	4
MarquetteUnivTV	1100	813	35	69
maryingles	339	315	14	18
MU_Active_Minds	93	116	40	21
MU_Bayanihan	116	96	11	10
MU_ClubTennis	45	55	9	4
MU_COESC	48	46	14	4
MU_CSC	2229	285	26	84
MU_GoldinPR	297	373	72	45
MU_IBSA	35	10	8	11
MU_mardigras	279	114	14	18
mu_orchestra	280	192	18	28
MU_OSD	679	710	76	94
MU_Peacemaking	519	818	67	57
Mu_Rec_sports	163	225	73	34
MU_YAA	909	459	57	62
MUAbbottsford	116	97	32	33
MUAdClub	618	274	41	50
MUAdmissions	1127	521	68	83
MUannex	768	711	98	66
MUAspin	103	132	13	9
muathletics	12105	7080	81	79
MUBackOut	253	291	90	40
MUBizAbroad	51	27	12	12
MUBizCareers	193	264	38	18
MUBusiness	1132	258	37	54
MUCAC	209	188	47	40
MUCampusMin	382	29	16	61
MUCarpenterTwr	93	76	33	28
MUChicagoAlumni	530	359	88	36

MUChorus	148	85	16	17
MUCircleK	43	113	28	9
MUClubDC	62	19	2	15
MUCobeenHall	285	112	55	53
MUCollegeofComm	2532	1968	108	97
MUCSCJobs	835	219	42	59
MUCycling	16	10	6	3
MUEducation	1110	732	60	72
MUeLIMO	37	0	0	11
MUEngineers	50	11	9	15
MUEntrepreneur	394	146	27	45
MUEnviroLaw	51	53	2	2
MUFatherFred	144	11	4	22
MUFootball	74	136	33	12
mugoggetters	224	173	36	42
MUGoldNBlues	795	967	72	51
MUGospelChoir	257	348	73	53
MUGradSchool	199	189	67	39
MUHealthEd	104	125	57	34
MUHungerCleanUp	283	259	60	62
MUITSO	103	89	15	19
mujournalism	300	370	45	27
MUKappaSig	449	335	27	24
mulaw	1910	122	6	70
MULawAdmissions	81	56	9	8
MULawPoll	1540	7	3	8
MULegalClinic	32	59	31	9
MULinguistics	167	371	0	0
MULundaRoom	17	5	3	9
MUMashudaHall	152	109	59	36
MUMcCabeHall	155	66	27	29
MUMcCormickHall	371	101	49	53
MUMSComp	95	112	12	13
MUNorCalAlumni	21	18	15	6
MUNRHH	143	102	34	33
MUOdonnellHall	81	27	4	27
muopusdean	92	12	10	15
MURASelection	87	57	42	24
MURUnningClub1	33	17	1	4
MUSafety	317	146	49	38
MUSailing	102	96	2	4
MUSchroederHall	216	84	50	46
museac	197	197	33	39
MUservelearn	100	178	29	13

MUSG	961	418	44	87
MUSigEpWiz	183	234	9	11
MUSocInnovation	145	140	16	18
MUSpiritShop	1211	149	47	63
MUStrazTower	273	257	56	53
musuperfans	651	231	21	51
MUtaekwondo	14	23	10	4
MUTFXC	152	75	2	9
MUTheatre	429	246	46	62
MUTrib_sports	111	60	11	15
mutribune	2533	884	64	94
mutribune_arts	69	29	3	8
mutribune_vp	112	244	25	11
MUTVSports	569	187	28	48
MUWatumishi	95	47	8	17
MUWomensSoccer	883	226	8	38
MUWTTC	49	48	10	9
NABJ_MarquetteU	287	295	31	34
OD2SW	13	9	4	6
OttWC	239	190	26	33
panhelmarquette	257	166	17	19
PHNettleton	206	214	8	10
ResidenceLifeMU	144	28	25	25
scottonj	32	3	0	3
SEACMarquette	104	137	65	25
SeniorChallenge	301	462	43	30
SHSMarquette	148	51	40	40
SlowFoodMU	766	318	13	24
srbyers	207	113	6	17
tkeane	2701	181	210	7
unsa_mu	34	69	11	2

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