Spring 2011

Social network analysis of the video bloggers' community in YouTube

Anusha Mogallapu

Department:

SOCIAL NETWORK ANALYSIS OF THE VIDEO BLOGGERS' COMMUNITY IN YOUTUBE

by

ANUSHA MOGALLAPU

A THESIS

Presented to the Faculty of the Graduate School of the

MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

In Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE IN INFORMATION SCIENCE AND TECHNOLOGY

2011

Approved by

Dr. Hong Sheng, Advisor
Dr. Richard Hall
Dr. Michael Hilgers

ABSTRACT

This research studied the structure of the social network of the video blogger community on YouTube. It analyzed the social network structure of friends and subscribers of the 187 video bloggers on YouTube and calculated the social network measures. This thesis compares the results to the structure described by Warmbrodt et al. in 2007 and explains the reasons for the distinctions. The number of video bloggers has increased enormously, and the form of their interactions has changed. As a result, the video blogger social network has evolved from a core/periphery structure to one that is centralized. This indicates that the video blogger community on YouTube presently revolves around few central people in the network.

ACKNOWLEDGMENTS

First, I would like to thank my advisor, Dr. Hong Sheng, for giving me guidance and support throughout my project. I am grateful for the opportunity to work with her. Dr. Sheng was always available for short meetings every week and gave me valuable advice to complete my project on time.

I would also like to thank my other committee members, Dr. Richard Hall and Dr. Michael Hilgers, for their continuous support and encouragement.

Finally, I would like to thank my family and friends for their patience and support throughout my project.

TABLE OF CONTENTS

Page

LIST OF ILLUSTRATIONS

LIST OF TABLES

1. INTRODUCTION

1.1. MOTIVATION

The use of blogs on the Internet has grown tremendously over the past few years. Technorati, the most popular blog search engine, has tracked over 133 million blogs since 2002 (Winn, 2009). According to the global media agency, Universal McCann, about 77% of the Internet users read blogs (Winn, 2009). Blogs are defined as "frequently modified web pages in which dated entries are listed in reverse chronological sequence" (Herring et al., 2004). Blogs allow authors to express their passion, point of view, and personality with the immediacy of up-to-date posts (Nardi et al., 2004).

Video blogs, also called vlogs or video logs, are a new form of blogs that have received increased attention over the years. Video blogs are similar to blogs except that the medium used to post content is video instead of text. Video blogs are gaining more attention these days as videos are a visually richer form of expression than plain text blogs (Zhang et al., 2009).The world of video blogs is often described using the word "vlogosphere". The state of vlogosphere has been changing rapidly. According to Mefeedia, about 20,000 vlogs were tracked in 2007, and the number of vlogs has now increased to 110,000 (Wauters, 2010). The interactions among video bloggers shape the structure of the community, and their influence has become especially important as video blogging has increased at a lightening rate. Warmbrodt el al. (2008) analyzed the social network structure of the video blogger network and found that the network structure was a core/periphery structure with a core periphery fitness ratio of 0.5, but their research was conducted when video blogging was in its nascent stages. Because, blogs are updated

frequently, the links among them also change frequently (Guo et al., 2009). Likewise, it seems the structure of the video bloggers' network must have experienced changed over the years due to the increase in the number of users and changes in the patterns of communication among them. Many studies have proved that the structure of online communities is bound to change with time (Kumar et al., 2006; Palla et al., 2007), but few or none have examined such changes in blogging communities.

The present study uses YouTube to find the social network structure of the video bloggers community. YouTube was selected for the study as it is the most popular platform for video blogging hosting around 36% of the total number of video blogs (Wauters, 2010).

1.2. RESEARCH QUESTION

The present research analyzes the structure of the video blogger network on YouTube. It also studies the nature of change in the video bloggers community by comparing the present social network structure to the previous structure of the community studied by Warmbrodt et al. in 2008 and offering some explanation for the change.

1.3. THESIS OVERVIEW

The remainder of the thesis is organized as follows:

Section 2 provides an overview of blogs in general and video blogs in particular. It also surveys previous studies on blogging and social networking communities. Section 3

provides an overview of social network theory, followed by a brief explanation of the various social network measures used in this study. Section 4 describes the data collection process used here. Section 5 presents the results of this analysis. Section 6 discusses the results and explores their implications. Section 7 briefly summarizes the research finding and suggests directions for future research.

2. LITERATURE REVIEW

2.1. OVERVIEW

This section first provides a brief introduction about blogs and video blogs followed by summary of studies conducted on blogs in various areas such as technology used for blogging, characteristics of bloggers, acceptance of blogging, psychological effects of blogging, formation of communities in blogging. It also summarizes studies conducted on online social networking communities and the change in social network structures over time.

2.2. BLOGS

Weblogs or blogs are web pages containing articles listed chronologically from most recent to oldest (Kolbitsch & Maurer, 2006)*;* their authors are called bloggers, websites that publish blogs are called blog sites. The virtual world of all blog sites is called the blogosphere (Agarwal & Liu, 2008). Each article or entry is called a blog post. A blog post can be a combination of text, images, video and links to other blog posts or web pages. Blogs are frequently updated and are open for public to read. Commenting on blog posts is a very important part of blogging.

There are two types of blogs: diaries or personal journals and filters (Herring et al., 2004). Diaries or personal journals are personalized articles in which the blogger posts about his or her personal, and social, or professional life. In January 1994, a college student named Justine Hall published the first diary-style blog (Pollock, 2001). Filters are collection of links to other websites supplemented with comments on the contents of each

linked page. Filter blogs may focus on any of a variety of areas such as technology, politics or music. The best known filter-style blog site is Slashdot, which focuses mainly on technology (Slashdot, 2005).

2.3. VIDEO BLOGS

"Video blogging" is defined as producing and sharing user generated video (Molyneaux et al., 2008). Video-blogging is a form of blogging that features video shorts instead of text. The tools used for video blogging are different from those used for text blogs. Whereas text blogging requires only text editing tools, video blogging also requires video recording and uploading tools.

In the early days of blogging, video blogs were called podcasts, a term generally used to describe both audio and video blog posts; now they are often called vlogs. According to Dean (2005), a popular technology news website, most video blogs have a home-grown, experimental feel, often including clips of the author's daily activities. Video blog posts are usually no more than five minutes long. According to Luers (2007), video bloggers make their videos accessible to the public in an effort to encourage conversation and elicit feedback among their peers.

Video-blog genres have several broad classifications. Some diary-type video blogs document the author's life or opinions on various topics. Others focus on entertainment and feature shows or short films. Still others discuss political issues (Luers, 2007).

Text blogs are based on non temporal data that can be controlled and cited easily. They are also a part of age long textual tradition sharing features known from diaries and

journals. Text blogs can be edited easily and require good writing skills. Video blogs on the other hand are based on temporal data and they are not related to any established tradition like text blogs. Also video blogs can be time taking to edit once posted. Video blogs are more expensive to create than text blogs. The consumers of blogs are less likely to identify with the authors of normal text blogs as it is harder to show the personality of a person through text. The personality of bloggers can be conveyed easily through video blogs. Video blogs gather more attention and are more visually appealing than normal text blogs (Millers, 2010).

Video blogging is different from video posting. A video post may refer to any video randomly posted on the web (e.g. commercial, film preview or any news article). Video blogs are videos recorded by an individual on his own and the content of the video is usually related to the person's life or his opinion on some issue.

Video blogs are usually hosted on video sharing sites such as YouTube, Blip.tv, Vimeo, MySpace video. Professional video bloggers post video blogs on their websites and also syndicate their videos to popular video hosting platforms. Currently, YouTube hosts the largest number of video blogs (about 35%) which is followed by Blip.tv (14%) and Vimeo (9%) (Wauters, 2010).

A study conducted by Molyneaux et al. (2008) analyzed the content of vlogs on YouTube and studied the characteristics of users on YouTube. It was found that the majority of video bloggers were men (58%) in the age group 20 to 50 years (61%) and the average age of a video blogger was 23 years. Some of the reasons to video blog as explained by some of the video bloggers were to meet new friends online, to improve

technological skills, to become a part of the attention economy of the internet (Wise, 2004).

2.4. RESEARCH ON BLOGS

Text blogs have become a popular focus of research in recent years. Topics have ranged from the acceptance of blogs and motivation for blogging to the effects of blogging and gender-related issues in blogging. Some studies have studied blogging tools and technology; others have examined blogging as a form of social communication. Since video blogs are closely related to blogs and there are very few studies on video blogging, the various findings on text blogging can be applied to video blogging as well and hence are reviewed below.

2.4.1. Blogging Technology. The technology used to create blogs plays an important role in the success of blogs and there are various studies which focused on blogging tools. Few of the studies in this area discuss about the benefits of technology used for blogging (Guo et al., 2009; Du & Wagner, 2006), the factors affecting a blog system (Guo et al., 2009).

Some blogging tools allow users to build blogs; others maximize connectivity and promote social interaction among bloggers (Du & Wagner, 2006). Many tools include features such as permalinks, trackbacks, and comments that encourage frequent updating of blogs thus increase the size of the blogosphere (Guo et al., 2009). Since blogs are updated frequently, Guo et al. (2009) used chaos theory to interpret blogging as a nonlinear system. Their study defined the blog system as the combination of a blog, its environment, and the blogger's behavior. They found that this system is affected by

factors such as the internal and external environments and the interface between the blog and the blogger.

The internal environment refers to the various tools offered by an environment (such as a website) for blogging (Guo et al., 2009). The external environment refers to the events (e.g., political or financial), cultural conditions, social interactions and relationships (Guo et al., 2009).

According to Du and Wagner (2006), there are three major types of blogging tools. The first type provides basic features for presenting content and creating link-driven text diaries. The second provides rich interface or multimedia capability permitting users to share more than just text content. These are the tools most often used by video bloggers. The third type provides improved content distribution and connectivity between blogs enhancing community building and social networking.

2.4.2. Characteristics of Bloggers. Some of the studies related to bloggers characteristics are the effect of gender on content and writing style of blogs (Herring et al., 2005; Armstrong & McAdams, 2009), role of gender in switching behavior of bloggers (Zhang et al., 2009), perception of credibility of blogs (Armstrong & McAdams, 2009) .

Herring et al. (2005) found that the writing of female bloggers is primarily interpersonal whereas that of male bloggers tends to be informative. The perceived credibility of blogs is influenced by gender, writing style and the information seeking nature of the reader of the blog (Armstrong & McAdams, 2009) . Majority of women's blogs are usually journals or diary entries. Men more often discuss politics, technology, and money, and their blogs are deemed to be more credible (Armstrong & McAdams,

2009). Switching behavior has been found to vary based on gender. Whereas women tend to care most about satisfaction and are likely to switch only if they are not satisfied, men tend to switch blogs if they find some other attractive alternative (Zhang et al., 2009).

2.4.3. Acceptance of Blogging. Many studies have focused on the factors affecting the acceptance of blogging (Ma et al., 2006; Seok et al., 2009; Saeed et al., 2009) by applying theories such as the technology acceptance Model (TAM) and the unified theory of acceptance and use of technology (UTAUT). Ma et al. (2006) used the UTAUT model proposed by Venkatesh et al. (2003) and Seok et al. (2009) and Saeed et al. (2009) used TAM. Seok et al. (2009) studied the influence of factors such as perceived ease of use and perceived usefulness, which are both a part of the TAM but their work also investigated factors related to social motivation, such as reputation, reciprocity, social identity, and enjoyment of helping and their effect on the intention to use blogs. They found that, along with reciprocity, factors considered by TAM most influenced the intention to use blogs; factors related to social identity played a moderating role. Saeed et al. (2009) extended the TAM by including an individual's cognitive style as a factor influencing both perceived ease of use and perceived usefulness. They found that a user's cognitive style has an impact on the acceptance of blogs.

2.4.4. Psychological Effects of Blogging. Researchers concerned with the psychological effects of blogging have studied how personality predicts the inclination to blog. They have also investigated blogging practices and bloggers' expectations of privacy (Guodagno et al., 2008; Baker et al., 2008; McCullagh, 2008; Ko & Chen, 2008).

Creative individuals willing to try new things are more likely to blog (Guodagno et al., 2008). Bloggers value self-expression and use blogging as a medium for reflection.

Although they are concerned about their private information, few employ mechanisms to protect their privacy in their blogs (McCullagh, 2008).

The comment feature available on most blogs promotes social interaction by allowing readers to comment on blogs. Many studies have found that blogging brings people together and relieves their sense of isolation. One study by Baker et al. (2008) examined the behavior of bloggers and nonbloggers who had used the social networking site My Space for about two months. They found that the level of social integration and reliable alliance increased among the bloggers indicating that blogging increases the sense of community and relieves feelings of alienation.

A few studies have performed cost benefit analyses of blogging. Users perceive many benefits of blogging, including heightened self-esteem, more rewarding social life, and improved social well-being Bloggers believe the benefits of blogging outweigh costs such as loss of privacy (Ko & Chen, 2009).

2.5. BLOGGING AS SOCIAL NETWORKING COMMUNITIES

Online communities are “social aggregations that emerge from the Internet when enough people carry on public discussion long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace" (Rheingold, 1993). According to McKenna and Bargh (2000), there are four domains in which a computer-mediated social interaction differs from interaction in a conventional medium: relative anonymity, reduced importance of physical appearance, attenuation of physical distance, and greater control over the time or pace of interactions.

Blogs are a form of computer-mediated communication that enables people to publish their writings or videos and establish online networks (Guo et al., 2009). Blogs bring likeminded people and communities together, thus providing opportunities to relieve feelings of isolation (Baker et al., 2008). They are a medium to interact with people over the Internet and they promote the emergence of blogging communities. Bloggers are highly interconnected, reading each others blogs, linking to the blogs of others, and referring to other blogs in their own writing (Du & Wagner, 2006). Thus, online communities are rapidly due to the ubiquitous nature of the Web (Taricani, 2007).

Blog communities develop from connections among blogs and their authors. Connections among blogs create a kind of community that is possible only with the technologies such as permalinks, trackback, and RSS feeds (Efimova & de Moor 2004).

According to Milgram (1967), the average path length between two Americans is 6 hops. There is evidence that social structures emerge around blogs. According to Kumar et al. (2003), the mathematical analysis of links between blogs indicates that community formation in the blogosphere is not random; rather, it is an indication of shared interests that connect bloggers with one another.

Guadagno et al. (2008) examined the relationship between personality and blogging behavior. People who are more open to new experiences are more likely to maintain a blog, and most bloggers write about their personal lives. The predominance of such people in the blogosphere may change over time with changes in blogging technology. Mitrovi'c and Tadi'(2009) studied data from two blog sites with completely different histories and cultural, and organizational profiles. Their analysis indicated that

blog users tend to cluster normally around a few preferred subjects, prompting the emergence of new user communities in blog- mediated communication.

Efimova and Hendrick (2005) characterized the network structure of the blog community, noting the potential for a virtual community. The network had many members on the periphery and a strong core with fuzzy boundaries that allowed the peripheral members to become core members through comments or links. Ali-Hasan and Adamic (2007) examined network structure through the blogrolls (the list of other blogs that a blogger recommends), citations, and comments of three blog communities in different geographical locations. They found that blogs permitted the formation of relationships, but they may not help bloggers sustain their real-world relationships because most communication in the blog community occurs through comments.

Much research addresses online social networking communities. The topics addressed include community formation and the structure of social networks. For example, Mislove et al. (2007) analyzed four popular online social networks (Flickr, Youtube, LiveJournal, and Orkut) to identify the structural properties common to all of them. Their results indicated that online social networks have a high degree of reciprocity, a tight core consisting of high-degree nodes i.e individuals connected to many other people in the network and nodes that share a similar degree score. Benevenuto et al. (2008) characterized the social network created by video interactions among users of YouTube. Santos et al. (2007) conducted a similar study showing that relationships among YouTube users have statistical distributions that follow power law functions, and both the topology and the connections are influenced by human social behavior.

Although various studies have examined numerous aspects of blogging, few have addressed the structure of bloggers' social network. The present study analyzes structure of the video-bloggers community on YouTube and studies the changes in this structure over time.

2.6. CHANGES IN ONLINE SOCIAL NETWORKS

According to Kumar et al. (2006), the density of social networks is nonmonotone as a function of time. They observed changes by studying the time graphs of two different social networks. They found that social networks go through distinct stages of growth, each of which is typically characterized by particular behavior in terms of the diameter or density of the structure or the regularity of the component structure (Kumar et al., 2003).

Social networks are subject to constant change due to frequent changes in patterns of activity and communication among members (Palla et al., 2007). Events in the life of a community include growth, contraction, merging, and splitting (Palla et al., 2007). The rate at which new connections are built in a network can be as short as minutes or hours while the rate at which new members join or leave a community may be as long as a year (Ebel et al., 2003). Figure 2.1 illustrates these phenomena.

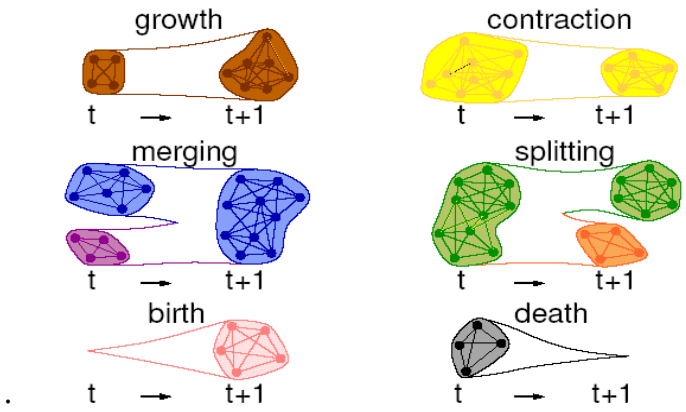

Figure 2.1 Events in a community (Palla et al., 2007)

Thus, all social networks are dynamic. A study conducted by Kelley et al. (2009) found that the blogosphere is especially dynamic due to the highly unstable nature of the connections among individuals. Blogs and news sites often change several times a day, whereas informational web pages change only occasionally (Bogen et al., 2007). Kumar et al. (2006) showed that the collection of blogs with their links (Blogspace) underwent a transitional behavior in 2001 and it has been rapidly expanding over the years in the metrics of connections between people and the community structure.

Video blogs being a comparatively new phenomena gaining popularity in the recent years, the community structure and connections between people in the community could be as well subject to change frequently. This study attempts to determine the structure of a video blogger community and explore the reasons for the changes in that community. It studies the links among video bloggers on YouTube to visualize the social network of bloggers and their friends and subscribers.

3. THEORETICAL FOUNDATION

3.1. SOCIAL NETWORK THEORY

Mitchell (1969) defined social networks as "a specific set of linkages among a defined set of persons, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behavior of the persons involved". Social network theory is the set of measures and constructs that describe the structure of a social network.

The origins of network theory can be traced back to three fields of study: sociology, anthropology, and role theory. Theorists such as Park, Cooley and Simmel emphasized that the key to understanding social life was the patterns of interaction and communication among people (Tichy et al., 1979). Anthropologists such as Levi-Strauss, Malinowski and Frazer emphasized the content of relationships that joined individuals and the conditions under which these bonds exist and evolve over time (Tichy et al., 1979). Network theory has been widely used in community studies and anthropology (Mitchell, 1969), and it features prominently in management literature (Allen, 1977).

A social network comprises nodes that represent the individuals and links that represent relationships among the individuals. The diagram that is used to represent the relations among people is called a sociogram. A sociogram uses points and lines to represent the relationship among people in a network.

Social network analysis is concerned with the structure of relationships among individuals within a group and tries to identify the causes and consequences of such

relationships. The main aim of social network analysis is to detect and interpret patterns of social ties among individuals (Nooy et al., 2005).

Any communication network can be represented by a discrete mathematical structure called a graph. Figure 3.1 shows a social network graph. The red circles or nodes represent individuals in the network; the lines connecting them represent links between individuals.

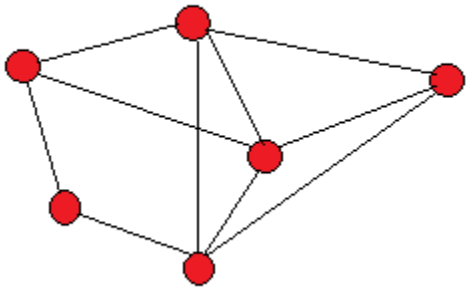

Figure 3.1 Social network graph

Freeman (1979) introduced various measures of relationships within a social network, including degree, betweenness, and closeness. These measures provide information concerning the relationships among the nodes of a bounded social network. The measures used in the present study are briefly described below.

3.2. CENTRALITY

Bavelas (1948) introduced the concept of centrality as applied to communication by individuals. According to Bavelas (1948) and Shaw (1954), when a person is strategically located within the network of communication paths linking people, that person is considered central. A central person can influence the group by transmitting or withholding information (Freeman, 1979). According to Leavitt (1951), such an individual is not dependent on others as relayers of information or intermediaries. The structure of a highly centralized network looks like a star, as shown in Figure 3.2. Such a network has one or two nodes in the center, which are surrounded by many nodes that have few or no connections to the center nodes (Kumar et al., 2003). This idea of centrality is being mobilized in a wide range of applications. Centrality is an important structural attribute of social networks.

In Figure 3.2, Node G is central, having more connections than the other nodes; all the other nodes surround Node G and have an equal number of connections in the network.

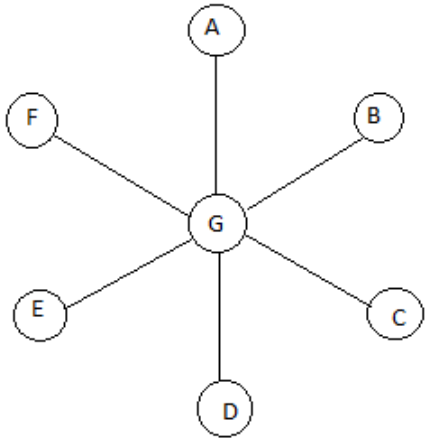

Figure 3.2 Freeman's star network

A node's centrality can be determined by its structural attributes, including degree, closeness, and betweenness. The choice of a particular structural attribute and its measures is dependent on the context of the application. Degree is the most stable measure of centrality (Zemljic & Hlebec, 2005). It is usually used when the main concern is communication-based activity. Betweenness, the least stable measure of centrality (Zemljic & Hlebec, 2005) is used when control of communication is most important. Closeness is usually used when the main concern is independence or efficiency (Freeman, 1979). The most stable centrality measure is degree centrality while the least stable measure is betweenness centrality.

3.2.1. Degree. Degree centrality is defined as the number of nodes in the network to which a particular node is connected. Degree centrality helps in finding the most active individual in the network. A node in a network is considered to be more central when it has higher degree compared to others in the network (Ahuja et al., 2003) Figure 3.3 shows an undirected social network with five nodes. Node A has a degree of four because

it is connected to four other nodes. Nodes B and D have a degree of two because each is connected to two nodes, Nodes C and D have a degree of one because each is connected to only one node. In this network, Node A has the highest degree; it is considered the most central node in the network for communication because it is connected to every other node in the network.

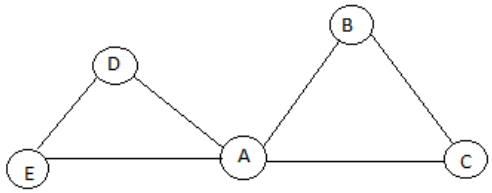

Figure 3.3 Sample social network

3.2.2. Betweenness. Betweenness is based on the notion that an individual who is important as an intermediary in the network is central in the network (Yang & Chen, 2008). It depends on the extent to which an individual is required as a link in the chains of contact that allow the transmission of information within the network.

Figure 3.4 shows a social network graph in which Node A acts as a link between two clusters of nodes. Information can pass from one cluster to the other only through Node A; therefore Node A has high betweenness.

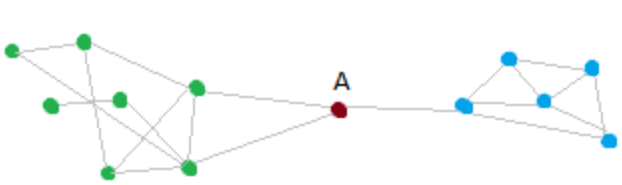

Figure 3.4 Betweenness centrality

3.2.3. Closeness. Bavelas (1950) developed measures of closeness. Durrington et al. (2000) noted that "closeness centrality examines how near an individual is to others in a social network through people they communicate with." The closeness of a node can also be used to estimate the time required for messages originating at some random node in the network to reach a particular node (Borgetti & Everett, 1999).

Closeness is calculated as the reciprocal of the sum of geodesic distances from a node to all other nodes in the network, where the distance between two nodes is the number of nodes that link them. This distance is an important macro-characteristic of the network (Hanneman, 2000). As distance increases, the time needed for diffusion of information across the network also increases.

The following provides an example of the calculation of geodesic distance among nodes in a network. Consider a network with three nodes A, B, and C, as shown in Figure 3.5. Because nodes A and B are adjacent, the distance between them is one. Similarly, the distance between B and C is 1. The distance between A and C is 2 because A is not directly connected to C, and two steps are required for information to go from A to C. The closeness of Node A can be calculated by summing the reciprocal of the distances from A to both B and C.

Closeness of A = 1/ (1+2) = 0.333

Similarly closeness of Nodes B and C will be

Closeness of B = 1/ (1+1) = 0.5

Closeness of C = 1/ (2+1) = 0.333

Thus, in this social network Node B has the highest closeness than the Nodes A and B.

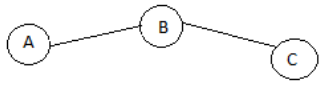

Figure 3.5 A simple network

Nodes with high closeness scores receive information sooner than nodes with lower closeness scores (Borgatti & Everett, 1999; Okamoto et al., 2008). Few studies have calculated closeness as the sum of geodesic distances without taking the reciprocal (Freeman, 1979; Sabidussi, 1966). Here, nodes with low scores are considered more central.

The present study calculates closeness as the reciprocal of the sum of distance from one node to all other nodes in the network.

3.3. CORE/PERIPHERY NETWORK

A network can be called a core/periphery structure if the network can be partitioned into two sets: a core whose members are densely connected to each other and a periphery whose members have more connections or ties to the members in the core than to each other. Borgatti and Everett (1999) proposed a formal model of core/periphery structure. The core/ periphery structure is somewhat between a highly centralized or star network and a highly decentralized network (Borgatti & Everett, 2006).

The nodes in the periphery may refer to the people who are new to the community and will join the core with time or people who act as bridges to other communities or individuals who are unique and may span other communities (Krebs & Holley, 2002).

Figure 3.6 shows a core/periphery network in which the green nodes represent the core members and the red nodes represent the peripheral members.

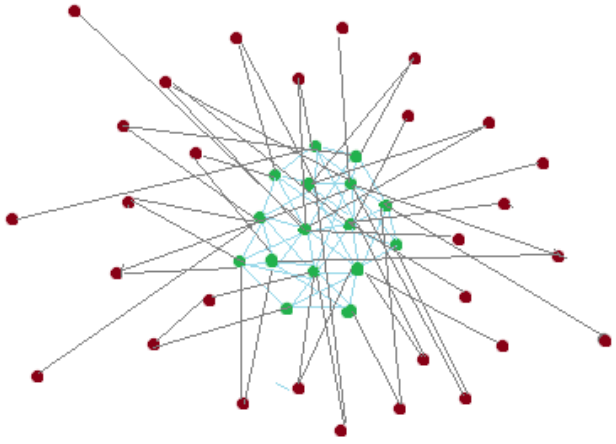

Figure 3.6 Core/periphery network

A core periphery analysis was used in this study to check if the network structure fits a core periphery structure as the previous structure obtained by Warmbrodt et al. in 2008 was a core periphery structure.

3.4. GROUP CENTRALITY MEASURES

Group centrality is a measure of the centrality a network or a group of individuals within the network. It indicates the extent to which a network resembles a star, or the extent to which a network revolves around a single node. Group centrality scores can be calculated for each of Freeman's centrality measures: degree, betweenness, and closeness.

Group degree is defined as the number of nongroup nodes that are connected to the members of the group (Everett & Borgatti, 1999). The group degree centrality of a network is normalized by dividing the degree of the group by the number of nongroup nodes (Everett & Borgatti, 1999). Normalization of centrality scores is necessary to compare network structures of different sizes (Everett & Borgatti, 2004). Group closeness is defined as the sum of the distances from the group to all nodes outside the group. Group betweenness indicates the proportion of geodesics connecting pairs of non-group nodes that pass through the group (Everett & Borgatti, 2004).

3.5. RESEARCH ON SOCIAL NETWORK ANALYSIS

Social networks have generated significant interest in the recent years because of their relevance to social processes such as information processing, distributed research,

and diffusion of social influence (Kossinetts et al., 2006). Social network theory provides tools to derive key social information processing mechanisms (Ibarra & Andrews, 1993), and it has been applied in many studies. According to Rice (1994), the structural position of an individual in a communication network influences that individual's performance ratings. Network centrality is associated with positive evaluation of job performance, features of workplace, and commitment to an organization among other factors (Rice & Mitchell, 1973; Roberts & O'Reilly, 1979; Dean & Brass, 1985; Hartman & Johnson, 1989). Network centrality positively influences motivation within a group (Tsai, 2001).

People in decentralized organizations tend to be more satisfied with work processes than those in centralized organizations (Ahuja and Carley, 1999). According to Marsden and Laumann (1977), people on the periphery of the network are dependent on those at the center, who are considered the most powerful individuals in that network. A study by Sparrowe et al. (2001) proved that people central to a network perform better than those who are peripheral.

4. DATA COLLECTION

4.1. DATA COLLECTION METHOD

This study evaluated the structure of a video blogger It studied YouTube in particular because this site is presently the leader in online video, ranked number one among popular video sharing sites (Billsborro-Koo, 2006). About 24 hrs of video are uploaded to You Tube every minute and the number of views in You Tube exceeds 2 million per day (Youtube facts, 2010). Most of the video bloggers prefer to host their videos on youtube (36%) (Wauters, 2010). YouTube provides more community-building capabilities (such as adding friends, subscribers, commenting) that other video sharing websites and it offers wider viewership (Billsborro-Koo, 2006). YouTube allows its users to upload and share videos easily on www.youtube.com and across the Internet through websites, mobile devices, email, and blogs. YouTube videos can also be embedded in other websites.

Each registered member of YouTube has a personal homepage that features a list of all videos uploaded and displays the comments of other users. YouTube also provides a platform for people to connect and interact with others around the globe. Users can add people to their network as friends and interact with them. They can also subscribe to the videos of other users. Subscribers receive updates when new videos are added. Friends of a user are those who communicate with the user on a personal level. Thus, users can network with other users on YouTube as either friends or subscribers, or both; therefore this study relied on both the friend and subscriber networks.

A comprehensive list of users was compiled from two sources. The first was the list of users registered in the people and blog channel of YouTube. Because many video bloggers present on YouTube are not registered, however, this work also used a list of video bloggers registered on the vloggers forum (http://vloggersforum.org/forum.php), which publishes posts by individuals who have a video blog channel on YouTube. The video bloggers introduce themselves through this forum and provide a link to their channel, the comprehensive user list thus obtained formed the community of video bloggers on YouTube used for this research. Because YouTube is enormous, this list is no doubt incomplete, but it includes a substantial segment of users.

A manual check filtered the users who were not bloggers. Finally, 187 users were identified as having their own web pages or video blog channels on YouTube. This research then analyzed the social network among these 187 users with a closed-group approach that identified the network from the list of users; rather than a snowball approach in which data begins with one particular user and continues from there. A snowball approach usually leads to an egocentric network with the first user at the center.

4.2. DATA COLLECTION PROCESS

First, the comprehensive list of users was compiled using a web crawler program that was developed specifically for this research. This data was collected from September 20, 2009 to September 25, 2009. This step produced a list of 375 URLs. Next, the URLS were filtered to eliminate those who were not video bloggers. Content analysis of the videos posted revealed those users users who did not post original videos or who posted

commercial content; the URLs of these users were eliminated from the list. After filtering, only 187 of the original 375 URLs remained on the list.

The web crawler program was then used again to compile a list of the friends and subscribers of each blogger. This list was stored in a SQL Lite database. A C# program was written specifically to build a social matrix of friends and subscribers.

A social matrix is a mathematical representation of a social network. It consists of rows and columns that represent the relationship between users in a network. Figure 4.1 provides an example.

	A	B	C
A	0	1	1
B	1	0	0
C	1	0	0

Figure 4.1 Social matrix

This matrix represents the relationship among Nodes A, B, and C. It indicates that links exist between Nodes A and B and between Nodes A and C. Because there is no link between Nodes B and C, the cell corresponding to both those nodes is marked 0.

The nodes in the network represent video bloggers. Two 187x187 matrices similar to that in Figure 4.1 were generated representing , respectively, relationships between video blogger and friend and video blogger and subscriber. These matrices were then analyzed using UCINET, and various social network measures of the friends and

subscribers networks were calculated. UCINET is a social network analysis tool developed by Steve Borgatti, Martin Everett, and Lin Freeman. The tool works with NETDRAW to produce graphical representations of the social networks. It was selected because it is open source software available for download free of cost. It is capable of handling a large volume of data (up to 32, 627 nodes). It is self-explanatory and easy to use, and it includes all the functions necessary to calculate social network measures.

5. RESULTS

5.1. FRIEND NETWORK

Figure 5.1 illustrates the friend network using UCINET. The nodes in the graph represent the video bloggers. The lines between the nodes are the links between them. This network has 110 active nodes (i.e., nodes that are connected to at least one other node). Seventy-seven inactive nodes were removed.

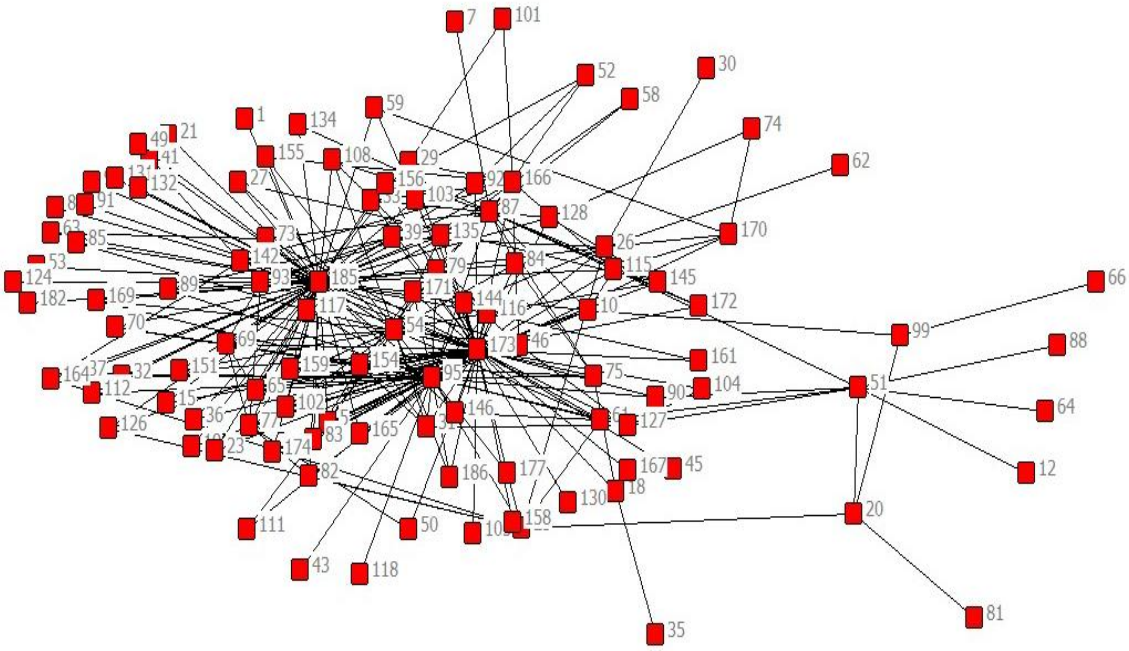

Figure 5.1 Structure of friend network

Table 5.1 lists the some of the nodes with their scores in degree, betweenness and closeness.

Table 5.1 Some nodes in friend network

Node	Degree	Normalized degree	Betweenness	Normalized Betweenness	Closeness	Normalized Closeness
7	1	0.005	0	0	38.533	0.207
31	6	0.032	5.983	0	54.833	0.295
54	24	0.129	175.011	0.010	63.833	0.343
87	19	0.102	293.182	0.017	61.083	0.328
173	60	0.323	1959.479	0.114	83.250	0.448
185	71	0.382	2730.032	0.159	88.750	0.477

Node 185 has the highest degree centrality, 71, which means that this particular node is connected to 71 other active nodes in the network. The other nodes that have a high degree centrality are 54, 87, 95, 154, 166 and 173. The nodes 185, 173, 95, 51, 87, 26, 115 and 10 have the highest betweenness centrality among all the 110 active nodes. These nodes serve as bridges and connect all the other nodes together. The nodes 185, 173, 95, 54, 87, 166 have highest closeness scores and are thus located at a shorter distance from all the other nodes in the network. These nodes receive information at a shorter time when compared to the nodes with high closeness. The normalized centrality scores indicate that all the nodes exhibit a greater closeness centrality than degree or betweenness centrality. So, in this network it takes less time fr information to diffuse to all the nodes in the network.

A few nodes are present on the periphery, far from the other nodes in the network. These nodes are connected to only one or two nodes in the network and thus have low degree and betweenness. These nodes represent video bloggers who are less active than other nodes in the network.

5.2. SUBSCRIBER NETWORK

Figure 5.2 below graphs the subscriber network. This network had 104 active nodes; 83 inactive nodes were removed from the network. Similar to the friend network, the red nodes in the network represent the video bloggers and the lines between them represent the relation between the bloggers.

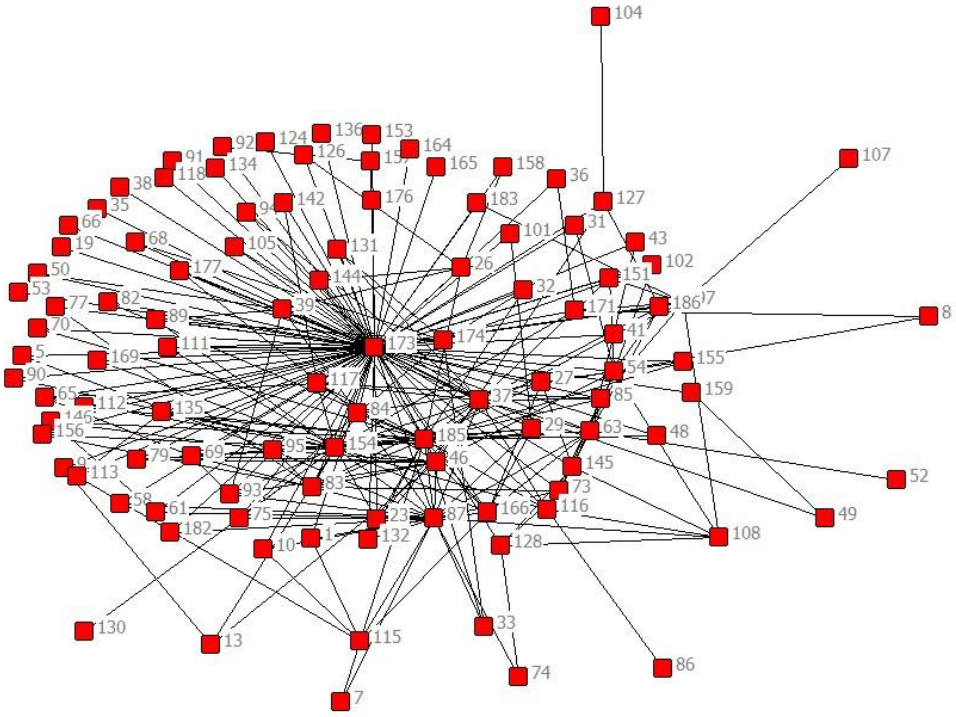

Figure 5.2 Structure of subscriber network

Table 5.2 shows the centrality measures for some of the nodes in the subscriber network.

Table 5.2 Some nodes in subscriber network

Node	Degree	Normalized Degree	Betweenness	Normalized Betweenness	Closeness	Normalized Closeness
8	2	0.011	0.5	0	37.583	0.202
27	5	0.027	2.509	0	52.5	0.282
37	18	0.097	137.806	0.008	60.000	0.323
87	25	0.134	323.878	0.019	63.333	0.341
173	90	0.484	4095.627	0.238	96.500	0.519
185	31	0.167	277.696	0.016	66.500	0.358

At the individual level, nodes that have a high degree centrality are 173, 185, 154, 87, 37, 46 and 54. The nodes 173, 87, 154, 185, 37, 97 and 63 have the highest betweenness centrality among all the 110 active nodes. These nodes serve as bridges and connect all the other nodes together. They may be regarded as the most influential nodes, which mean that they might be able to exchange information with most of the people in the network when compared to the other nodes. The nodes 173, 185, 154, 87, 37 have highest closeness scores and are therefore located at a shorter distance from the other nodes. In this network also, the normalized scores of all the measures indicate that the closeness centrality of all the nodes is higher when compared to the degree and the betweenness centrality. The nodes have a very low betweenness centrality which shows that neither of them act as bridges to other nodes in the network.

In the subscriber network, it can be observed that there are few nodes that are on the periphery and are connected to either one or two nodes in the network. These nodes might refer to the video bloggers who are either new to the community or people who are not active in the network.

5.3. GROUP CENTRALITY MEASURES

Group centrality measures were calculated to study the difference between the friend network and the subscriber network. The degree and betweenness of both networks were calculated using UCINET. The network closeness scores could not be obtained as the network contains disconnected nodes.

Tables 5.3 and 5.4 show the results.

Table 5.3 Centrality measures of friend network

Degree	Betweenness
36.90%	11.13%

Table 5.4 Centrality measures of subscriber network

Degree	Betweenness
47.32%	15.79%

The structures of these networks differ visually. Both have high degree low betweenness, indicating that in both networks, the connectivity between the nodes is high, but few nodes act as bridges to nodes in other groups. The group centrality measures indicate that the subscriber network is more centralized than the friend network because it has higher degree and betweenness scores than the friend network.

There are 87 common nodes in both the networks. The remaining nodes exist either only either in the friend network or subscriber network. These 87 nodes may refer to video bloggers who are active in the community as they are present in both the friend

and subscriber network. The nodes (e.g., 5, 36, and 77) have a betweenness score of zero in both the networks which implies that most of the nodes have common properties in the sense that few nodes are influential while few of them are not active in both the friend and subscriber network.

Similarly, some nodes in the friend network (e.g., 173, 154, and 87) with high degree, betweenness and closeness also have high centrality in the subscriber network. These nodes may represent video bloggers who are especially influential in the network because they are connected to most of the other nodes in both networks. Table 5.5 shows the nodes that have high centrality scores in both the friend and subscriber networks. The normalized centrality scores of the nodes in the subscriber network are higher than that of the nodes in the friend network.

Table 5.5 Nodes with highest normalized centrality in both networks

Node	Friend network			Subscriber network		
	Degree	Betweenness	Closeness	Degree	Betweenness	Closeness
87	0.102	0.017	0.328	0.134	0.019	0.341
154	0.070	0.001	0.311	0.140	0.016	0.345
173	0.323	0.114	0.448	0.484	0.238	0.519
185	0.382	0.159	0.477	0.167	0.016	0.358

5.4. CORE/PERIPHERY ANALYSIS

Core/periphery analysis was used to determine whether either of the friend or subscriber networks exhibits a core/periphery structure. The core/periphery analysis identifies a set of nodes that are densely connected with one another and another set that have few connections. The densely connected nodes form the core, and those with few connections form the periphery of the network. UCINET uses a genetic algorithm to measure the core/periphery goodness of fit, which is expressed as a fitness score between 0 and 1. A fitness score of 0 indicates that the network does not fit the core/periphery model, whereas a fitness measure of 1 indicates that the network is a good fit for a core/periphery structure. The friend network has a fitness score of 0.164, and the subscriber network has a fitness score of 0.152.

These measures suggest that neither of the networks fits the core/periphery network structure. The friend network has a negligibly higher core periphery fitness ratio than the subscriber network. In both networks, therefore, few influential or central people post videos that are watched by all others in the network.

5.5. COMPARISON WITH THE PREVIOUS NETWORK

In 2007, Warmbrodt et al. analyzed the social network of video bloggers. Their study analyzed the social network of video-bloggers registered on a video blog directory called VlogDir. VlogDir was a popular and reputable directory of video bloggers in 2007.It does not exist currently. They captured the URLs of blogs in the directory and filtered the list, eliminating inactive links. The inbound and outbound links of every active blogger’s page on VlogDir were captured using the blog-tracking site Technorati.

Warmbrodt's group constructed a social matrix from the links and analyzed the network structure using UCINET. The final network thus obtained consisted of 34 active nodes; it is illustrated in Figure 5.3.

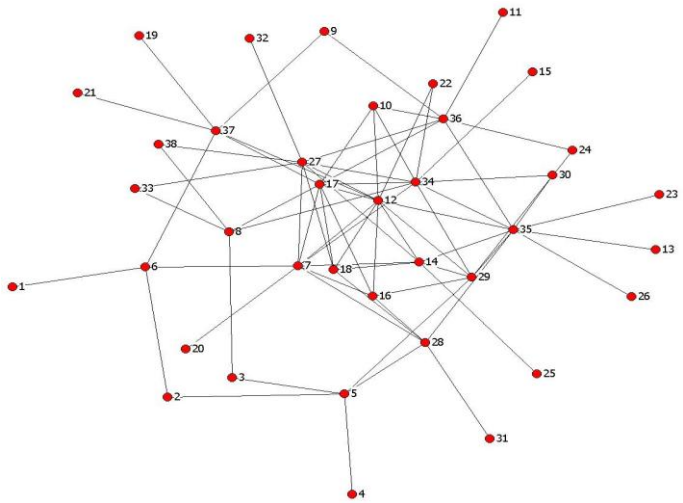

Figure 5.3 The structure of the video blogger community (Warmbrodt et al., 2008)

Tables 5.6 and 5.7 shows the network measures obtained by Warmbrodt et al. and during the present study, respectively.

Table 5.6 Centrality measures calculated by Warmbrodt et al.

Network Degree	**Network Betweenness**
20.27%	17.46%

Table 5.7 Centrality measures calculated here

Network	**Network Degree**	**Network Betweenness**
Friends	36.90%	11.13%
Subscribers	47.32%	15.79%

The 2007 study indicated that the video blogger community at that time had a core/periphery structure, with 50% fitness. The network was highly decentralized; the highest degree score was 20.27%. As indicated above, neither network analyzed here has a core/periphery structure. The core/periphery goodness fit score of the friend network is higher than the subscriber network. The friend network has a lower degree score of 36.90 % while the subscriber network is a more central structure with a network degree centrality score of 47.32%. The friend network and the subscriber have low betweenness centrality scores of 11.13% and 15.79% which is less than that of the older network. This indicates that, the earlier network included a greater percentage of people who acted as bridges between nodes in the network. The low betweenness scores in the present networks may be due to the larger number of people and the greater number of connections between them.

Overall, the centrality of both the present networks is greater than that of the 2007 network. The number of video bloggers has increased rapidly; therefore more bloggers have an audience for their videos. With each new blogger, the links between the nodes shift, altering the network structure. In addition, blogs are updated frequently, and the links among bloggers tend to change with every update (Guo et al., 2009). Many studies (Burkhardt & Brass, 1990; Kumar et al., 2007) suggest that the network structures tend to

change over time. A study conducted by Burkhardt and Brass (1990) observed the effect of technological change on the structure and power of an organization. It found that employees of the organization gained power and became more central to their network as technology became more widely available. The various tools available to video bloggers may similarly influence the frequency of upload and viewership among video bloggers, altering communication patterns and network structures.

As demonstrated by the work of Warmbrodt et al., in 2007, there were few video bloggers in 2007 and all were equally central and thus had equal power in the network. The structure of the network at that time therefore was core/periphery. Now, the number of video bloggers has increased but only a few are active. The entire network revolves around those key bloggers, making it far more centralized than the 2007 network.

6. DISCUSSION AND IMPLICATIONS

6.1. FRIEND NETWORK VS SUBSCRIBER NETWORK

The network structure and the individual and group centrality scores of the nodes in both the friend and subscriber network were calculated. The network degree and betweenness scores of the subscriber network were higher when compared to the scores of the friend network.

Many subscribers may post original videos rarely, more often viewing videos uploaded by others. There may be only a few central video bloggers who upload videos regularly, making this network more centralized than the friend network.

Core/periphery analysis revealed that neither of the two networks exhibited a core periphery structure due to their low core/periphery fitness scores. Both the networks have a higher degree centrality than betweenness centrality.

6.2. PRESENT NETWORK VS PREVIOUS NETWORK

The network structure of the video blogger network obtained presently and the previous network obtained by Warmbrodt et al. (2008) were compared. The previous network structure was a core/periphery structure while neither of the two networks presently exhibit core/periphery structure. The network centrality scores indicate that the present networks have higher centrality scores than the previous network.

From 2007 to the present, the video blogging network has evolved from a core/periphery structure to a centralized structure. Previously, a core group of video bloggers had numerous links with others, and only a few bloggers remained at the

periphery. The present network structure is more centralized, meaning that most bloggers have numerous connections to others. This shift may be due to increased interaction among video bloggers.

If this trend continues, the network structure of the future will be even more centralized. However, the network structure may vary from one community to another depending on the number of people on the site, the popularity of the site,, and many other factors.

6.3. IMPLICATIONS

The results of the present research indicate that the structure of the video bloggers has changed over the last three years, becoming more centralized. The entire network revolved around a few central individuals. The implications of this observation are briefly discussed below.

This research shows how the social network of video bloggers changes over time. The structure of any community is dynamic, changing rapidly and continuously as new nodes are added. This is true of the video blogger community. The size of the community and the links among members tend to change over time.

Social network analysis examines the structure of communities. The reasons for changes in the structure of a community are important. This study only explored the community of video-bloggers on YouTube. Future studies could address the generalized structure of the video blogger community rather than focusing on a single community.

This study suggests a trend in the video blogger community; if this trend continues the community will become more centralized. Nowadays, many tools are available to

record and upload videos more easily than ever. These tools available may be responsible for the sharp increase in the number of video bloggers. The features available on a particular video sharing site may influence bloggers to use that site. Video blogging sites can increase their membership by providing easy to use, robust features for uploading videos and networking among users.

As video blogs grow more popular, they may prove useful for businesses to communicate with consumers. Video blogs allow people to communicate on a more individual level. They also have great potential for advertising. Companies invest a lot of money in blogs to advertise their products (Guo et al., 2009); analysis of the network structure would allow them to identify the people central to the network and thus develop an advertising strategy that reaches most of the network.

Text-blogs are already widely used by politicians and celebrities to express their thoughts and ideas. Video-blogs might make communication more effective than plain text-blogs. Analysis of the network structure could help determine the most influential people in the network, through whom the messages could be passed to the majority of the community.

7. CONCLUSION

This is a study of the social network of a video blogger community. It used a sample size of 184 video bloggers to evaluate the structure of this network, considering both friends and subscribers. The network structure is centralized. The work of Warmbrodt et al. (2008) proved that the network once had a core/periphery structure. Communication patterns among video-bloggers are changing continuously.

The present research could be further extended to analyze the social network of video blogger on YouTube based on patterns of comments on video blogs. One limitation of the present study is that it considers only bloggers on YouTube; however, many other video blog communities exist. Future studies could focus on these other communities. Finally, the structure of the video blogger network could be further analyzed by grouping blogs in subject categories, such as personal, political, technological and scientific.

APPENDIX

CENTRALITY MEASURES

Friend Network Centrality Measures

ID	Degree	Betweenness	Closeness
1	1	0	48.033
3	1	0	1
5	4	0	53.417
7	1	0	38.533
10	6	208.29	56
12	1	0	30.933
15	2	0	51.45
18	3	108	47.617
19	2	0	51.45
20	4	132.912	37.2
21	1	0	48.033
23	2	0	51.45
25	8	177.173	48.5
26	8	258.045	55.667
27	3	4.105	49.7
29	4	41.824	52.783
30	1	0	36.717
31	6	5.983	54.833
32	2	0	50.5
33	4	1.154	53.117
35	1	0	33.083

Friend Network Centrality Measures (continued...)

36	2	0	51.45
37	2	0	50.5
39	5	6.779	53.75
41	2	0	48.533
43	1	0	42.25
45	1	0	46.2
46	8	8.816	55.833
47	1	0	1.5
49	1	0	48.033
50	2	0	46.7
51	8	373.066	44.083
52	3	2.833	40.7
53	1	0	48.033
54	24	175.011	63.833
58	2	0	40.7
59	3	8.234	49.367
61	6	98.832	52.917
62	1	0	36.717
63	2	0	48.533
64	1	0	30.933
65	6	1.32	54.417
66	1	0	28.917
69	8	7.667	54.617
70	3	0.737	51
71	1	0	1

Friend Network Centrality Measures (continued...)

73	4	10.042	52.95
74	2	1.143	38.15
75	6	19.256	51.75
77	9	18.814	55.25
79	7	3.036	55.417
81	1	0	27.417
82	4	23.953	53
83	6	1.1	54.417
84	7	8.619	54.783
85	2	0	48.533
86	1	0	48.033
87	19	293.182	61.083
88	1	0	30.933
89	3	1.2	51
90	3	54.506	50.417
91	1	0	48.033
92	3	25.642	52.117
93	6	6.188	53.95
95	37	783.399	71.5
97	1	0	48.033
99	3	123.998	39.25
100	2	1	2
101	2	0	37.983
102	4	0	53.417
103	3	6.71	52.117

Friend Network Centrality Measures (continued...)

104	2	0	47.25
105	1	0	46.2
108	4	1.831	51.033
111	2	0	44.25
112	2	0	50.5
115	8	250.269	57
116	5	20.281	53.917
117	6	14.841	54.917
118	1	0	42.25
119	1	0	1.5
124	1	0	48.033
126	3	14.024	49.917
127	6	77.157	51.917
128	5	82.785	53.783
130	1	0	46.2
131	1	0	48.033
132	1	0	48.033
134	2	7.333	48.7
135	4	0.635	52.95
142	5	16.788	53.583
144	4	2.229	53.75
145	5	9.34	49.95
146	4	3.933	53.833
151	3	0	52.117
154	13	22.687	57.917

Friend Network Centrality Measures (continued...)

155	3	0.635	50.033
156	3	25.642	52.117
158	1	0	46.2
159	5	9.712	53.917
161	2	0	46.867
164	3	16.07	49.917
165	3	0	52.917
166	12	137.622	57.833
167	1	0	46.2
169	3	0	49.867
170	5	43.308	46.75
171	6	2.268	54.917
172	3	9.767	48.333
173	60	1959.48	83.25
174	3	0	52.917
177	3	7.766	49.833
182	1	0	48.033
185	71	2730.03	88.75
186	3	0	49.917

Subscriber Network Centrality Measures

ID	Degree	Betweenness	Closeness
1	3	7.517	51.667
5	2	0	50.333
7	2	0	39.333
8	2	0.5	37.583
9	2	16.633	50.5
10	3	7.517	51.667
13	3	1.5	40.75
19	1	0	49.833
23	4	0	52.167
26	6	5.33	52.667
27	5	2.509	52.5
29	6	3.91	53.167
31	2	0	50.667
32	3	0.341	51.167
33	3	1.448	43.75
35	1	0	49.833
36	2	0	50.5
37	18	137.806	60
38	1	0	49.833
39	6	4.167	52.333
41	3	1.222	51.5
43	2	0	50.5
46	13	59.191	57.333

Subscriber Network Centrality Measures (continued…)

49	2	0.5	38.25
50	2	0	50.333
52	1	0	36.417
53	1	0	49.833
54	13	95.164	56.5
58	2	0	51.167
60	1	0	1
61	3	0.75	51.667
63	11	119.036	56.5
65	4	0.2	51.667
66	1	0	49.833
68	2	0	50.5
69	8	2.745	54
70	2	0	50.667
73	6	4.644	53.333
74	2	0.778	39.5
75	4	0	52.5
77	2	0	50.333
79	5	0.111	52.5
82	2	0	50.667
83	11	16.473	56.167
84	9	16.175	55.167
85	7	8.314	53.833
86	1	0	35.5

Subscriber Network Centrality Measures (continued…)

87	25	323.878	63.333
89	4	1.754	51.833
90	2	0	50.667
91	1	0	49.833
92	2	0	50.333
93	6	3.548	53.5
94	2	0	50.5
95	8	7.715	54.333
97	8	119.731	53.833
100	1	0	1
101	2	0	50.333
102	3	0.816	51.333
103	1	0	1
104	1	0	34.583
105	2	0	50.5
107	1	0	35.333
108	6	16.38	44.417
111	3	0.667	51.333
112	2	0	50.667
113	3	8.217	51.167
115	7	13.052	44.917
116	7	116.83	54
117	8	8.071	54.167
118	1	0	49.833
119	1	0	1

Subscriber Network Centrality Measures (continued…)

124	1	0	49.833
126	2	0	50.333
127	4	102.476	51.667
128	5	38.979	52.167
130	1	0	39
131	3	0.833	51.167
132	4	0	52.333
134	1	0	49.833
135	4	1.75	52
136	1	0	49.833
142	2	0	50.333
144	3	0	51.167
145	5	9.859	52.333
146	4	0.667	51.667
151	4	2.575	52
153	1	0	49.833
154	26	279.68	64.167
155	3	0.573	51.5
156	3	0	51.167
157	2	0	50.333
158	2	0	50.333
159	2	28.767	50.5
164	1	0	49.833
165	1	0	49.833
166	9	17.361	55.167

Subscriber Network Centrality Measures (continued…)

169	2	0	50.667
171	5	50.188	52.667
173	90	4095.63	96.5
174	9	28.665	54
176	1	0	49.833
177	3	0.367	51
182	2	0	51.167
183	2	0	50.667
185	31	277.696	66.5
186	5	5.797	52.667

BIBLIOGRAPHY

Agarwal, N., Liu, H.(2008) Blogosphere: research issues, tools, and applications, *ACM SIGKDD Explorations Newsletter*, 10(1), 18-31.

Ahuja, M, K., Carley, K, M.(1999). Network Structure in Virtual Organizations, *Organization Science*, 10(6), 741-757.

Ahuja, M., Galletta, D., & Carley, K. (2003). Individual Centrality and Performance in Virtual R&D Groups: An Empirical Examination. *Management Science, 49*(1), 21-38.

Ali-Hasan, N., and Adamic, L.(2007). Expressing social relationships on the blog through links and comments, *In Proceedings of International Conference on Weblogs and Social Media*, March 2007.

Argamon, S., Koppel, M., Fine, J., Shimoni, A, R.(2003). Gender, genre, and writing style in formal written texts, *Text*, 23 (3), 321–346.

Armstrong, L, C., McAdams, M, J. (2009). Blogs of Information: How Gender Cues and Individual Motivations Influence Perceptions of Credibility**,** *Journal of Computer-Mediated Communication*, 14, 435-456.

Baker, J, R., Moore, S, M. (2008).Blogging as a Social Tool: A Psychosocial Examination of the Effects of Blogging, *Cyberpsychology & Behavior*, 11(6), 81-85.

Bavelas, A. (1948). A Mathematical Model for group structures, *Human Organization*, 7, 16-30.

Benevenuto, F., Duarte, F., Rodrigues, T., Almeida, V, A, F., Almeida, J, M., Ross, K, W. (2008). Understanding video interactions in youtube, *Proceedings of the 16th ACM International Conference on Multimed*ia, Vancouver, Canada.

Billsborro-Koo, Ryan. (2006, April 7). *Ten video sharing sites compared*. Retrieved from http://www.dvguru.com/2006/04/07/ten-video-sharing-services-compared/

Blood, R. (2004). How blogging software reshapes the online community. *Communications of the ACM*, 47(12), 53-55

Bogen, P, L.,Revilla, L., Furuta, R., Hubbard, T., Karadkar, U, P., Shipman, F (2007), Longitudinal Study of Changes in Blogs, *JCDL* , June 17-23, 2007

Borgatti, S, P., Everett, M, G. (1999) Models of core/periphery structures. *Social Networks* 21:375–395.

Borgatti, S. P., & Everett, M. G. (2006). A Graph-Theoretic Perspective on Centrality. *Social Networks, 28*(4), 466-484.

Burkhardt, M., D. Brass. (1990). Changing patterns or patterns of change: The effects of a change in technology on social network structure and power, *Admin. Sci. Quart*, 35, 104-127

Dean, J, Jr., Brass, D.(1985). Social interaction and the perception of job characteristics in an organization, *Human Relations*, 38, 571-582.

Dean, K. (2005, July 13). *Blogging + video = vlogging*. Retrieved from http://www.wired.com/entertainment/music/news/2005/ /07/68171

Du, H, S., Wagner, C. (2006).Weblog success: Exploring the role of technology, *International Journal of Human Computer Studies*, 64, 789-798.

Durrington, V, A., Repman, J., Valente, T, W. (2000).Using Social Network Analysis to examine the time of adoption of computer-related services among University Faculty , *Journal of Research on Computing in Education*, 33(1), 16-27.

Ebel, H., Davidsen, J., Bornholdt, S. (2003). Dynamics of Social Networks, *Complexity*, 8(2), 24-27.

Efimova, L. and Hendrick, S.(2005). *In Search for a Virtual Settlement: An Exploration of Weblog Community Boundaries*. Retrieved from https://doc.novay.nl/dsweb/Get/Document-46041/weblog-community-boundaries.pdf

Efimova, L., and de Moor, A. Beyond Personal Web publishing: An Exploratory Study of Conversational Blogging Practices, *Proceedings of the 37th Annual Hawaii International Conference on System Sciences* (HICSS‘04), Big Island, HI, U.S.A. (2004).

Everett, M., Borgatti, S, P.(2004). Extending Centrality, In Carrington, P., Scott, J., Wasserman, S. (Eds.) *Models and Methods in Social Network Analysis* (2005)

Freeman, L. C. 1979. Centrality in social networks: Conceptual clarification. *Social Networks***,** 1, 215-239.

Goldberg, M., Magdon-Ismail.,Kelley, S.,Mertsalov, K(2009).Stable Statistics of the Blogograph, *Lecture Notes in Computer Science*, Springer Berlin / Heidelberg, 5661,pp 104-114.

Guadagno, R, E., Okdie, B, M., Eno, C, A. (2008). Who blogs? Personality predictors of blogging, *Computers in Human Behavior*, 24(5), 1993–2004

Guo, X., Vogel, D., Zhou, Z., Zhang, X., and Chen, H.(2009). Chaos Theory as a Lens for Interpreting Blogging**,** *Journal of Management Information Systems* 26(1), pp. 101–127.

Hanneman, R. E**.** (2000), *Introduction to Social Network Methods*. Online Textbook Supporting Sociology 157. Riverside, CA: University of California, 2000. (http://faculty.ucr.edu/~hanneman/)

Hartman, R, L., Johnson, D, J.(1989).Social contagion and multiplexity: Communication networks as predictors of commitment and role ambiguity, *Human Communication Research*, 15, 523-548.

Herring, S, C., Scheidt, L.A., Bonus, S., and Wright, E.(2004). Bridging the gap: A genre analysis of weblogs, *Proceedings of the Thirty-Seventh Annual Hawaii International Conference on System Sciences.* Los Alamitos, CA: IEEE Computer Society, 2004.

Herring, S. C., Scheidt, L. A., Bonus, S., and Wright, E. (2004): *"*Bridging the Gap: A Genre Analysis of Weblogs*", Proceedings of the 37th Annual Hawaii International Conference on System Sciences* (HICSS'04), Big Island, HI,

Ibarra, H., Andrews, S, B. (1993).Power, Social Influence, and Sense Making: Effects of Network Centrality and Proximity on Employee Perceptions, *Administrative Science Quarterly*, 38(2), 277-303.

Kelley, S. Goldberg, M. Magdon-Ismail, M. Mertsalov, K.(2009).Stability of individual and group behavior in a blog, *Proceedings of the IEEE International Conference in Intelligence and Security Informatics*, Dallas, TX

Ko, H., Chen, T. (2009). Understanding the Continuous Self-Disclosure of Bloggers from the Cost-Benefit Perspective, *Proceedings of the 2nd conference on Human System Interactions (HIS 09')*, Cantania, Italy.

Kolbitsch, J., Maurer, H. (2006). The Transformation of the Web: How Emerging Communities Shape the Information we Consume, *Journal of Universal Computer Science*, 12(2), 187-213.

Kossinets, G., Watts, D, J.(2006). Empirical analysis of an evolving social network, *Science*, 311(5757), 88-90.

Krebs, V., & Holley, J. (2002). Building Smart Communities Through Network Weaving [Electronic Version]. Retrieved December, 2010 from http://www.orgnet.com/BuildingNetworks.pdf.

Kumar, R., Novak, J., Raghaven, P., & Tomkins, A. (2003). On the bursty evolution of blogspace. *In Proceedings of the twelfth international conference on World Wide Web*. Budapest, Hungary, 568-576.

Laumann, E. O., and F. U. Pappi. 1973. New Directions in the Study of Community Elites. *American Sociological Review*, 38, 212-30.

Leavitt, H, J. (1951). Some effects of communication pattern on group performance, *Journal of Abnormal and Social Psychology*, 46, 38-50.

Luers, W. (2007). Cinema without show business: A poetics of vlogging. Retrieved August 10, 2010, from http://hdl.handle.net/2027/spo.pid9999.0005.105

Ma, W, W., Li, P., Clark, T,H,K.(2006). Examining the cognitive style effects on the acceptance of online community weblog systems, *Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICSS '06),* January, 2006.

Marsden, P., Laumann, E. (1977). "Collective Action in a Community Elite." Pp. 199-250 in Power, Paradigms and Community Research, edited by R. J. Liebert and A. W. Imershein. Beverly Hills, Calif.: Sage.

McCullagh, K.(2008),Blogging: self presentation and privacy**,** *Information & Communications Technology Law* ,17(1), 3-23.

McKenna, K. Y. A., & Bargh, J. A. (2000). Plan 9 from cyberspace: The implications of the Internet for personality and social psychology, *Personality and Social Psychology Review*, 4, 57–75.

Mefeedia.com (2010, October 10), http://www.mefeedia.com

Milgram, S (1967). The small world problem. *Psychology Today*, 1(May), 62-67.

Miller, A, M. (2010, April 28). Blogging Vs Vlogging, Retrieved from http://ezinearticles.com/?Blogging-Vs-Vlogging&id=5100307

Mislove, A., Marcon, M., Gummadi,k, P., Druschel, P., (2007). Measurement and analysis of online social networks, *Proceedings of the 7th ACM SIGCOMM conference on Internet measurement*, 2007.

Mitchell, J. C.(1969). The concept and use of social networks. In J. C. Mitchell (Ed.), Social networks in urban situations. Manchester, England: University of Manchester Press, 1969.

Mitrovi´c, M., Tadi', B. (2009). Bloggers Behavior and Emergent Communities in Blog Space, *The European Physics Journal*, 73(2), 293-301.

Molyneaux, H., O'Donnell, S., Gibson, K., Singer, J.(2008) Exploring the Gender Divide on YouTube: An Analysis of the Creation and Reception of Vlogs. *American Communication Journal*, 10(2), 1-15.

Nardi, B, A., Schiano, D. J., Gumbrecht, M., Swartz, L. (2004). Why we blog, *Communications of the ACM*, 47(12), 41-46.

Nooy, W., Mrvar, A., Batagelj, V.(2005). Exploratory Network Analysis with Pajek, Cambridge University Press, New York, 2005.

Okamoto, K., Chen, W., Li, X. (2008), Ranking of closeness centrality for large scale social networks, *Lecture Notes in Computer Science*, 5059, 186-195.

Palla, G., Barabási, AL., Vicsek, T.(2007),Quantifying Social group evolution, *Nature*, 446, 664-667.

Pollock, H. (2001), Who Let the Blogs Out?,Yahoo Internet Life. Retrieved from http://web.archive.org/web/20010813193029/http://yil.com/features/feature.asp?volume=07&issue=05&keyword=blogs.

Rheingold, H. (1993). The Virtual Community: Finding Commection in a Computerized World**.** Addison-Wesley Longman Publishing Company Co., Inc, Boston. MA

Rice, L, E.,Mitchell, T, R.(1973).Structural determinants of individual behavior in organizations, *Administrative Science Quarterly*, 18, 56-70.

Rice, R, E. (1994). Relating Electronic Mail Use and Network Structure to R & D Work Networks and Performance, *Journal of Management Information Systems*, 11(1), 9-29

Roberts, K, H., O'Reilly, C, A.(1979). Some correlations of communication roles in organizations, *The Academy of Management Journal*, 22, 42-57.

Sabidussi, G. (1966). The centrality index of a graph, *Psychometrika*, 31, 581-603.

Saeed, N., Yang, Y., Sinnappan, S. (2009), Effects of Cognitive Style on User Acceptance of Blogs and Podcasts, *Ninth IEEE International Conference on Advanced Learning Technologies*, 2009.

Santos, R, L., Rocha,B, P., Rezende, R, G., and Loureiro, A., A. (2007). Characterizing the YouTube video-sharing community. *Technical report*.

Schler, J., Koppel, M., Argamon, S., and Pennebaker, J. (2006). Effects of age and gender on blogging, *In Proceedings of the AAAI Spring Symposium Computational Approaches to Analyzing Weblogs*, Menlo Park, CA, 191--197.

Scott, J. (1996). Social Network Analysis: A Handbook. Sage Publications. 11 April 1996.

Seok, H., Jaekyoung, L., Sooyeon,K.(2009). A study on the factors Influencing the intention of Blog usage, *Pacific Asia Conference on Information Systems (PACIS '09).*

Shaw, M, E.(1954). Group structure and the behavior of individuals in small groups, *Journal of Psychology*, 38, 139-149.

SlashDot (2010, November 10), http://www.slashdot.org/.

Sparrowe, R, T., Liden, R, C., Wayne, S, J., Kraimer, M, L. (2001). Social Networks and the Performance of Individuals and Groups, *The Academy of Management Journal*, 44(2), 316-325.

Taricani. E.(*2007).* Communities of Blogging: Extensions of Our Identities. *American Communication Journal*.9(3), 1-9.

Tichy, N, M., Tushman, M, L., Fombrun, C. (1979). Social Network Analysis for Organizations, *Academy of Management Review*, 4(4), 507-519.

Toral, S, L., Martinez-Torres, M, R., Barrero, F. (2010).Analysis of virtual communities supporting OSS projects using social network analysis, *Information and Software Technology*, 52(3), 296-303.

Tsai, W.(2001). Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance, *The Academy of Management Journal*, 44(5), 996-1004.

Venkatesh, V., Morris, M, G., Davis, G, B., Davis, F, D. (2003) User acceptance of information technology: toward a unified view, *MIS Quarterly*, 27 (3), 425–478.

Warmbrodt, J., Sheng, H., Hall, R. (2008). Social Network Analysis of Video Bloggers' Community, *Proceedings of the 41st Hawaii Conference on System Sciences (HICSS 08').*

Warmbrodt, J., Sheng, H., Hall, R., Cao, J. (2010). Understanding the Video Bloggers' Community, *International Journal of Virtual Communities and Social Networking*, Vol. 2, No. 2, April-June 2010, pp.43-59

Wauters, Robin. (2010, January 5). *State of the vlogosphere.* Retrieved from http://techcrunch.com/2010/01/05/mefeedia-state-of-the-vlogosphere-2010/

Winn, Phillip. (2009, August 21). *State of the blogosphere*. Retrieved from http://technorati.com/blogging/article/state-of-the-blogosphere-introduction

Wise, J. M. (2004). "An Immense and Unexpected Field Action: Webcams, Surveillance, and Everyday Life." *Cultural Studies, 18 (2-3),* (March-May), 424-442.

Yang, S, J, H., Chen, I, Y, L. (2008). A social network-based system for supporting interactive collaboration in knowledge sharing over peer-to-peer network, *International Journal of Human–Computer Studies*, 66 (1), 36–50.

Yotube facts & figures (history & statistics). (2010, May 17). Retrieved from http://www.website-monitoring.com/blog/2010/05/17/youtube-facts-and-figures-history-statistics

Zemljic, B., Hlebec, V. (2005).Reliability of measures of centrality and prominence, *Social Networks*, 27, 73-88.

Zhang, X., Xu, C., Cheng, J.(2009).Effective Annotation and Search for Video Blogs with Integration of Context and Content Analysis, *IEEE Transactions on Multimedia*, 11(2), February 2009.

VITA

Anusha Mogallapu was born in India on November 24th, 1985. In May 2007, she received her B Tech in Electronics and Telematics from Jawaharlal Nehru Technological University in Hyderabad, India. She worked in Wipro Technologies, an IT company from June 2007 to November 2008.

She pursued her Master of Science Degree at Missouri University of Science and Technology, Rolla. At Missouri University of Science and Technology, she worked as a Graduate Research Assistant from August 2009 to December 2010 in the Department of Business and Information Technology. She spent most of her time on finding the structure of the video blogging community and helping her peers on other projects.

She received her MS in Information Science and Technology in May 2011.