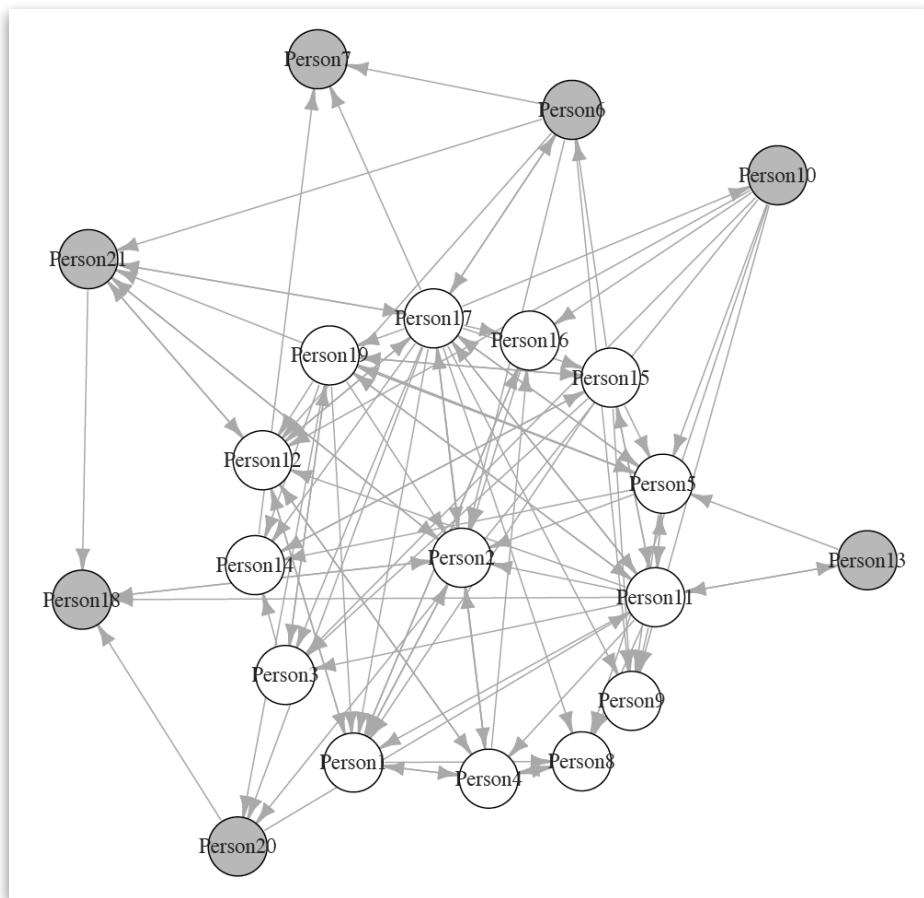


Lab Portfolio Examples

These student portfolios were submitted for CMS 350C: Clouds, Crowds, and Community. They are compiled here with the permission of the authors for educational purposes only. **Do not circulate or share this document without the permission of Dr. Joshua Barbour (barbourjosh@utexas.edu).** The original authors retain copyright and all other rights.

Though none of them are perfect, each portfolio has something to recommend it. Rather than modeling your portfolio on these, take inspiration from them to make your own portfolio as strong as it can be. Questions? Contact Dr. Barbour at barbourjosh@utexas.edu.

How Data Scientists and Network Analysis Could Help AlertMedia Innovate and Grow



A Proposal by

Dear AlertMedia,

My name is J H , I am a recent graduate of a network analytics course and am looking to expand my knowledge of social networks to help local companies innovate and grow. Through the experience and tools that I have come to develop, I hope to provide opportunities for insight into network structure and data analysis, that can be useful for strengthening formal structures within companies and improving the services they offer to clients.

I came across your company when doing research about local start-ups that have been successful in the last few years. I noticed that as a company that offers solutions for communication management, and the sending of messages to large numbers of individuals, network analytics could be beneficial in finding new insights about your products, and the networks they operate within. More specifically, by looking at your client's formal and informal network structures, there is critical data that can allow your services to adapt to the specific needs of each company, and the unique requirements that different types of messages demand. This is an important step in allowing your products and services to continue to grow and stay competitive in an emerging market.

Below I have compiled a portfolio of my work in network and data analysis. I have highlighted three important insights that can be found through the use of network analysis, some of the general reasons why these are important to know, and how these insights can be applied to AlertMedia. The first section deals with how identifying individuals within a network that hold significant informal power (i.e. they have a large amount of influence among actors), can help to target important messages to these individuals first. While AlertMedia focuses on sending communication across different platforms to all members of a corporation, identifying those that have a powerful social influence and ensuring that these individuals have received important messages, can help verify that these messages will be diffused within a network and accepted among actors. In the event of an emergency, while the goal is to extend communication to all individuals, sometimes messages can be lost among stress and chaos. By identifying those individuals that people go to for help or advice, and focusing your efforts on ensuring that they have successfully received important communication, can allow them to act as a human backup for the destination of messages when others do not have access to technology or have been prevented from seeing notifications.

The second section of my portfolio, shows how network analysis can help to determine the most efficient modes of communication for each individual within a network. If you consider all the different platforms of communication that AlertMedia utilizes (i.e. email, text messages, application push notifications, automated calls, etc.) as nodes within networks that allow for pathways to other actors, you can identify which pathways are the most effective in allowing information to flow to each individual. This information can be used to target specific platforms for each individual, based on that individual's strength of relation to each platform, to ensure that messages are received in the fastest and most likely way. This section also shows how network analysis can help to determine structural holes within a network, and identify modes of communication that would allow for messages to be received more often. It also illustrates how network analysis can be used to track the extent to which new features actually improve or strengthen communication networks over time.

I believe that network and data analysis can be very beneficial to AlertMedia as you continue to grow and develop. I would be very grateful for the opportunity to meet with you in person and learn more about your company, the logistics of your products and services, and to discuss in more detail how I can help to inspire innovation and development through the use of network analysis.

Sincerely,
J H

Network Analysis Portfolio

J H

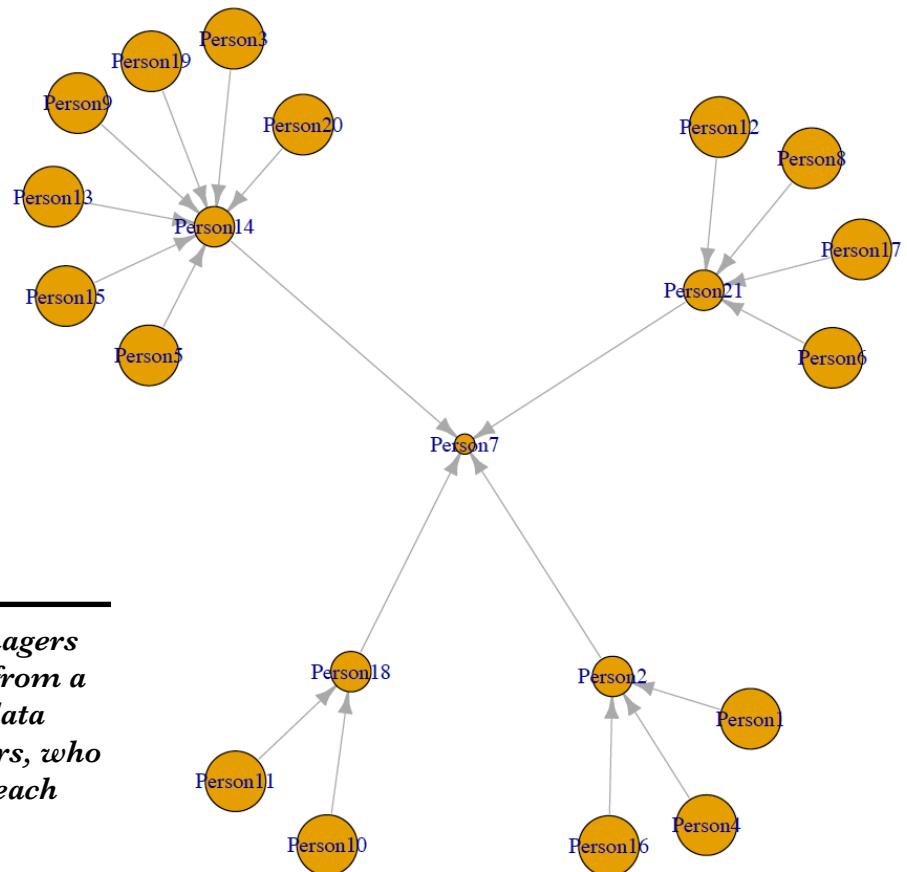
What follows is a comprehensive portfolio of my network and data analysis work to date. With the experience and tools that I have at my disposal, the following three insights involving network structure, connectivity, and centrality/centralization can be applied to the model of AlertMedia, and help inspire innovation and growth.

1. Through an analysis of social and personal networks of AlertMedia's clients, I can help to identify important brokers of information flow and individuals that hold great informal communication power within networks.
2. Through formal network analysis of your clients, I can help to determine the most efficient mode of communication for each actor within a network.
3. Through structural analysis of the communication networks between AlertMedia and your client's, I can help to determine structural holes and new pathways (or ties) that can improve the overall connectedness of your networks and increase the flow of information. I can also determine the degree to which new features offered to your clients actually improve or help communication to and between actors (nodes) overtime.

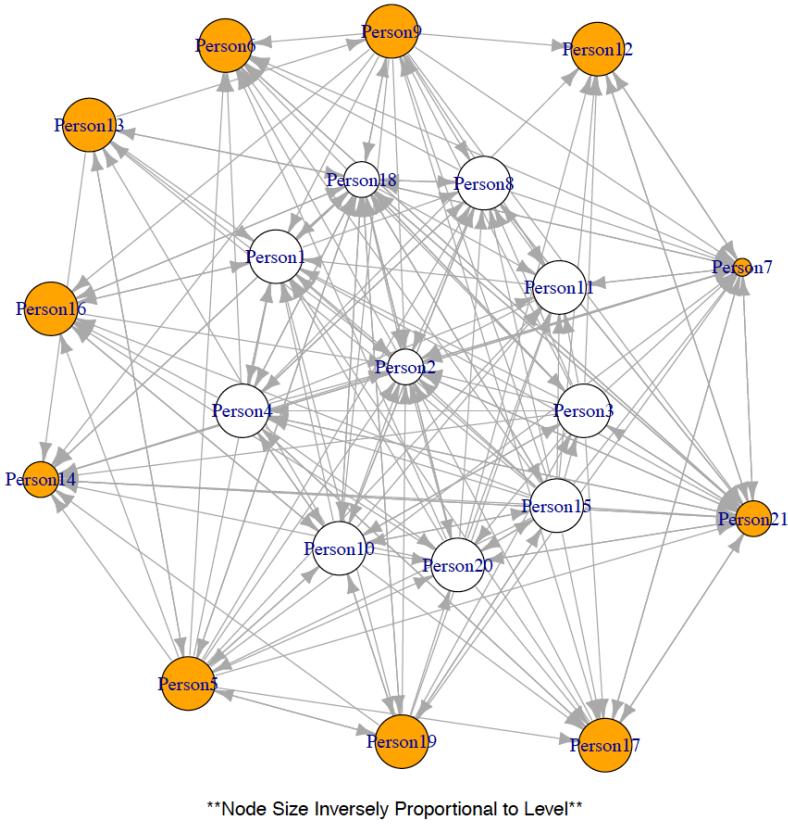
Informal Network Power

When analyzing networks (particularly within corporations), it is important to look for distinctions between formal and informal structures. The following example of network analysis did just this, and was able to identify important actors within this network, that held significant informal power. This can be vital when needing to get important information to all members of an organization, either during an emergency or when implementing new changes. Identifying and targeting the individuals that have important influence over other actors can allow for important information to travel quicker and be accepted faster.

"I analyzed the Krackhardt High-Tech Managers classic dataset that looked at 21 managers from a high tech company and collected network data based off of the formal structure of managers, who each manager went to for advice, and who each manager saw as their friend. I wanted to understand which managers held the most informal power within the company, which is useful information when implementing changes throughout the company or introducing new information that effects the company as a whole."



Node Size Inversely Proportional to Level



By looking at informal network information, such as the individuals that each node considers to be their friend, and the nodes that individuals trust as sources of advice, we can begin to understand how the network works informally. In this example, Person 2 was identified as having a vital role in the network with great potential for influence over other actors. This can be very useful when wanting to introduce messages and information within a specific group in a network. The white nodes represent a clique, which is a grouping of highly connected individuals, in which each actor is connected to every other actor. Person 2 would therefore be a good node to target to influence this group of actors.

However, an important part of network analysis goes beyond creating sociograms (visualizations) to help easily envision certain aspects of the network. These sociograms are actually based off of many measures of network properties. These measures are where the heart of network analytics takes place. The table below highlights some important measures that I calculated to help analyze this network and create the above sociograms. Several important numbers have been highlighted and called out as significant to understanding the social structure of this network.

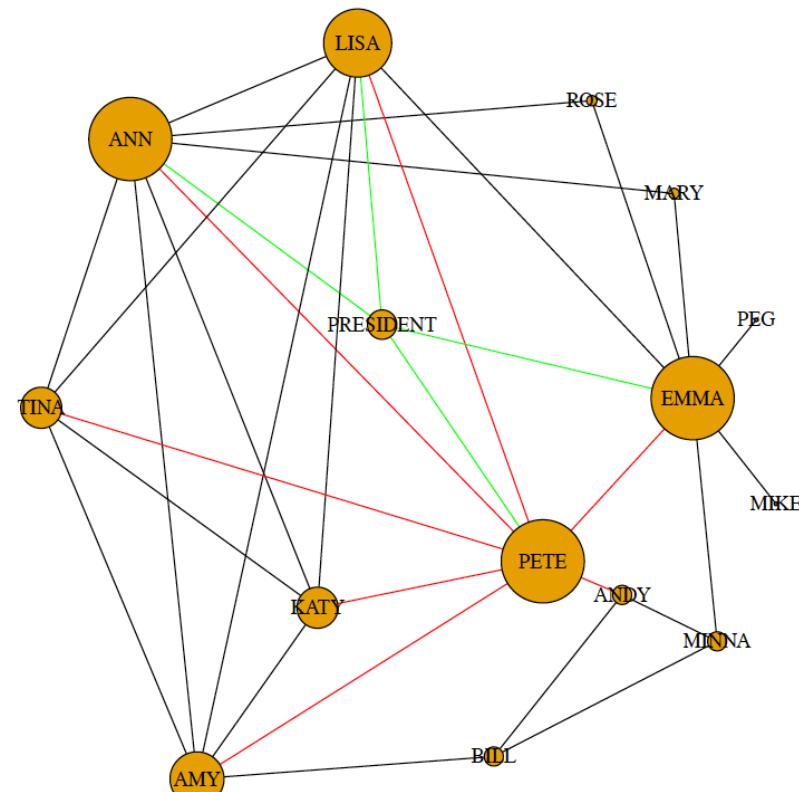
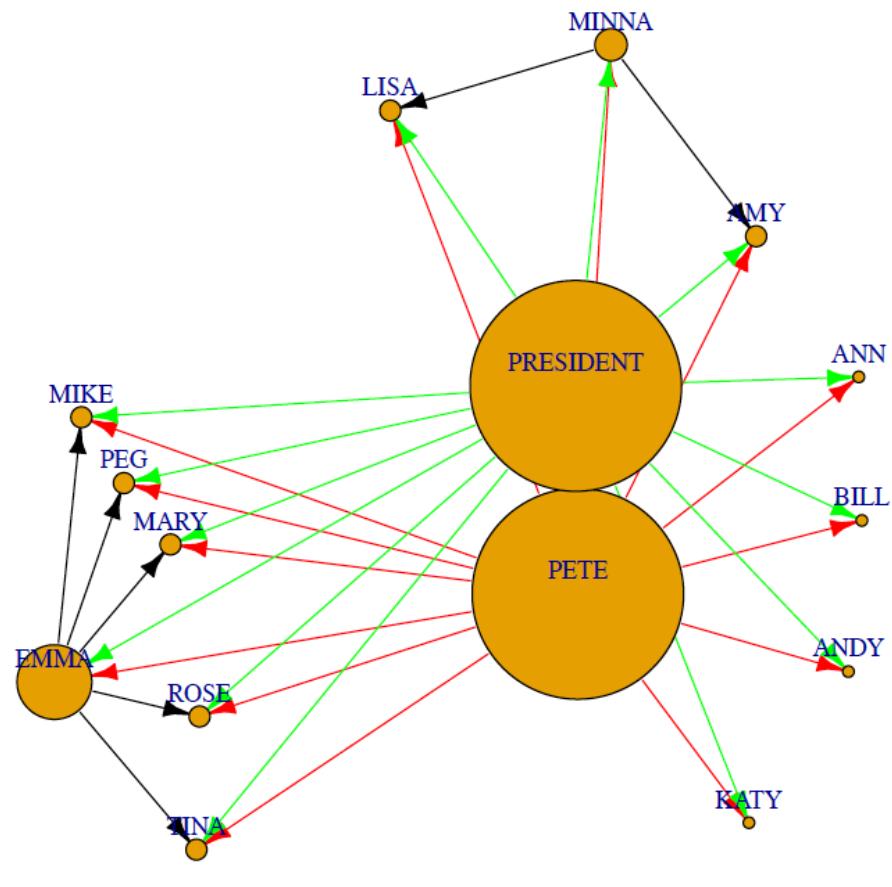
	Degree In Advice	Degree Out Advice	Degree All Advice	Degree In Friend	Degree Out Friend	Degree All Friend	Density Advice	Density Friend	Clustering Global Advice	Clustering Global Friend	QAP Test Results
Person1	13	6	19	8	5	13	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person2	18	3	21	10	3	13	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person3	5	15	20	5	2	7	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person4	8	12	20	5	6	11	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person5	5	15	20	6	7	13	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person6	10	1	11	2	6	8	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person7	13	8	21	3	0	3	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person8	10	8	18	5	1	6	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person9	4	13	17	6	0	6	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person10	9	14	23	1	7	8	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person11	11	3	14	6	13	19	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person12	7	2	9	8	4	12	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person13	4	6	10	1	2	3	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person14	10	4	14	5	2	7	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person15	4	20	24	4	8	12	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person16	8	4	12	4	2	6	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person17	9	5	14	6	18	24	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person18	15	17	32	4	1	5	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person19	4	11	15	5	9	14	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person20	8	12	20	3	2	5	0.452380952	0.242857143	0.734508816	0.471494607	0.15
Person21	15	11	26	5	4	9	0.452380952	0.242857143	0.734508816	0.471494607	0.15



Here is another example of using network analysis to determine the differences in formal and informal power within a specific network. The visual to the right also incorporates specific aspects of measures of centrality right into the sociogram, allowing for deeper visual analysis. Degree is a measure of how many connections a specific actor has. Because this network is a directed network (directed networks are those in which connections extend from one node are directed towards another. Arrows show connections from the origin of the connection to the node it is directed towards- double arrows mean the connection is reciprocated), degree is calculated for both the amount of connections extending from and going into each node. The node size in this case is based on Degree total for each actor.

"I analyzed the Thurman Office classic data set, in which two sets of data were collected from observations of interactions among employees in the overseas office of a large international corporation for sixteen months. The first dataset recorded the formal association structure within the corporation, and the second dataset recorded the informal associations among the employees. While the President holds the formal power among the individuals in the network he does not hold nearly as much actual power when placed into the informal network associations. You can see between the two visuals, that the actual degree and power of the President is significantly smaller than most of the other nodes. The second visualization makes it clear that there are three major actors within the network: Emma, Ann, and Pete."

For this network, many calculations were done as well to help explain what was happening between the formal and informal network. The table below highlights some of these calculations, emphasizing the power and dependency of the actors within the two networks. Here, once again, there is an important distinction between the formal and informal structures which have significant implications for communications within the network.



	Degree Total	Degree In	Degree Out	Dependency	Power	Closeness
Node	degall2	degin2	degout2	bdepend2	bpower2	cl12
ANN	8	8	8	-0.632902208	0.439664445	0.043478261
AMY	6	6	6	2.378839334	-0.857806855	0.041666667
KATY	5	5	5	0.501956924	-0.15065425	0.038461538
BILL	3	3	3	-1.069386489	-2.237266862	0.033333333
PETE	8	8	8	0.283714783	-0.48885767	0.05
TINA	5	5	5	0.501956924	-0.15065425	0.038461538
ANDY	3	3	3	1.025738061	-2.114283801	0.034482759
LISA	7	7	7	0.501956924	0.17730058	0.047619048
PRESIDENT	4	4	4	1.462222343	0.447863316	0.04
MINNA	3	3	3	1.156683346	-1.849870218	0.035714286
MARY	2	2	2	1.047562275	0.487832811	0.035714286
EMMA	8	8	8	0.152769498	0.304383077	0.05
ROSE	2	2	2	1.047562275	0.487832811	0.035714286
MIKE	1	1	1	0.327363211	0.210096064	0.03030303
PEG	1	1	1	0.327363211	0.210096064	0.03030303

Table 1.2 - Measures of Centrality for Informal Network Associations

Efficient Communication, Network Structure, and Effectiveness of

When Analyzing large networks with many nodes and connections between them, it may also be useful to know which pathways allow for the most efficient communication and flow of information. A frequent problem with sociograms in network analytics is something called the “hairball” effect, where so many nodes and connections are present, that it makes it hard to make determinations based solely on visualizations. This is directly related to network size, as network size increase visuals carry less utility in and of themselves.

“For this lab, I analyzed the Freeman’s EIES (Electronic Information Exchange System) data set, that looked at a network of fifty individuals interested in interdisciplinary research, and the effect of computer mediated communication over time (at time one and time two). I looked at five measures of network centrality and centralization for both time one and time two: Density, Clustering Coefficient (local), Clustering Coefficient (global), Mean Distance, and Constraint.

Computer mediated communication not only led to more connections in the broader interdepartmental network, but also lead to a more connected network of nodes within the academic discipline of Sociology itself.

Figure 1.2– EIES Data – Time 1

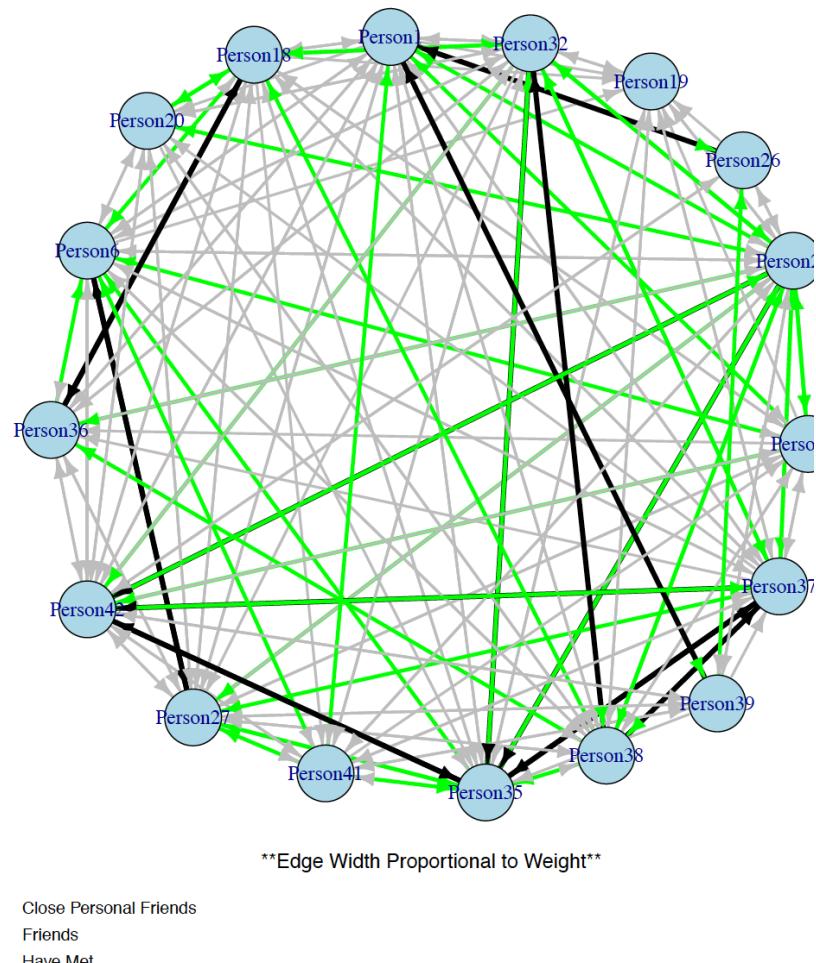
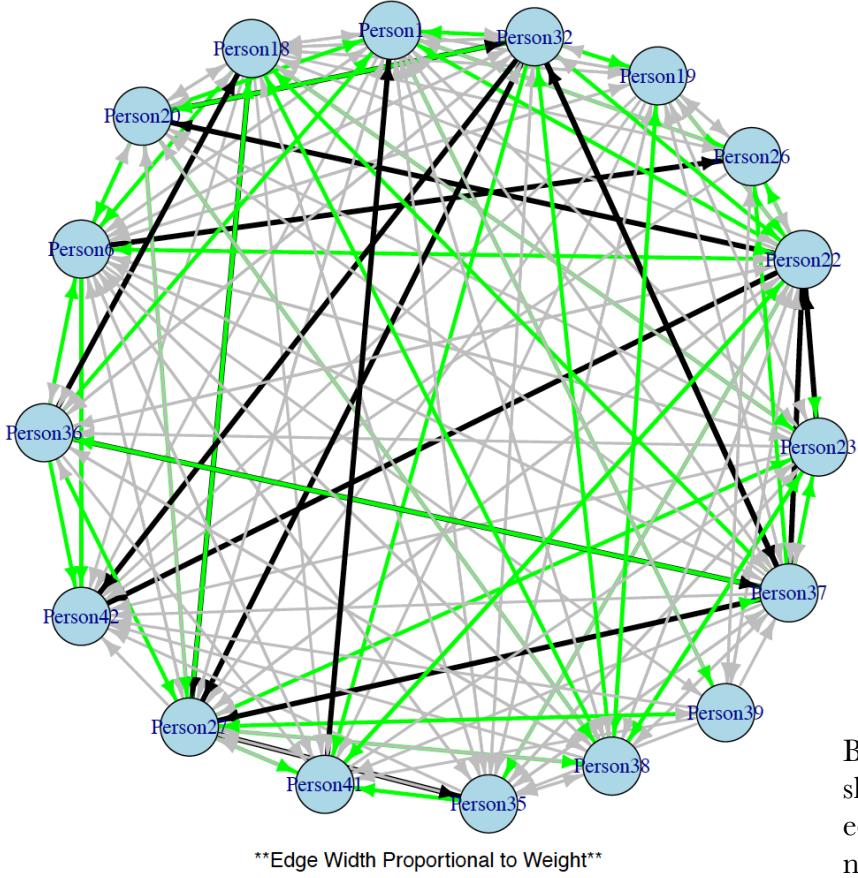


Figure 1.3– EIES Data – Time 2



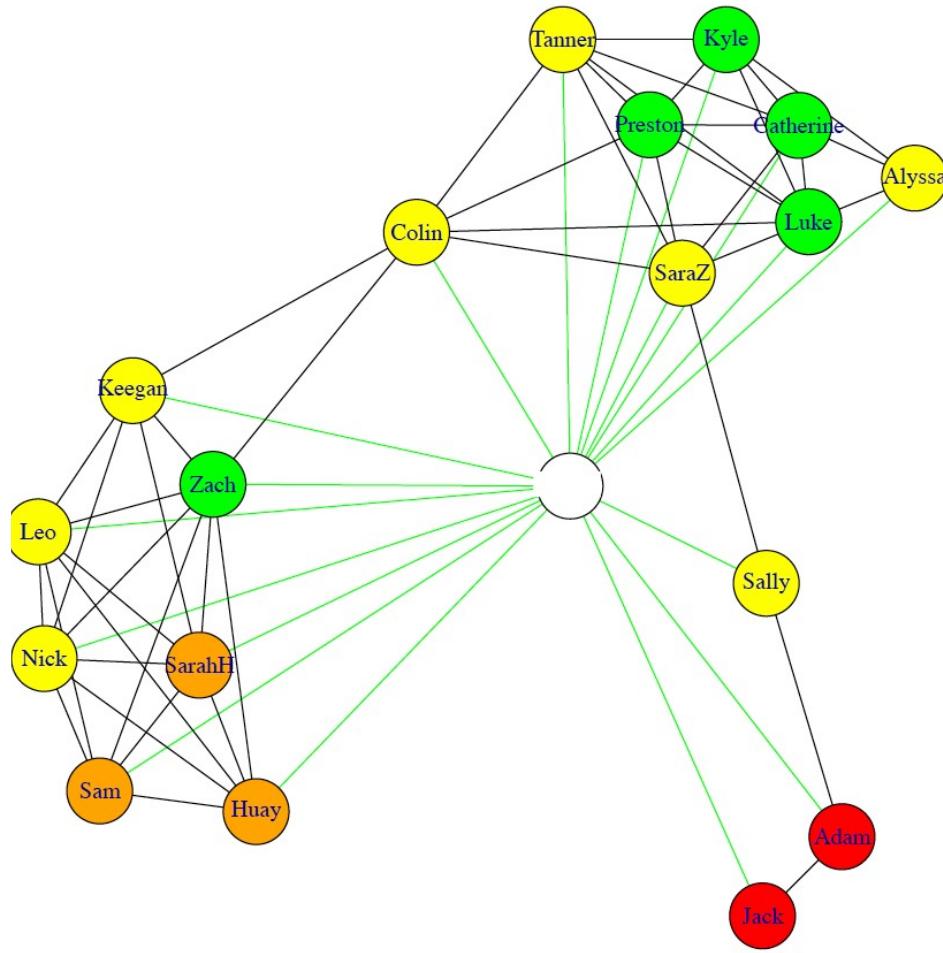
- Close Personal Friends
- Friends
- Have Met

Node	Density - Time 1	Density Time - 2	Clustering (local) - Time 1	Clustering (local) - Time 2	Clustering (global) - Time 1
Person1	0.694852941	0.768382353	0.197701149	0.195564516	0.806913997
Person6	0.694852941	0.768382353	0.216524217	0.222988506	0.806913997
Person18	0.694852941	0.768382353	0.231884058	0.253561254	0.806913997
Person19	0.694852941	0.768382353	0.333333333	0.253623188	0.806913997
Person20	0.694852941	0.768382353	0.316176471	0.323529412	0.806913997
Person22	0.694852941	0.768382353	0.170114943	0.208602151	0.806913997
Person23	0.694852941	0.768382353	0.274853801	0.280632411	0.806913997
Person26	0.694852941	0.768382353	0.222222222	0.333333333	0.806913997
Person27	0.694852941	0.768382353	0.210826211	0.221674877	0.806913997
Person32	0.694852941	0.768382353	0.22	0.218461538	0.806913997
Person35	0.694852941	0.768382353	0.231884058	0.236666667	0.806913997
Person36	0.694852941	0.768382353	0.274509804	0.278947368	0.806913997
Person37	0.694852941	0.768382353	0.233618234	0.238916256	0.806913997
Person38	0.694852941	0.768382353	0.206521739	0.24	0.806913997
Person39	0.694852941	0.768382353	0.263736264	0.314285714	0.806913997
Person41	0.694852941	0.768382353	0.252631579	0.303030303	0.806913997
Person42	0.694852941	0.768382353	0.177248677	0.222988506	0.806913997
Node	Clustering (global) - Time 2	Mean Distance - Time 1	Mean Distance - Time 2	Constraint - Time 1	Constraint - Time 2
Person1	0.863384189	1.305147059	1.231617647	0.233956234	0.230724836
Person6	0.863384189	1.305147059	1.231617647	0.259338255	0.245872756
Person18	0.863384189	1.305147059	1.231617647	0.254151613	0.251838
Person19	0.863384189	1.305147059	1.231617647	0.280573214	0.257190689
Person20	0.863384189	1.305147059	1.231617647	0.28434162	0.27278015
Person22	0.863384189	1.305147059	1.231617647	0.233008635	0.238104673
Person23	0.863384189	1.305147059	1.231617647	0.262673193	0.261827901
Person26	0.863384189	1.305147059	1.231617647	0.376981285	0.302188655
Person27	0.863384189	1.305147059	1.231617647	0.257072078	0.250172557
Person32	0.863384189	1.305147059	1.231617647	0.263634711	0.257689179
Person35	0.863384189	1.305147059	1.231617647	0.261044828	0.258545577
Person36	0.863384189	1.305147059	1.231617647	0.279097484	0.267066911
Person37	0.863384189	1.305147059	1.231617647	0.259417243	0.251181192
Person38	0.863384189	1.305147059	1.231617647	0.262806571	0.262404883
Person39	0.863384189	1.305147059	1.231617647	0.321167041	0.293732516
Person41	0.863384189	1.305147059	1.231617647	0.274676729	0.26379425
Person42	0.863384189	1.305147059	1.231617647	0.244855957	0.243664531

The overall density of the network increased by almost eleven percent after the introduction of computer mediated communication, resulting in 20 more directed connections across seventeen nodes. The tendency towards closure across the network also increased by almost 7 percent, meaning the probability of two adjacent vertices of a specific node being connected increased across the network. And while the percent to which the nodes became less constrained within the network varied, all seventeen nodes saw a decrease in their constraint, making structural holes more advantageous to all nodes.”

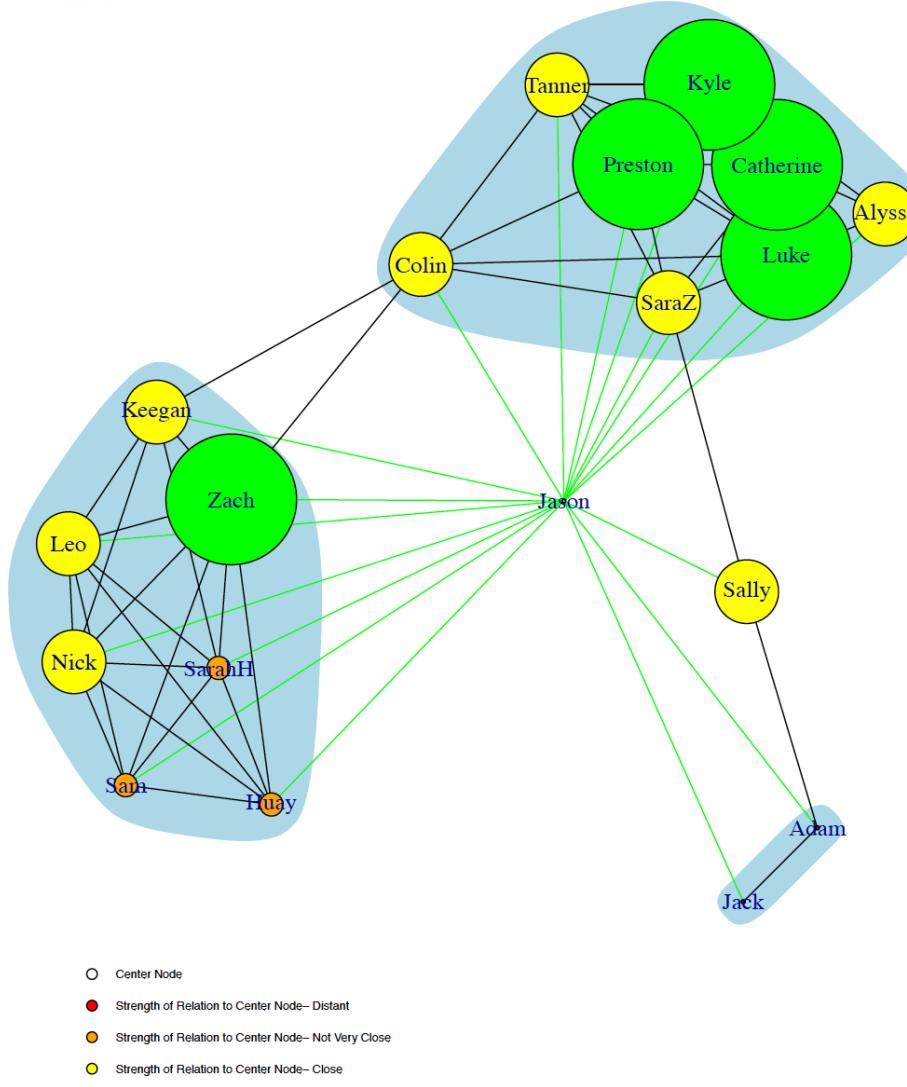
By looking at measures of geodesic distance (the shortest path connecting two nodes) and eccentricity (the largest geodesic distance for each node) as well as network diameter, an idea of the scope and size of the network can be determined.

This can be useful information when trying to find the most efficient path for information to flow. Maximum flow is another great measure that determines the number of nodes in the neighborhood of a source that lead to pathways to a target. The larger the maximum flow, the more likely communication will occur successfully and the connections between nodes are considered to be less vulnerable (Hanneman & Riddle, 2005, ch. 7, p. 19). Again calculations were made to assist in the network analysis and can be seen in the table to the left.



- Center Node
- Strength of Relation to Center Node - Distant
- Strength of Relation to Center Node - Not Very Close
- Strength of Relation to Center Node - Close
- Strength of Relation to Center Node - Very Close

"The following visualizations were based off of personalized network data in which I attempted to map out my most frequent connections in several different spheres of my life (Academic Matters, Job Acquisition, Friends, and Professional Development). The second visualization highlights the three distinct groupings of nodes, where the top right grouping is composed mainly of Friends, the left grouping mainly of Professional Development, and the bottom grouping mainly Job Acquisition. There are two nodes that bridge the gaps between these three groups ("Colin", and "Sally"), and these nodes blend the line between professional connections and friends within my personal life."



The overall structure of a network is also important when determining the best practices of communication between actors. Sometimes networks consist of multiple components that are separate from one another, and sometimes they consist of pretty distinct and separate groupings of nodes. Analyzing the ways in which these components (which are not connected inherently) and groups are or are not connected is an important part of network analysis. In the network to the left, there are three distinct groupings of nodes. It has been made clear that there are three nodes that have important roles as brokers of communication between groups and thus have significant power within the network. Identifying grouping such as those visible in the network to the left and the one below, can be useful in understanding the constraint and power of actors within a network and also allows for the identification of structural holes that may be harmful to the network overall. By identifying these holes, it is then possible to look for ways to make group

To view my portfolio, please follow the link below. By clicking on the visualization images, you will be able to explore my previous work.

Corey Baker and the Long Center for the Performing Arts,

My name is A M and I am a network analyst with experience in organizational networks. After speaking to many employees at your organization and looking at the recent high turnover numbers, I hope to assist you all in creating a more encouraging and efficient network of employees. I plan to collect data on your informal networks and identify which common configuration your company most closely resembles.

I recently spoke with many current and former employees of the Long Center to determine the most pressing issues your organization is facing. According to my sources, you've had very high turnover in the last year and a half due to poor management and communication. My anonymous sources tell me that there was a lack of communication between departments and an unwillingness to move projects forward within departments. Your marketing department, specifically, has had a difficult time cooperating with one another, possibly due to low trust connections. This appears to fit in with one of the five most common network configurations - irregular communication patterns. It also seems that large projects, like the Greater Austin High School Musical Theatre Awards, require the help of multiple departments, but the departments have a hard time working together to complete goals, which fits with the fragile structures configuration.

If you look through my portfolio website, you will be able to look at the various projects I have worked on to get an idea of what kind of work I can do for you. In the first project that appears on the website, "Visualizing My Personal Network Data", I demonstrated my ability to find which people/nodes are most influential and look for patterns and possible beneficial connections, which I would use when I first collect information on your company's formal and informal networks. In my second project, I looked at ties between Florentine families and determined which families held the most power, particularly in regards to how messages were spread. In the project "Making Sense of Global and Local Network Properties", I used my knowledge of transitivity and density to demonstrate how some ties are more likely to form than others. Lastly, and most relevant to your company's problems, is the "Organizational Analysis" project. Here, I looked at the different kinds of informal networks and how they affect the flow of communication. The informal networks include **advice networks**, in which members are relied on for problem solving and technical information, **communication**, where members talk

about work-related topics regularly and **trust networks**, which includes members who will back each other in crisis and share important political information (Krackhardt & Hanson, *Informal Networks*). It would be beneficial to look at your company's informal networks when spreading different messages, as it appears that there is lack of communication between employees and lack between employees and management.

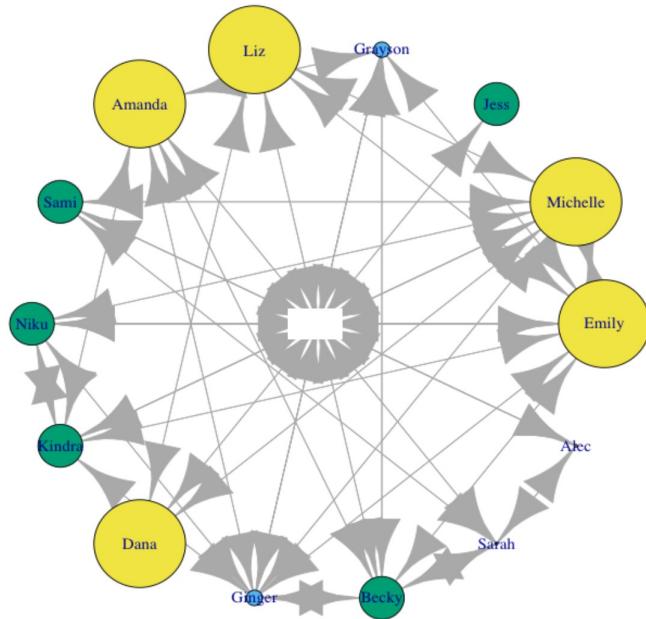
In addition to identifying your informal networks, I believe it is vital to recognize your organization's configuration. As I mentioned previously, your company appears to fit the "irregular communication patterns" and "fragile structures" configuration. Other configurations include 1) imploded relationships, where members only communicate within their own department; 2) hole in the network, which occurs when you expect to find a connection between people, but it's missing; and 3) bow-ties, where multiple members are relying on one person to get their messages across (Krackhardt & Hanson, *Informal Networks*). To fix the irregular communication patterns that are occurring, it may be beneficial to organize sporting events, bringing together the members of your departments. When dealing with the fragile structures, you may organize a cocktail party where members can mingle and cultivate stronger personal relationships.

I would love to meet with you all to discuss what kind of changes could benefit your organization and to learn even more about the way in which the Long Center operates. I look forward to hearing back from you, so together we can create a stronger work culture that produces more effective results.

Best,
A M

AI M

Welcome to my portfolio. I invite you to explore my site to get a better understanding of my specialties, technique and professional experience in network analysis. My previous work will help me in future endeavors when organizing team projects and electing team leaders, identifying how messages are spread throughout your network and how to communicate them more efficiently, and to differentiate which kind of networks (advice, trust, communication) are best to look at for various situations.

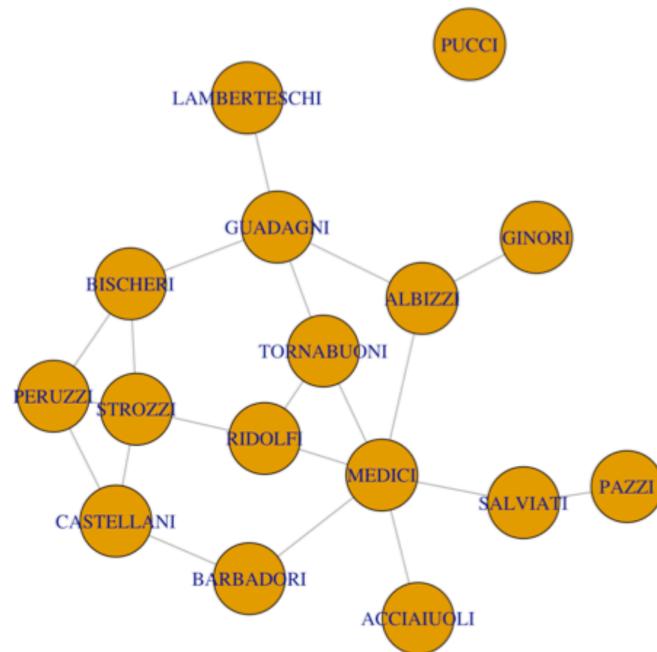


Visualizing My Personal Network Data

In this project, I analyzed the patterns within my personal network of close connections and identified which people would benefit from a connection. I was also able to look at how the density of my network affected communication and which nodes were the most influential.



"Dana is in one of the best places to get her message to flow to someone else because while she only has three connections, those three people are heavily connected to others in the network. As I look through my connections, it would seem advantageous to introduce Sarah and Ginger, since they have a couple of connections in common. Though it's not presented in the data, both Sarah and Ginger work in the same field and could actually benefit from having that connection".

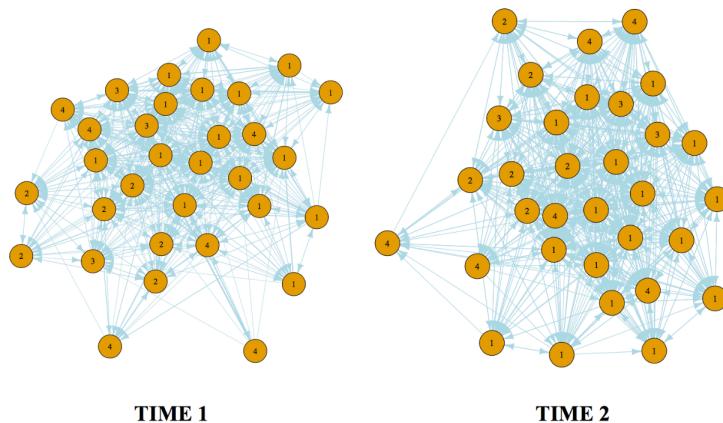


Researching, Quantifying, Describing, and Visualizing Network Data

For this project, I analyzed a data set dealing with the marital and business connections between Florentine families. I was able to identify the strongest or most influential families and describe how the messages would flow through the network.



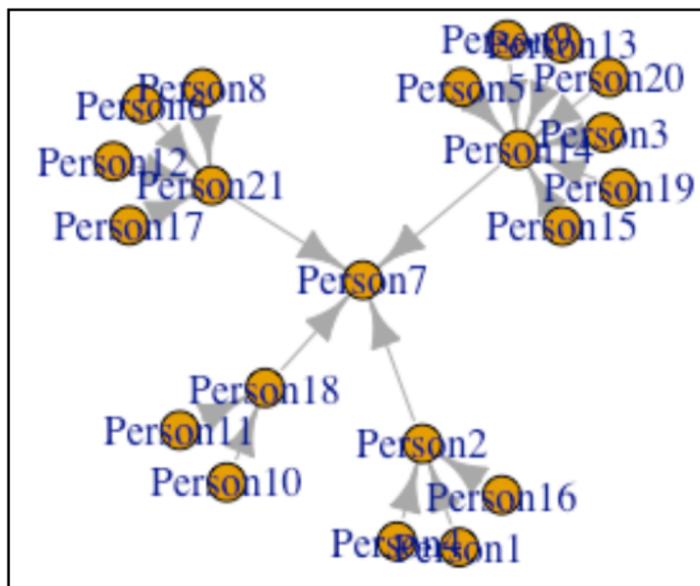
"When we visualized the data by wealth, we were able to see that two of the families had significantly larger nodes: the Medici family and the Strozzi family. It is interesting to see that those two families that hold most of the wealth are also two of the most connected and most powerful families, aside from the Guadagni family who are also highly connected, but do not have the level of wealth that the other two families have".



Making Sense of Global and Local Network Properties

When looking at the Freeman data set, I was able to compute and describe features of the network such as transitivity and density. I also found that in such dense and complicated networks such as this one, network visualizations are often hard to decipher and may benefit from using other kinds of visuals.

"As you can see in the visualizations, there was a lot of overlap in relationships causing a web-like visual that is hard to read. You can still see that the relationships have grown stronger as there are fewer "1" labels in the second recording of the data. These new and stronger relationships could be predicted from the original data as transitivity was measured at .842. By the second recording of data, transitivity was .901. The probability that the nodes know each other and relationships will strengthen increases in the second record because time has passed and more nodes are



Visual of who reports to who by department

Organizational Analysis

This high-tec company was analyzed to determine how different kinds of relationships effect communication flow and how those relationships differ.

"Those at the same level were more likely to give advice to one another than they were to be friends as shown by level 2's clustering coefficient for advice (.325) compared with their clustering coefficient for friendship (.208). The same is shown with level 3's clustering coefficient: .546 for advice and only .363 for friendship".

A F
Crowds, Clouds, and Community
Data Analysis Portfolio

A () F

1915 Robbins Pl • Austin, TX 78705 • (832) 677-3682 • abrahamfa96@gmail.com

December 15th, 2017

Workers Defense Project
5604 Manor Rd
Austin, TX 78723

To the Director of Recruitment at the Workers Defense Project,

My name is Abraham Flores and I am currently a senior at The University of Texas at Austin double-majoring in government and political communication. This letter serves as an application to the Data Analyst position in the organizing department of the Workers Defense Project. As someone looking to lend a hand in the labor movement unfolding right here, in Austin, Texas, my career objective lies in using my skillset to catalyze and facilitate organizing initiatives that Workers Defense is planning to pursue.

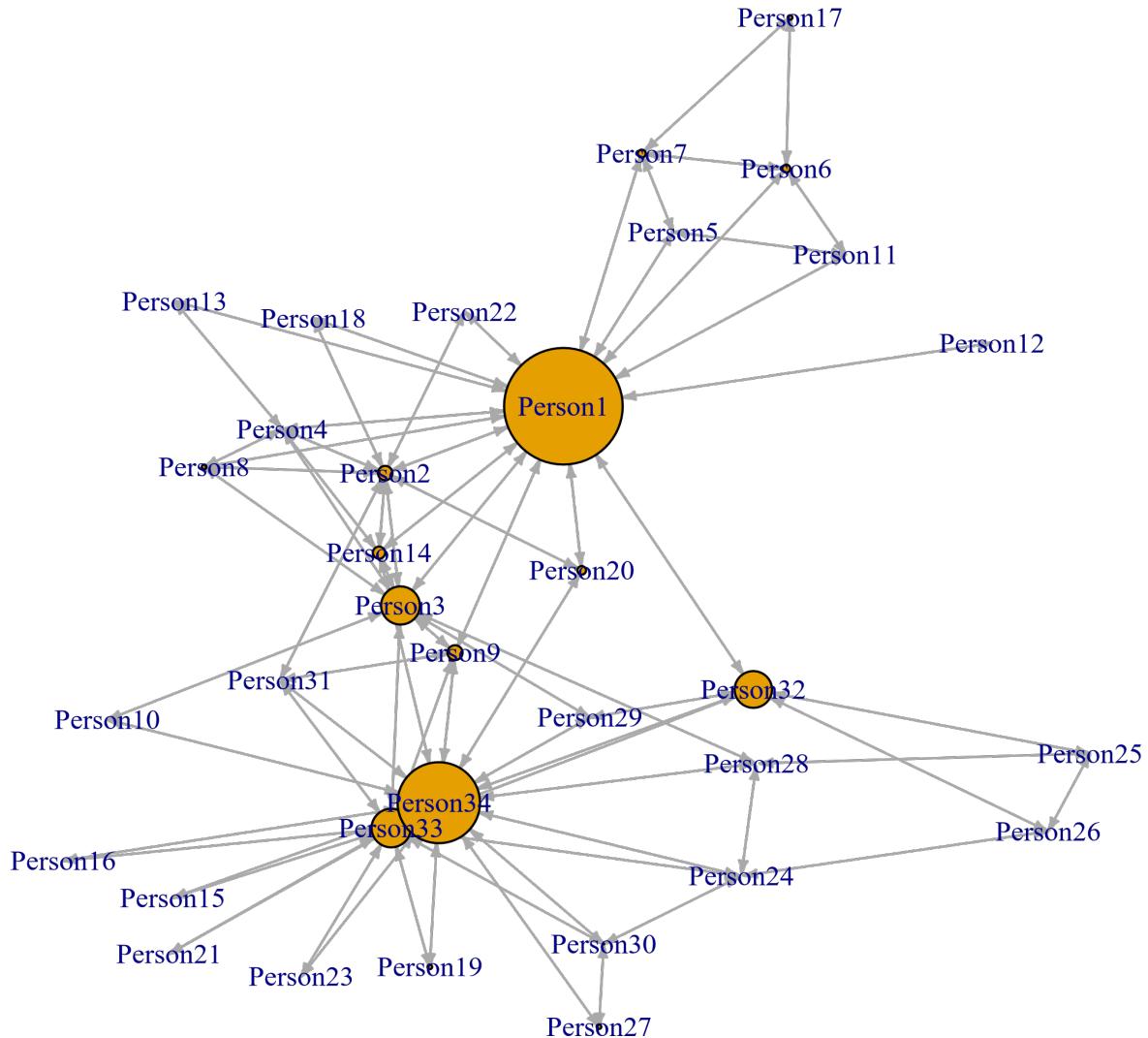
As you are well aware, there is currently an immense dearth of labor activists and organizers in Texas. Seeing as we live in a right-to-work state which has the weakest unions it has ever had and does very little to educate younger generations on organized labor, the time has come to rethink the way we organize in the great state of Texas. Though we generally need a higher number of advocates in this industry, we can do our part within advocacy groups like Workers Defense to maximize our resources and utilize our actors most efficiently. Put a different way, it is always better to have a tight-knit team which works “smarter” as opposed to having a large team which lacks the organization necessary to be legitimately effective.

The majority of organizing and advocacy is learning who the key players are and how to best reach them. As an organizer with a background in data analysis, I can aid in advancing the Workers Defense Project’s advocacy initiatives by generating visuals and values that grant the organization a more complete picture of which nodes have more power than others, which nodes are experts through analyzing informal networks, and which nodes interact most closely by analyzing subgraphs of larger networks.

Below is my portfolio showcasing all three of these techniques.

Power as a tool of prediction.

Earlier this year, I worked on a dataset consisting of members of a Karate Club that ended up splitting apart. By homing in on which nodes had more power in the organization, we were able to make sense of the factions and alliances that developed after the split. To be clear, this sociogram simply demonstrates who communicates with whom, but the nodes are depicted as larger the more power they have.

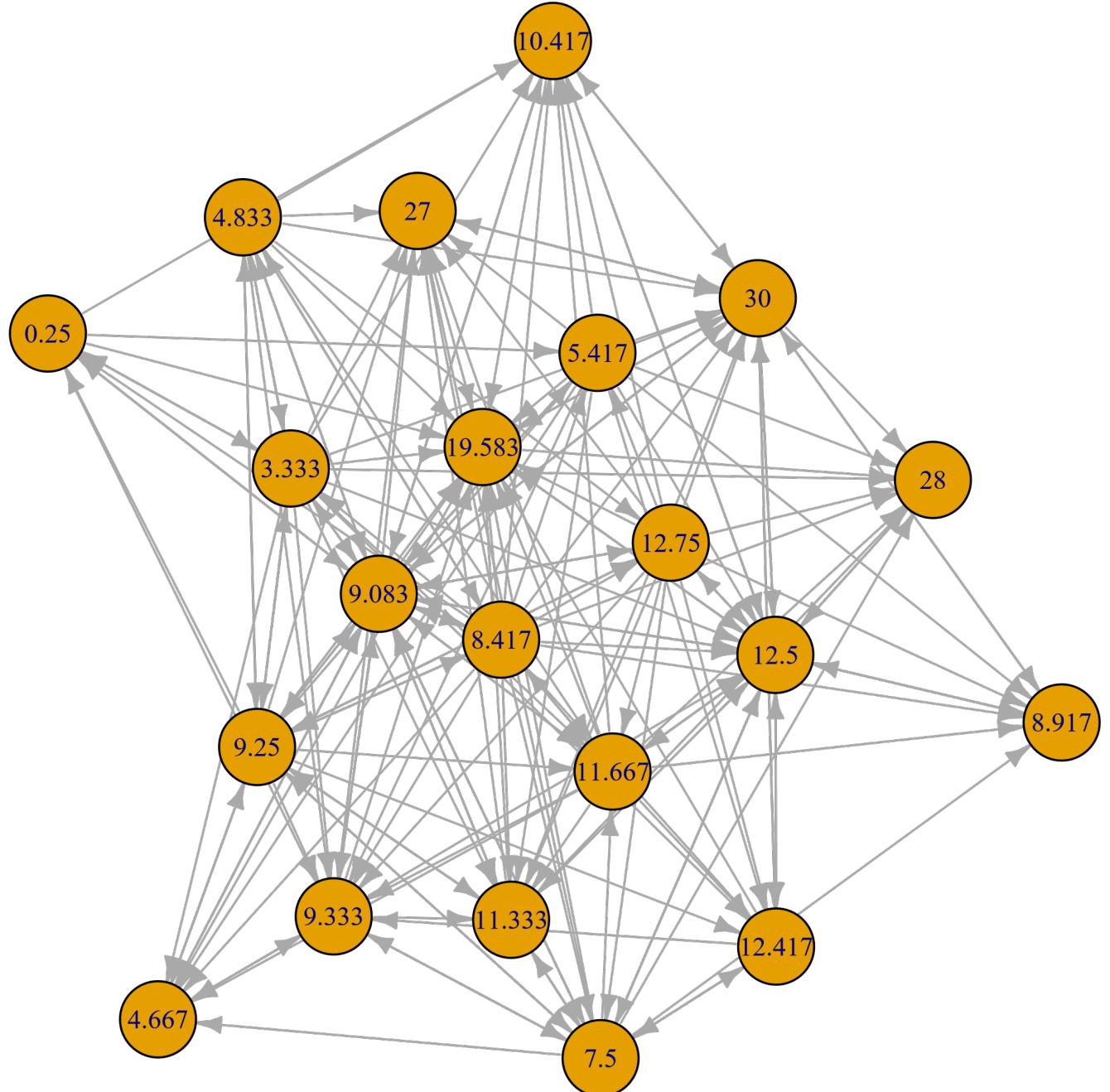


The more ties a node has, the higher their betweenness is, the more central they are, the more power and influence they consequently hold. This visual follows these themes as the influential characters (Persons 1, 32, 3, 32, and 33) are the very ones who hold most ties, highest centrality, highest betweenness, and highest eigenvector values. Having this data, therefore, gives us a very good indicator that, if a split did ever occur, the organization would likely be divided among followers of Person 1 and followers of Person 34, and that's exactly what happened.

Along those same lines, being able to pick out powerful nodes in Austin's labor advocacy network would give us an insight into potential divides and alliances that we could thus tailor our organizing efforts towards.

Informal networks as predictors of experts.

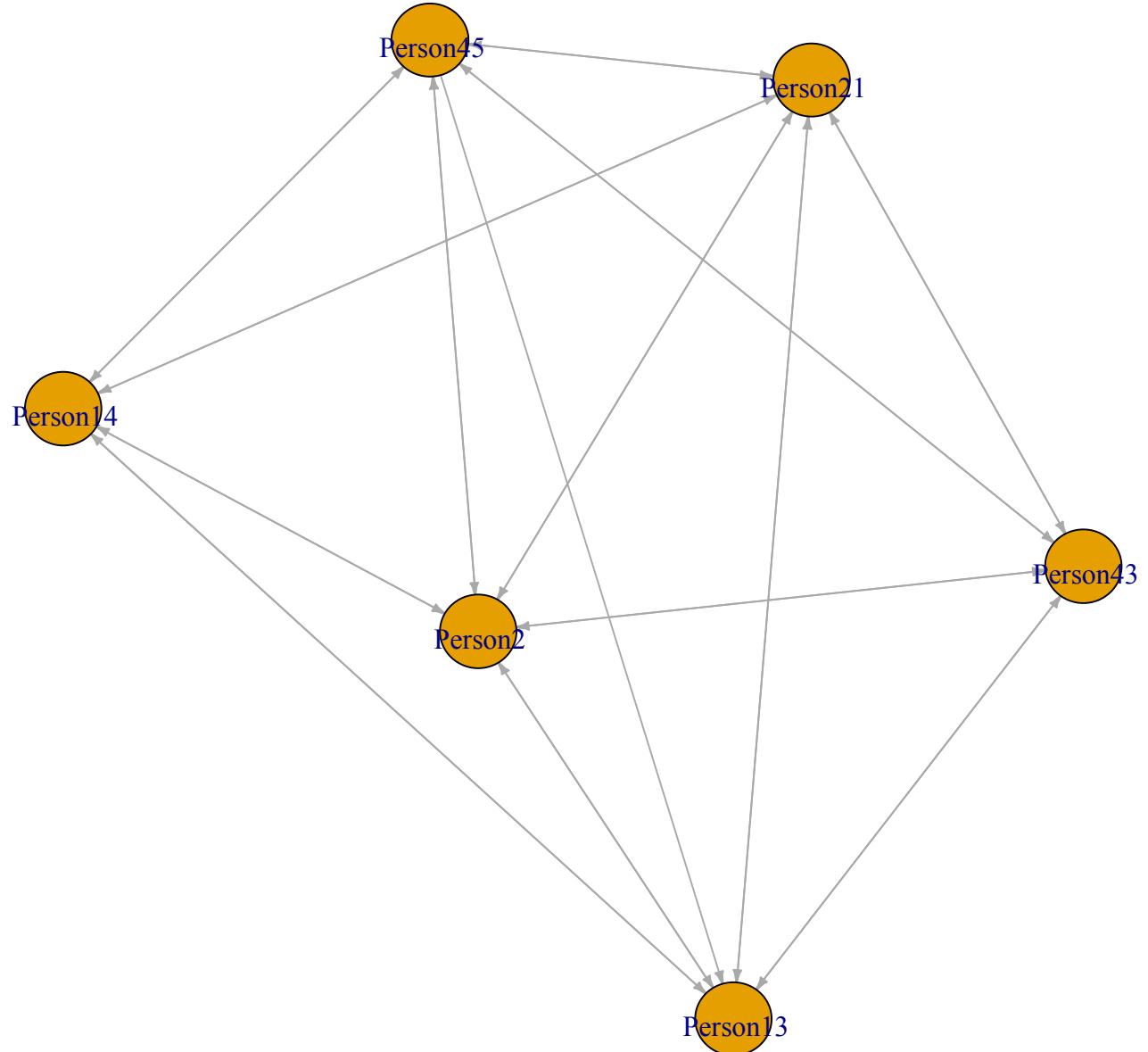
The next visual portrayed characterized by 21 managers and their communicative patterns. Each player was labeled according to their tenure in the company in question, and the edges linking them together represent who seeks whom out for advice.



Clearly, this sociogram picks out the experts of the company, like nodes tenured 9.083, 12.5, and 19.583, players who are sought out for advice very frequently. This informal network thus gives us a more accurate depiction of which nodes keep the company running. In the context of advocacy, being able to pick out labor experts is essential to the initiatives that Workers Defense takes on regularly.

Subgraphs as magnifying lenses.

The last visual consists of 6 anthropologists who were part of a larger network of 32 academics. By homing in on the network of specifically anthropologists, I was able to gauge how this essential part of the data interacted with one another.



This network, with a density of .9 and a transitivity of .923, is an effective subset of the overall network. If this were, say, the legal department of another labor-related advocacy group, like the Equal Justice Center, we could take comfort in the notion their lawyers communicate regularly and with ease. If the subgraph wasn't so tight-knit, we would be able to feasibly alleviate structural holes that would facilitate communication and consequently facilitate our advocacy.

As organizers, we anticipate. Locating nodes with power, picking out experts within networks, and zooming in on subsets within larger data are all tools that can help us anticipate, organize, and advocate.

If possible, I would love to schedule a meeting to discuss my portfolio, my experiences, and the Workers Defense Project's up and coming advocacy initiatives. Thank you so much for your time and consideration.

All the best,

To Whom It May Concern,

My name is M B . In addition to being a full time Communication Studies student at the University of Texas at Austin, I have worked with Hopdoddy Burger Bar for one year and five months as a server at the South Congress location. This past August I was also hired on as an intern for the corporate office. I do additional work as a data analyst and have been observing the networks that exist at the South Congress location and at the home office. I think that my experience with examining networks and the stories that they tell, or fail to tell, could be of great use to this unique, successful business as it moves forward and grows.

After working for Hopdoddy, I have been able to think critically about the company and understand it through different perspectives. Hopdoddy, for the most part, operates smoothly and successfully. The company relies on its strong ties within each individual restaurant location—particularly so at the South Congress location—as well as at the corporate office. Because the networks at both of these locations are not yet enormous, I think that it would be interesting to look at the formal network and then look at the informal networks for the South Congress location and the home office to see if there are any fragile structures or holes in those networks. Examining these networks could help management with understanding the relationships present throughout them as they grow and help to identify any culture that exists.

For an example of how I could visualize the formal network relationships at the South Congress location and at the corporate office, I included Visual 1 in my portfolio. I created this visual to describe and visualize the formal relationships for a network data set titled “Thurman office data.” By creating this visual, I was able to see what sorts of relationships were present based off of the formal relationship data. I also could see which actors had greater degrees of centrality in the formal network. Looking at a network’s formal relationships is incredibly important because it will tell you about the network’s skeleton. Understanding the network’s backbone will ensure that predictable problems that arise will be attended to properly by certain actors.

In addition to looking at the formal structures of the networks, I could also examine their informal network structures. Looking at both networks' informal structures will allow management to understand the company in a more well-rounded way and show where the "true relationships" existed outside of the formal structure. In Visual 2, I generated a visual that mapped an advice network of the managers of a high-tech company from the Krackhardt data. Through the visual, I was able to see which actors asked other actors for advice. In turn, this showed which actors were asked the most for advice in the network. If I were to conduct an advice map of the two networks at Hopdoddy that I am interested in, I would be able to highlight if those who gave the most advice were also central to the network's formal structure. If not, I would then be able to gather more attribute data on the actors in the network and try to make conclusions from there using both the formal and informal structures.

A final thing I would like to examine within the informal structures of Hopdoddy would be to map out the friendships in the network. In Visual 3, I created a visual that mapped out the friendships among the managers in the Krackhardt data. This revealed who was friends with who and showed me where mutual friendships existed and where they did not. I think that the looking at the informal structures of networks in these ways allows for management to understand who is trusting who and who is talking to who on a consistent basis. These insights could help the company to progress more efficiently, especially when there is a need to spread information throughout it or implement a new kind of training.

In conclusion, I would really look forward to meeting so that we could discuss the different networks within Hopdoddy and visualize them. Hopefully by employing the analytics techniques that I have learned, we can come to understand this company in ways that help to tell its stories the most accurately. I look forward to meeting in the near future.

Best,

M B

Lab 5: Portfolio

Visual 1

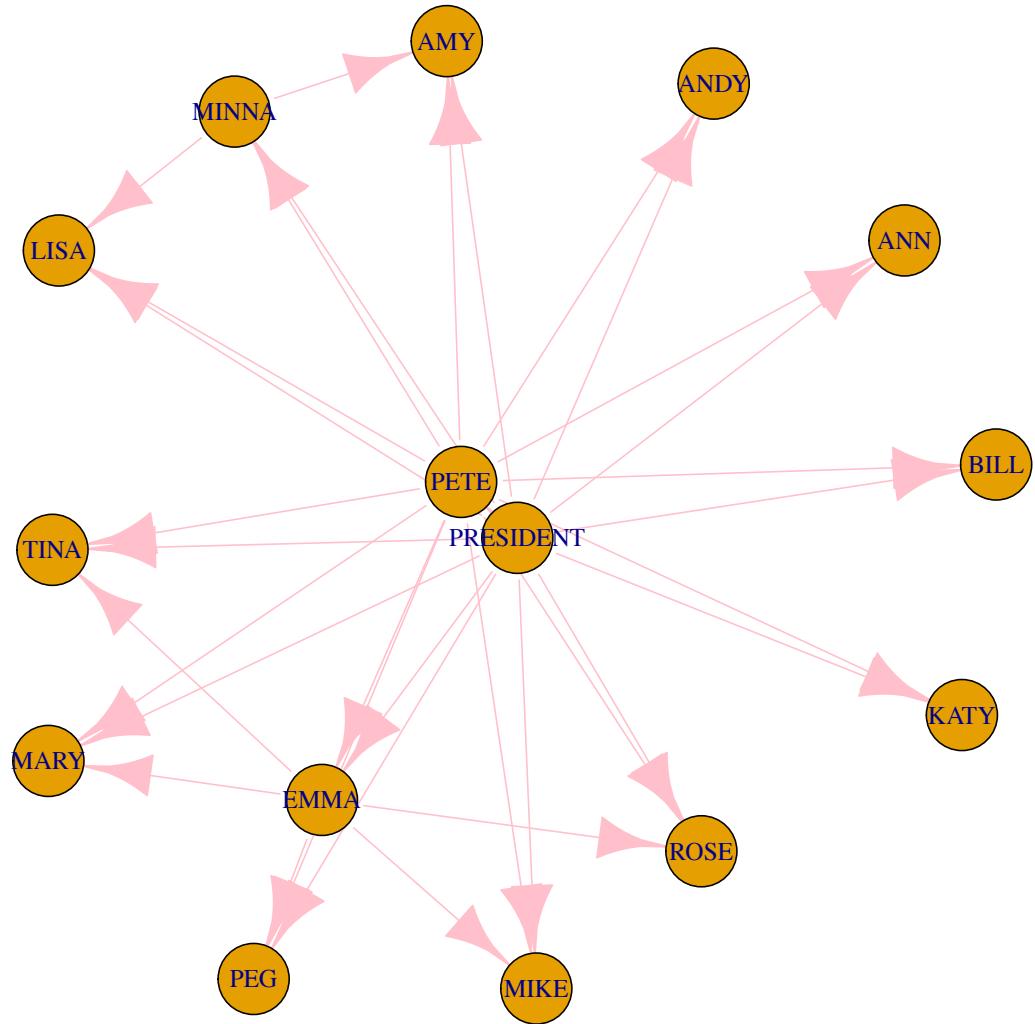


Image taken from Lab 2 submission, where I used R Studio to generate this visual that represents the formal network relationships in the Thurman office data set. The visual indicates that the data is directed and highlights which actors are most central to the network.

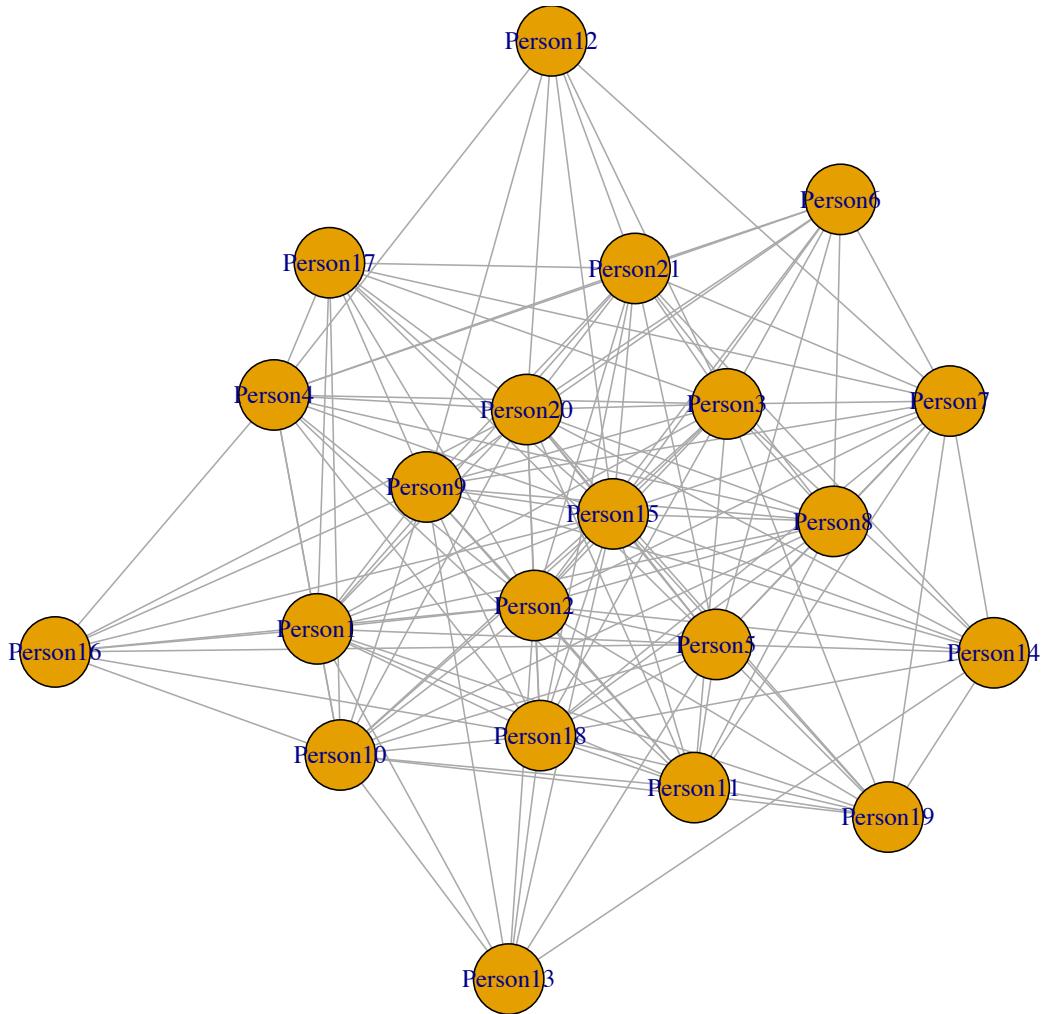
Visual 2

Image taken from Lab 4 submission. I used R Studio to generate this visual representing an Advice network from the Krackhardt data set. This visual allowed me to look at the network relationships based off of advice and think about them while also considering the attribute data of the actors.

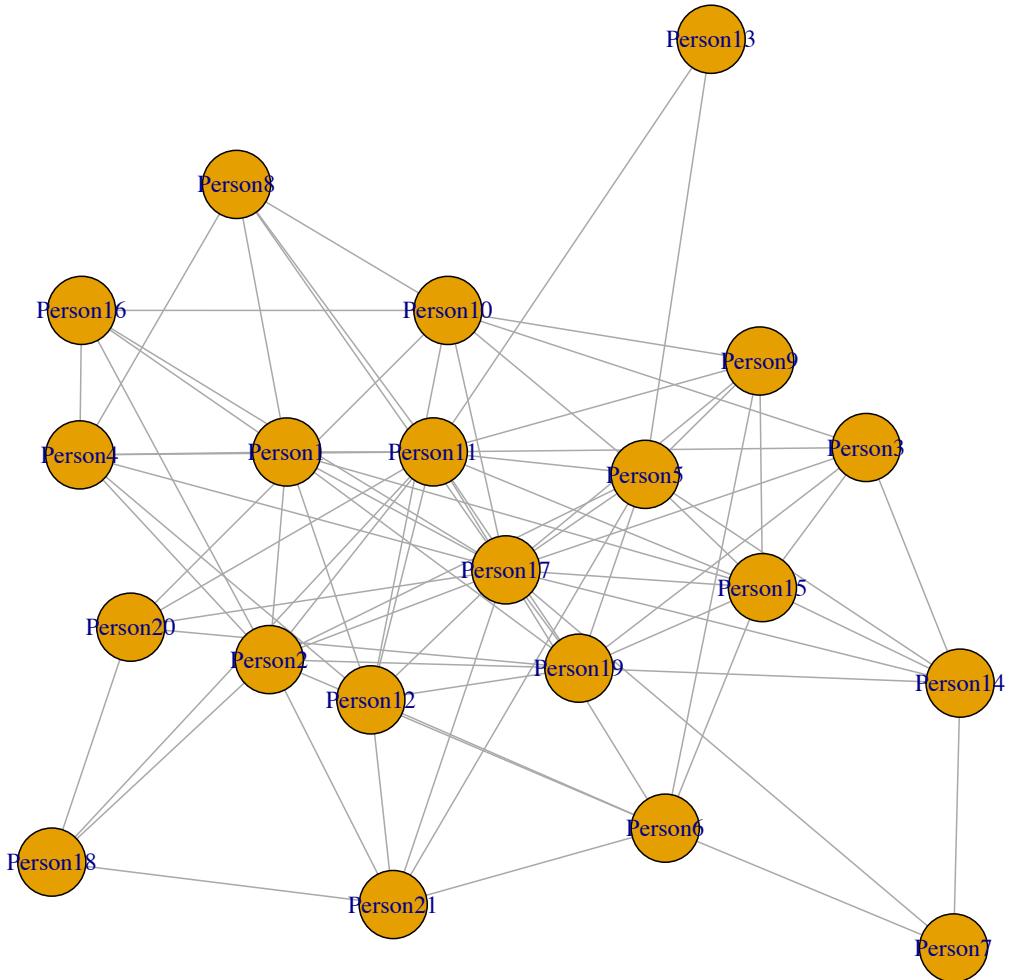
Visual 3

Image taken from Lab 4 submission. I used R Studio to generate this visual representing a Friendship network using the Krackhardt data set. This visual allowed me to examine where friendships within the network existed and draw conclusions about them while also considering the attribute data of the actors.

Dear Mr. Walton

My name is A C and I am a skilled Data Analyst looking to apply my expertise in the retail industry. My goal as a Data Analyst is to find the hidden workings within organizations. I compile data and organize it in such a fashion that I can uncover patterns that point to underlying truths about how companies do and ultimately can operate to function more efficiently.

As I have researched your company, Walmart, in the past couple of weeks, I have discovered some interesting issues in the managerial structure. It appears that many complaints have been filed over the last couple of years to suggest that not only are managers hard to reach as a customer, but as a worker too. Managers at Walmart have become scarce and difficult to find in store while workers take on the majority of responsibility in day to day customer interactions. The problem I see here is that workers are being forced to learn through trial and error rather than through education and management. The managers who are working on and off the floor seem to also have structural holes in their networks amongst each other and operate independently and with un-supervised power. To summarize my findings, I think that Walmart is suffering from structural holes and a lack of connectedness that are becoming a detriment to the ever-evolving customer experience.

Below, I have attached my portfolio to showcase the types of analysis and techniques I would like to apply to Walmart's managerial issues. The first work I have showcased demonstrates my capacity to visualize networks in multiple ways. It is important to have diversity and options when analyzing networks as to find different trends and patterns. This first piece of work also demonstrates my ability to find succinct numbers that conclude some key

network attributes such as density. With these base skills, I plan to compile visualizations that will first help us understand where structural holes appear and where the networks need work.

My second piece of work showcases my ability to find key patterns in densely populated networks using two different approaches. By looking at the Pagget data from the separate points of family and business ties, I was able to uncover why certain actors held more power than others and why certain actors showed loyalty to others. The main assumption might be to look at managing your stores from a solely business perspective but there may be more going on than meets the eye. Management has been experiencing a revolution as of late and the ability to match this trend is important in keeping up with competition and customers. Each individual Walmart store has its own unique networks and I plan to look at each one using multiple approaches to uncover the key points for restructuring.

Lastly, my work on informal networks displays the most directly applicable skills to Walmart's current situation. There are often sub-networks within the overall network which I uncovered and explored here. What is obvious is that the 3 divisions of CEO, Managers, and Workers have more than one network between them. Specifically, these 3 divisions can be looked at through the lens of informal networks such as friendship networks and advice networks. By looking into the sub-networks, I was able to pinpoint where power comes from within the networks and how the networks can be restructured to better utilize those powerful actors. Within Walmart's own managerial networks, I plan to separate the data into sub-networks to identify trust networks and advice networks. From there, I recommend moving certain actors around to better motivate and organize workers. Within these managerial networks, I believe it is necessary to hire outside managerial talent to act as idea men for the division of managers at each individual store. I call these outside talents gatekeepers. These gatekeepers will be

responsible for communicating with the higher ups and will also be responsible for generating good managerial ideas to spread down to the other day to day managers in each store to flesh out and expand on. These gatekeepers will also serve to create and preserve a hierarchy that will naturally run down through the managers to the workers. I believe that implementing these actors and structuring the company in this way will lead to the most efficiency.

With all of this said, I would like to schedule a meeting with you to further discuss my vision for applying network analysis to your stores and gain more insight into the company's workings. I look forward to hearing back from you.

Sincerely,

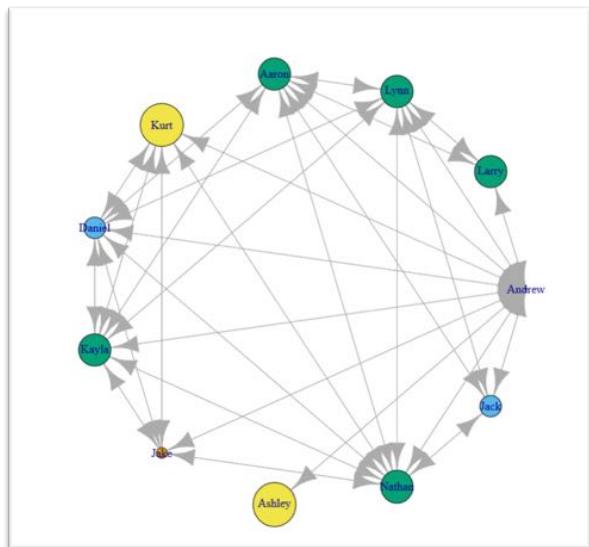
A C

Portfolio

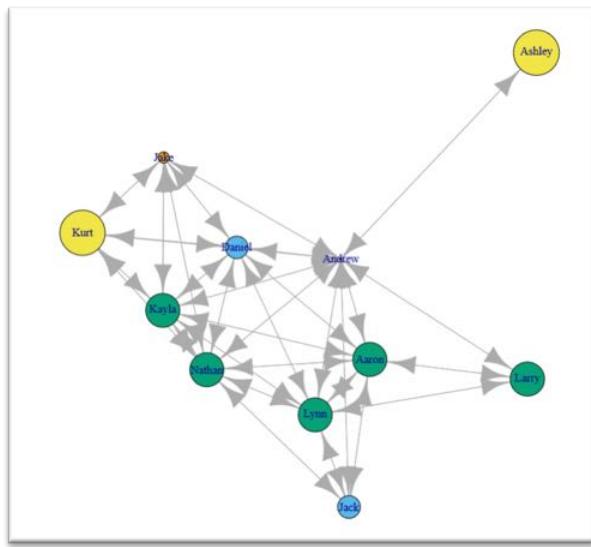
Personal Network

Visualization 1 is a circle plot that I think provides the nicest aesthetic. The most central actor that isn't myself is clearly Nathan even though my strongest relationships are with Kurt and Ashley. The Density of my network ended up being 0.5818182. Visualization 2 shows that it would take a while for information to travel from Jake to Jack since they are on opposite sides of the plot and if any information was to reach Ashley, there is only one way that can happen which is through me. Visualization 2 also backs up the idea that Nathan is one of the central actors with Kayla also being very involved in the movement of information in this network. Visualization 3 also shows Nathan right in the middle of this network in a much cleaner plot that simply shows the direction that information would be flowing. Visualization 3 shows that if any information is to reach Larry, it would have to travel through either Lynn, Aaron, or myself making him a more difficult connection to get information to.

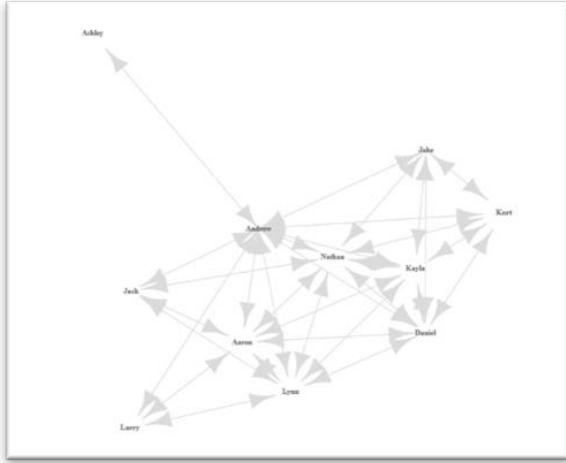
Visualization 1



Visualization 2



Visualization 3

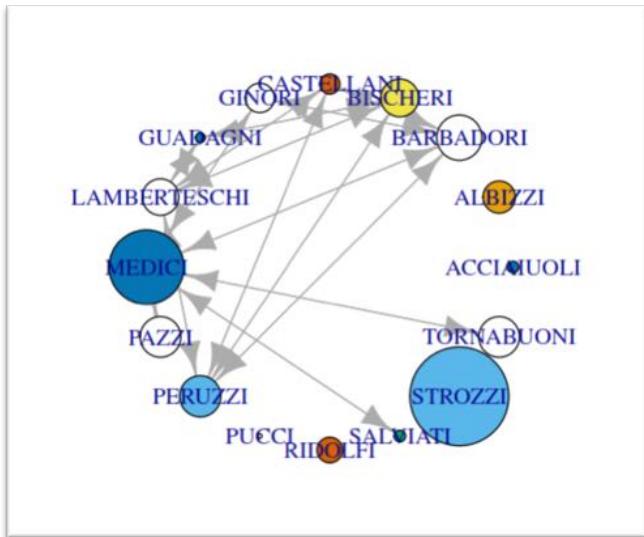


Padgett Data

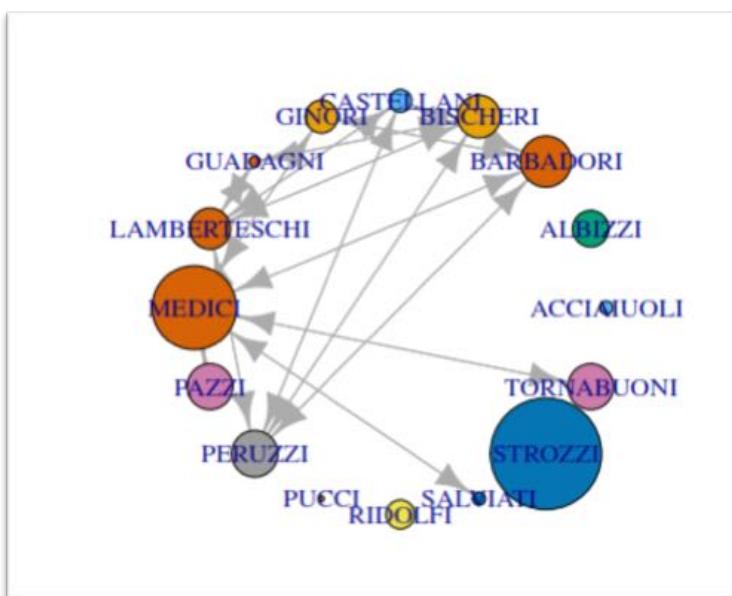
In terms of analysis of the Padgett Data, I found a few things very interesting. Some of the actors who were not connected through business ties were heavily connected through marriage. For example, the Strozzis, who have no calculated “power” in the business ties model have the 3rd highest power in the marriage model. In the business models, the Strozzi family has the largest amount of wealth and functionally no influence upon the network due to a lack of ties. However, in the marriage model, the Strozzi family has money, power, a high calculated centrality, and a high flow betweenness score. The three pieces of data I chose, power, eigenvector centrality, and flow betweenness score, show some constants between the business and marriage model. In general, those with more wealth had consistently high levels of power as long as they had connections in either model. If a certain actor, however, had less wealth but a higher centrality and more priors/ties, they too tended to have a high amount of power within the network. The best example of this would be the Peruzzi Family. Actors with fewer ties in business did not always struggle to have power in the marriage model which suggests that the power dynamics

between these families were not just orchestrated and swayed by those powerful in one variable. Families high betweenness and centrality tended to dominate more than others.

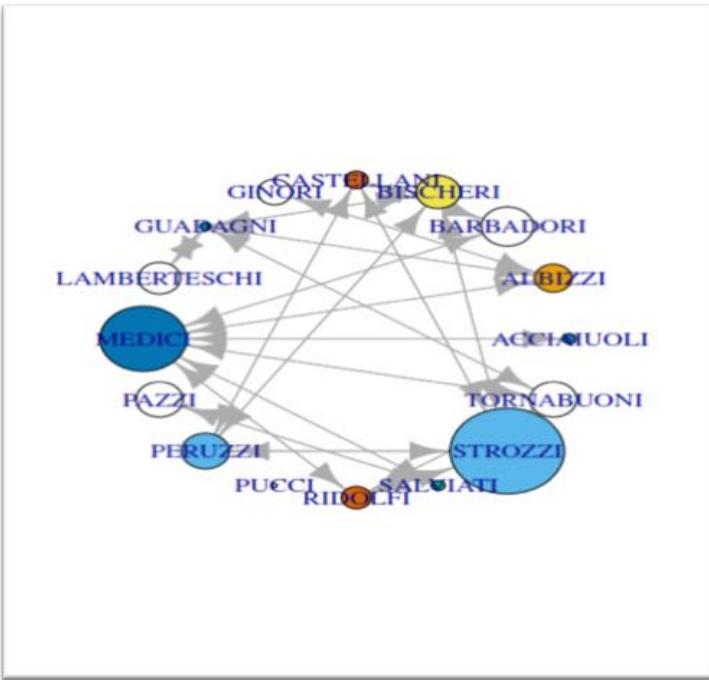
Business Relationships (Colors Represent Prior Relationships and Sizes Represent Wealth)



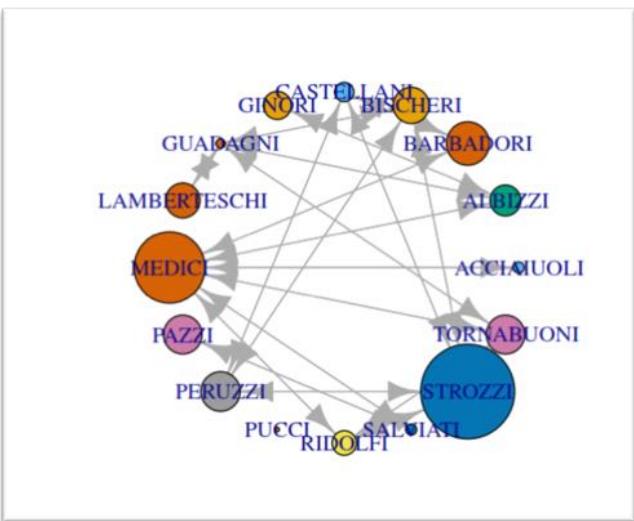
Business Relationships (Colors Represent Ties and Sizes Represent Wealth)



Marriage Relationships (Color Represents Prior Relationships and Size Represents Wealth)



Marriage Relationships (Colors Represent Ties and Sizes Represent Wealth)

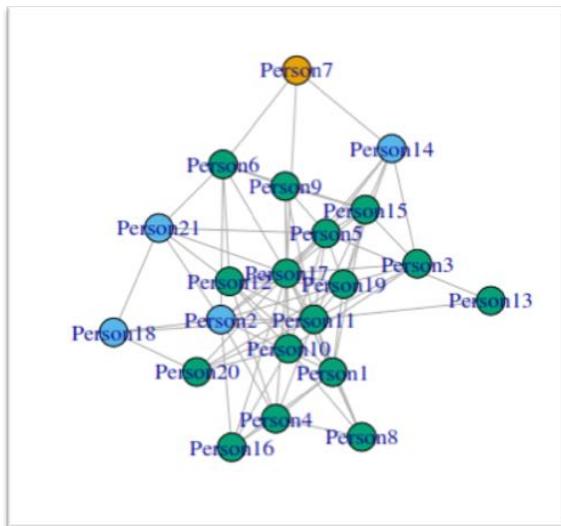


Informal Networks

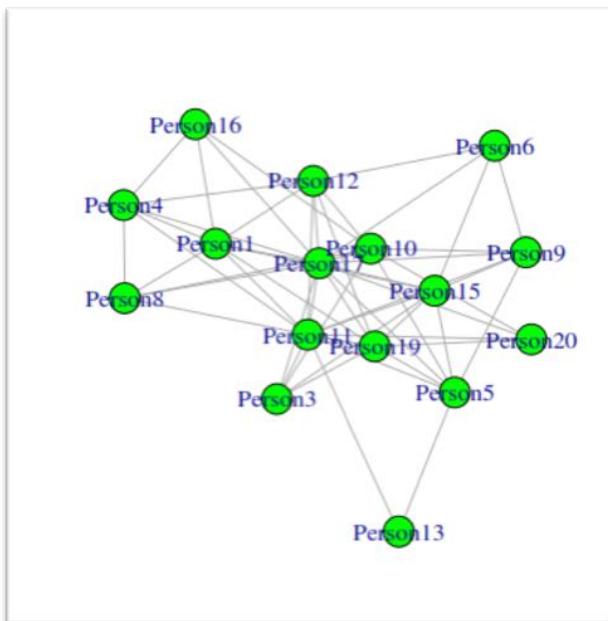
I chose to look closely at the Advice network and how the level and department subgroups within the advice network affected power dynamics. Specifically, I wanted to look at the managers with the most power based on how many managers came to them for advice and explore why they were the ones most likely to be approached by the less powerful managers. The two most powerful managers in the level subgroup with numbers above 1.0 were, in order from high to low: Person 9, Person 17. For the purpose of this analysis, I chose to look at the connections these powerful managers had within the departments as they pertain to advice network and the level as it pertains to friendship network. Person 9 has a decent amount of friends at 6 among the managers but other managers also have 6 friends and don't rank among the most powerful in the level advice network. It turns out that Person 9 is just above average enough in his connections within his particular department and just above average enough in his level friendships to give him a greater trustworthiness when it comes to giving advice among managers. What makes Person 9 an even more powerful manager however, the real kicker, is that he is one of the only managers connected to Person 14, one of the 4 VP's. Person 14 is the only VP not connected by friendship within his particular level which means that any manager professionally connected to VP14 has a strong relationship with a VP than the other VP's do. What the analysis of Person 9 shows us is that while it is expected to have more power with more connections professionally and in a friendly sense, one single connection to a more exclusive node can enhance that manager's credibility as an advice giver. What I found particularly interesting was that Person 17 goes a step further in confirming that last theory. Person 17 is one of the only 3 people who claim friendship with the CEO. Person 17 scored a 20.21 in centralization betweenness among friends in the manager level. That is by far the highest score. Person 17 also has 8 different advice connections within the manager group. What

appears to be the case is that having a connection with an exclusive node within a network can result in more power for whoever has obtained, or claimed to obtain, that connection. In this case, it is Person 9, connected exclusively to VP14, and person 17, the only manager affiliated with the CEO, who top the power rankings among managers and the advice connections they have on their level.

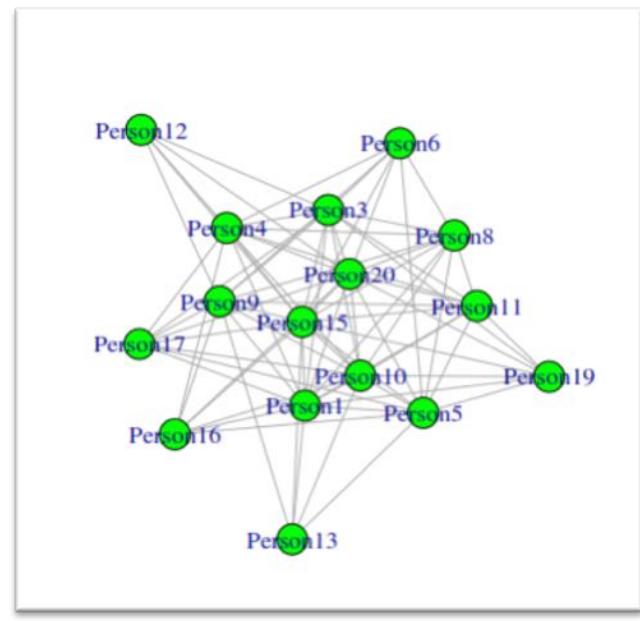
All Friendships with Level as Color



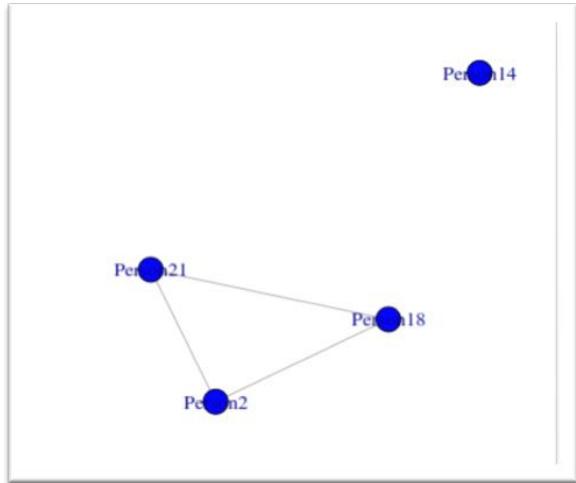
Friendships with Managers



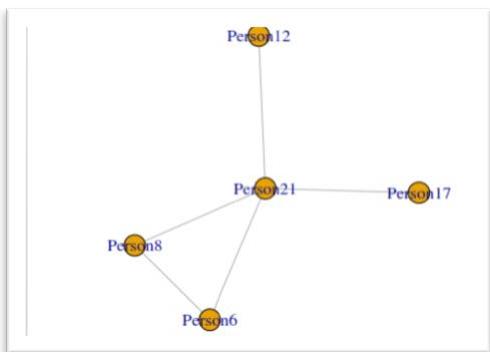
Advice Among Managers



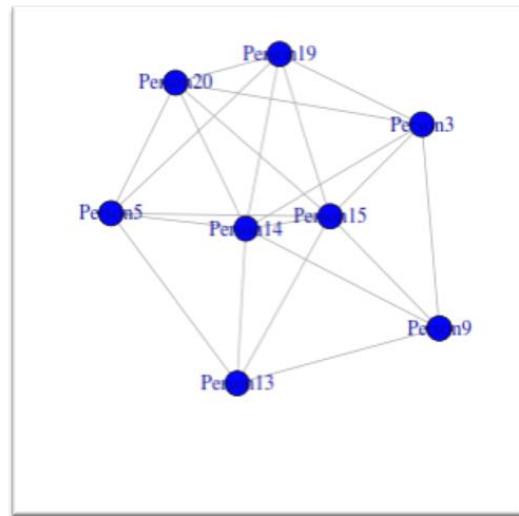
Friendship Among VP's



Person 17's Department with Advice



Person 9's Department with Advice



Dear Bayern Munich executives,

My name is J K , and I'm writing you to express interest in helping your organization from a network analysis perspective. I have followed the team for several years, so not only do I have the motivation to help it run smoothly, but I have some knowledge about the players and the club's recent history. My goal is to analyze the myriad of relationships (players and coaches, coaches and coaches, and players and players) over time within the team so that the coaching staff can focus more on training- and game-related issues. Research has found that managers of companies rarely understand the informal networks that run within their workplace, so having someone studying those forces as her job would be beneficial.¹

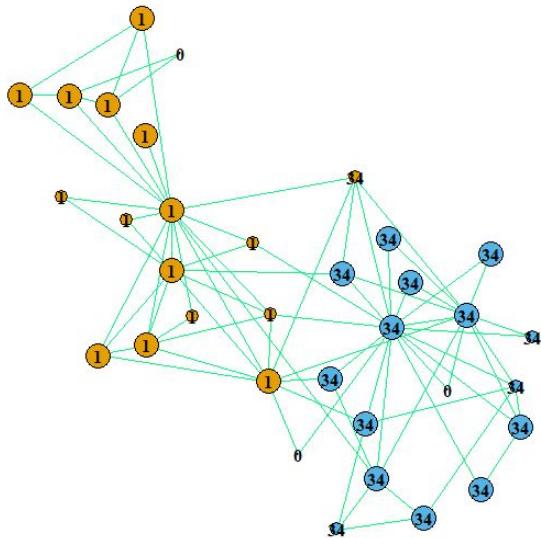
As one of the top-tier teams in Germany and in the world as a whole, Bayern attracts a variety of players from different backgrounds. While this is good for the team's talent, it leaves the door open for clashes of personality. In addition to that potential issue, any sports team has the potential to have conflict between coaches or between players and coaches. Any of those problems can distract the organization from the tasks at hand, much to the detriment of the team's performance on the field. Social network analysis can spot places of concern, sometimes before the conflict reaches its peak.

Over the past two years, Bayern has had four different coaches, one of whom was interim (Willy Sagnol) and the current one (Jupp Heynckes) has yet to sign a long-term contract.² It's important for the team, in the eventual search for a more permanent coach, to ensure that the players are behind whatever decision is made. The image on the following page is from a data set showing a karate club and who each member supports as a leader.

¹ Krackhardt, David, and Jeffrey R. Hanson. "Informal Networks: The Company Behind the Chart." *Harvard Business Review*, 1 Aug. 2014, hbr.org/1993/07/informal-networks-the-company-behind-the-chart.

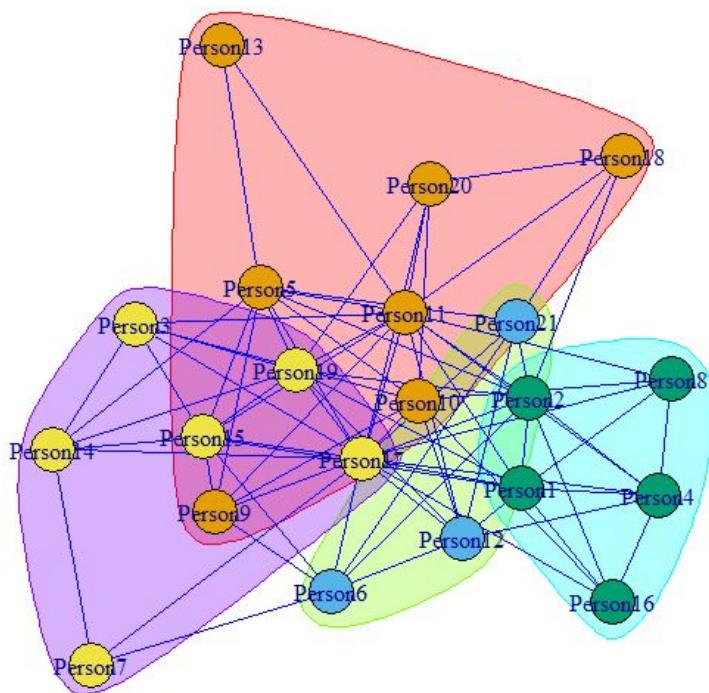
²

<http://www.espn.com/soccer/bayern-munich/story/3296788/jupp-heynckes-still-yet-to-sign-his-bayern-munich-contract>



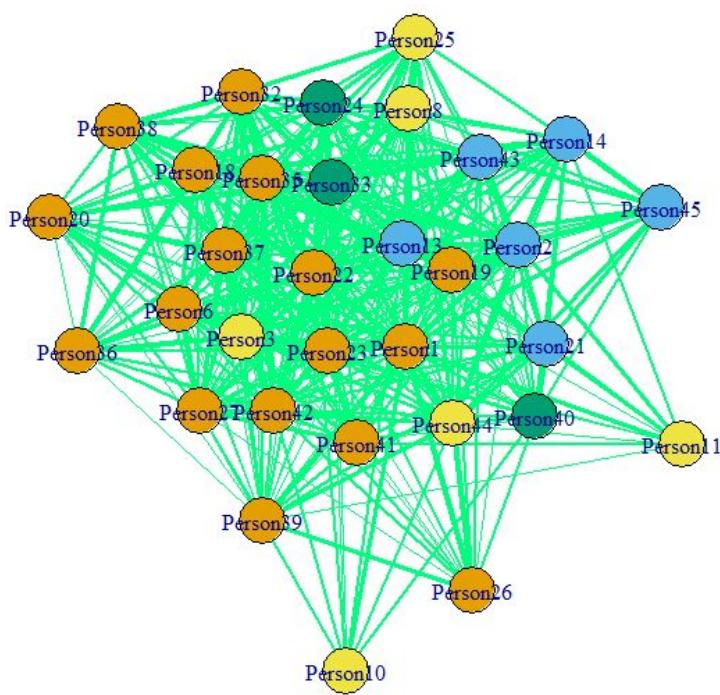
As you can see, the members are almost evenly split -- and split they would, as the club ultimately broke into two separate ones. The colors indicate which club each member wound up in, and then the number is which leader they support -- in most cases, they joined the club led by who they supported. This situation is one that Bayern would like to avoid. When candidates begin to be found, I could interview players to see who they support, in the hopes of finding the least divisive decision.

As I mentioned earlier, Bayern has a diverse list of players. Though most have played together for at least a season, there are some new pieces, and new players will continue to cycle in and out as time goes on. Even if there wasn't such a variety of home countries, there could still be the possibility of conflict between players. Some may be inclined to hide their issues the best they can, in the hopes of preserving the team, but social network analysis could find potential problems. I could ask players who they communicate with often on the team, as well as what teammates they consider friends or trust. If there were any players who didn't have as many connections, then there should be a worry that they're not comfortable with the team. Additionally, players that had a large amount of connections -- especially in what is called the "trust network" -- could be prime candidates for captaincy, should a new one need to be chosen.



This is a graph of another organization's trust/friendship network, where the program I used attempted to find sub-groups within the organization. While sub-groups are expected, as people will naturally gravitate more towards some than others, it would be a red flag if there were a large number of small groups without any overlap. That would indicate a lack of trust spread throughout the network, which would be a problem for a organization that relies on efficient teamwork for success.

Finally, the other type of potential risk would be conflict amongst coaches. It's important for the staff to be on the same page to maximize the effectiveness of communication. While conflict between players would be unlikely to bleed into the management, conflict between coaches could trickle down and lead to additional conflict within players. Here I mean conflict as in prolonged differences and dislike, not the occasional disagreement. As with the player/player networks, I would talk to the coaches and determine their communication and trust networks. Instead of looking for groups, though, as the staff is smaller than the roster, it would be more useful to look for missing links or perhaps links that are not as strong as others.



Though this graph is more cluttered than the one of the coaching staff, the point it makes is the same. The lines here have different thicknesses based upon the “closeness” of the relationship between the two people connected. If the coaching network was characterized by mostly lines of the thinnest variety, that could indicate a lack of trust within the coaching staff. Additionally, while the people in this network have many connections, if the coaching network had some coaches who only had one or two ties, then perhaps the staff is not as well-connected as it should be.

I hope looking through this letter and my examples has made you more aware of potential issues for the organization, but also assured you that these problems can be identified through data collection and network analysis. I look forward to the opportunity to speak with you at a later date to answer any questions and build on what I know of the organization.