

UNIT-4: SAN-Tie Strength

Introduction

- Any kind of relationship type can be used in SNA.
- The tie strength is the measure of strength of a relationship between people.
- **The strength of tie is a combination of the amount of time, the emotional intensity, the intimacy, and the reciprocal services which characterize the tie.** [Mark Granovetter]
- Strong tie [family members, very close friends]
- Weak Tie [more casual friendship]
- People with whom no meaningful relationship, or vendor that businessman may contact are not considered as weak or strong ties. They are called **Absent ties**.
- Absent tie would not appear as edge in the network
- Tie strength is more important factor to consider in SNA
 - Flow of information in weak tie and strong tie are different.

The role of tie strength

Carl Y. was doing commission sales for an encyclopedia firm, but was not doing well. He decided he would have to find a different job; meanwhile, he started driving a cab to bring in extra money. One passenger asked to be taken to the train station where he had to meet a friend. This friend turned out to be an old friend of Carl Y's, and asked him "what're you doing driving a cab?" When Mr. Y explained, the friend offered him the job he now holds labor relations manager for a small company, owned by his friend.

Granovetter, 1974, p. 34

Granovetter found that 56% of the people he talked to found their jobs through personal contacts (Granovetter, 1974, p. 14)

The role of tie strength

- In the examples, Every case has at least one weak relationship link an old friend, a neighbor of the family, or someone met at a party.
- These relationships, known as weak ties, turn out to be incredibly important for finding a job and for the spread of anything through social connections.
- This is because a person's weak ties are likely to travel in different social circles, while strong ties are likely to know one another and travel in the same social circles.
- The social connections of weak ties are more diverse and provide access to a much broader range of information and people than strong ties.
- This was emphasized in a replication of Milgram's "six degrees" experiment [**related to distribution of books**]
- Weak ties are important in ways beyond the spread of information.
- They also play an important role in how organizations and groups function.

- In one study, researchers found that one way to improve racial integration in classrooms was to arrange class structures to form many weak ties between black and white students, rather than focusing on building fewer, stronger relationships between students of different races (Karweit, 1979).

- Another study looked at job satisfaction in a children's psychiatric hospital. While many hospitals of this type have high turnover rates and low job satisfaction, this particular hospital was quite different. Morale was quite high, and the researcher attributed this to the many weak ties among the hospital staff. Instead of being organized into tight-knit, insular groups, the staff all frequently interacted with one another and everyone knew each other on a first-name basis. This made it easier for individuals to interact with one another and to integrate into new groups (Blau, 1995).

- This does not mean that strong ties are unimportant.
- Strong ties family and close friendship relationships are more committed, reliable, and trustworthy.
- They also form a critical part of social structure.
- Even in a job search, where Granovetter originally showed the importance of weak ties, strong ties play an important role. A follow-up study of nearly 1,800 people showed that over 56% of them used ties to find their job, but among those, 72% used strong ties.

- Strong ties are more willing to help and have greater motivation to do so. This is true in finding jobs, but in many other contexts as well.
- Two simultaneous studies of social structure found that people rely heavily on strong ties.
- People with strong ties provide one another with access to food stamps, housing, child care, money, social support, and other items of value. The close relationships of both family and family-like friends are vital to this social structure.

- Both types of ties have their benefits.
- Because people linked by strong ties see one another frequently and interact on a deep level, they are motivated to help one another, put effort into the relationship, and behave in a trustworthy way.
- Weak ties, on the other hand, do not have these motivations, but they do provide access to a more diverse set of information and resources.
- They are also easier connections to form and maintain. This means they provide an easy and important link to the world outside a person's core social circle.

Measuring tie strength

- To analyze tie strength in social network analysis, the network must include relationship information.
- In small networks, especially if data is hand-collected, it may be feasible to ask each person to rate the strength of their tie to each person.
- Larger networks require a mechanism for measuring tie strength. There is no single factor that defines a strong or weak tie, but a number of predictors can be combined to estimate the strength of a relationship.
- **“The Strength of Weak Ties,”** Granovetter offers four intuitive factors that may contribute to tie strength.
 - “The strength of a tie is a combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie.”

4 intuitive factors contributing to tie strength

- **Time** : Includes the amount of time people spend with each other, the duration of their relationship (i.e., how long they have known each other), and how frequently they see one another.
- **Emotional intensity**: Is indicated by the closeness of a relationship; close friends or family members are likely to be strong ties, while more casual friends form weaker ties.
- **Intimacy, or mutual confiding**: Relates to people sharing secrets or intimate personal details with one another. The more of this information they exchange, the closer their relationship is likely to be.
- **Reciprocal Services**: Are favors that people do for one another. They may be personal (e.g., pet sitting or picking up someone's dry cleaning), financial (e.g., loaning money), professional (e.g., putting people in contact with one another) etc.

- There are several other factors, but three are more widely accepted as important.
- **Structural** features relate to the social network of the two people in question. Those who have many mutual friends are likely to have stronger ties
- **Social Distance** measures how different people's social situations are. This includes factors like age difference, race, education, and socioeconomic status. People with strong ties tend to have similar social attributes.
- **Emotional Support** describes the communication between people that validates their emotions, shows understanding of their problems, and tries to alleviate stress.

- All seven factors are not equally important in determining tie strength
 - For example, studies have consistently shown that measures of a relationship's closeness, often captured through emotional intensity or intimacy, are among the strongest indicators of strength (Marsden, 1984)
- Factors are not independent.
 - For example, people who have a very intimate relationship will often spend a lot of time together. People of different ages and positions in life, or those who have a large social distance are also less likely to have as many mutual friends as people with similar social positions. Thus, when measuring behavior or interactions, a single measurement may describe more than one of these factors.

- It does not always follow that having many of these factors indicates a strong tie.
 - For example, roommates may have many friends in common, be in socially similar situations (and therefore have a low social distance), spend a lot of time together, and even do favors for one another, yet still maintain a distant and impersonal relationship.
- A natural question to follow is how these factors are measured.
 - Intimacy, for example, is difficult to quantify, and depending on the context of a relationship, its meaning may vary. Indeed, there is no single correct answer for how to measure any of these relationship features. If measuring them is important, it will depend on the context, the information available, and likely many other factors.

Example for tie strength measurement by Gilbert and Karahalios (2009)

- Subjects answered a series of questions about their relationship with friends on Facebook, and information was collected from both users' profiles and their interactions. This Facebook data was used to create a set of attributes designed to reflect each of the seven aspects of tie strength mentioned earlier.
- Few examples of the over 70 variables they used to measure tie strength are as follows

Intimacy

- Number of days since their last communication
- Number of friends in common
- Number of “intimate” words in their communications, as determined by software that automatically analyzes text

Intensity

- Number of words exchanged on one another’s walls
- Depth of email threads in their inboxes (i.e., how many messages were sent back and forth in a conversation)

Reciprocal services

- Number of links shared on one another’s wall
- Applications the users had in common (presumably because they could be working together within the application context)

Social distance

- Age difference
- Difference in the number of educational degrees
- Difference in the number of occupations

Tie strength and network structure

- Network structure is related to tie strength.
- People who have many friends in common are likely to have stronger ties than people with few mutual friends.
- There are many ways that tie strength and network structure are related.
- Strong ties have unique properties within a social network. They are not randomly scattered throughout the network, but rather tend to appear in clusters.
- Strong ties have tendency to appear in clusters. Each person will have many more weak ties connecting them to people outside this small group, but a person's strong ties tend to have strong ties to one another.

- This pattern of strong ties being densely connected leads to another structural concept called the **forbidden triad**.
- Imagine three people: Alice, Bob, and Chuck. Alice and Bob have a strong tie, and Alice and Chuck also have a strong tie. What does that tell us about the relationship with Bob and Chuck?

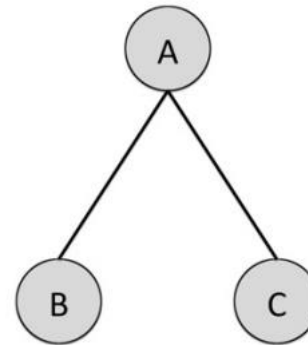


FIGURE 5.2

The Forbidden Triad.

- Granovetter named this triad “forbidden” because of the unlikelihood that no connection between Bob and Chuck exists

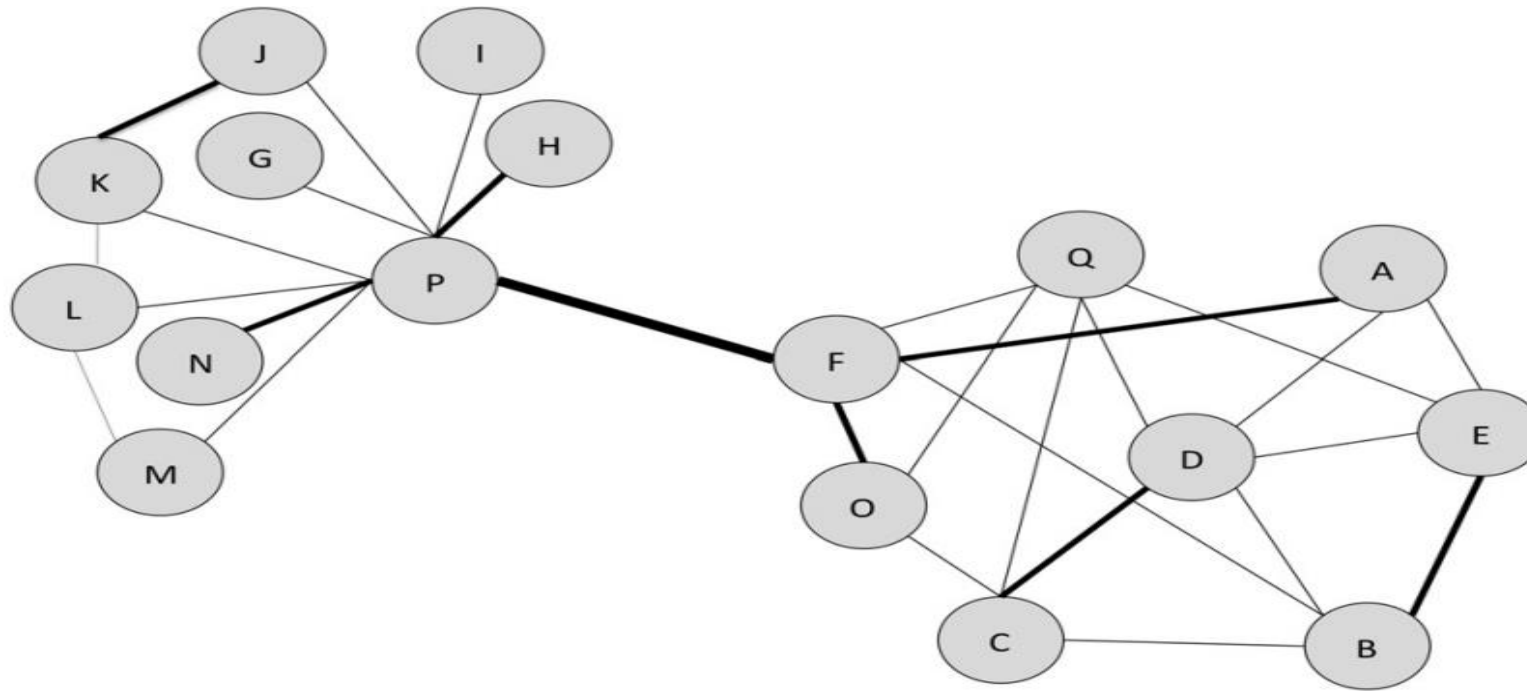


FIGURE 5.3

The edge between P and F is a bridge that connects the two clusters of nodes. It is a strong tie, and thus we would expect connections between some of the triads with two strong ties (e.g. PFO, PFH, PFN). It is very unlikely that no tie third tie would exist in any of those triads, and thus it is unlikely that a strong tie would be a bridge.

- Granovetter described this in his work with the principle that **no strong tie is a bridge**;
- while strong ties may be bridges, it is unlikely given what we know about the distribution of edges. It is also unlikely that, over time, a strong tie would remain a bridge. Weak ties would be likely to form and connect nodes to remove the strong tie's bridge status.

Tie strength and network propagation

- Network propagation is a phenomenon where things spread through a network.
- For something to spread from one person to another in a network, there needs to be a path between them. This can be a direct edge, either a strong or weak tie, or a series of edges between mutual contacts. It will pass from one person to some of his or her neighbors, and from them on to their neighbors.
- . Granovetter proposes that as the strength of a tie becomes stronger, the overlap in social circles will tend to increase. This means that if we follow all edges from our strong ties, we will reencounter many of our own friends. That in turn implies that if we pass information to our strong ties and if they pass it to their strong ties, it will not go very far; instead, it is likely to reach people who have already received the message.

- If we pass that same information to our weak ties, it has a chance to go farther in the network. Since there is usually smaller overlap in friends between a person and their weak ties, the weakly connected people have a chance to spread the information to new people whom the source did not know
- Weak ties are connected to diverse social groups that the person would not otherwise communicate with, the weak ties are more often sources of new information, like job opportunities
- Weak ties are powerful in helping spread information farther through a network, but this is not to say that strong ties are unimportant.
- Strong ties tend to be more trustworthy, reliable, and personal.
- A weak tie may be able to tell a person about many job opportunities, but a strong tie will have a better idea of what jobs would be a good fit.

BUILDING NETWORKS

- **Modeling Networks:**

Defining Nodes:

Which node to include?

What constitute an edge?

Node types:

People

Networks with Single type of entity

Networks with heterogeneous types of entity

- **Bipartite Graphs**

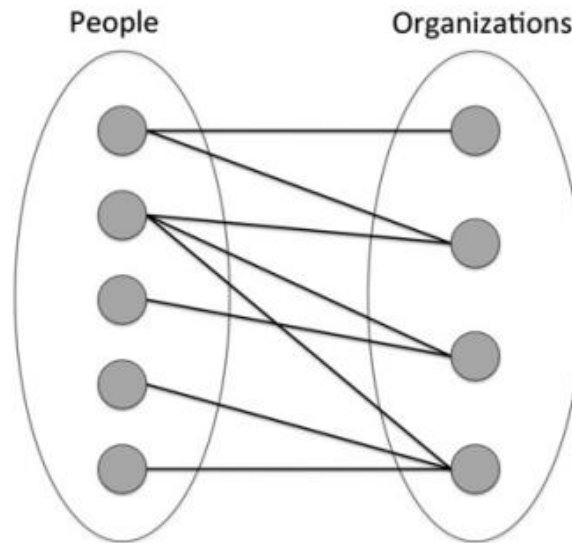


FIGURE 8.1

A bipartite graph has two types of nodes (people and organizations in this example), and edges always connect a node from one group to a node from the other group.

- Bimodal Network
- Multi-modal Network
- Affiliation Network : Networks connect people to organizations
- Networks may have multiple types of edges.
- Ex: friendships and family relationships could be included. Networks with multiple edge types are called multiplex networks
- Homogeneous networks : with one type of node and one type of edge.

- **Node Selection:**

- Not every node should necessarily be included. Defining what qualifies a node to be included in a network is an important step in network creation.

For example, consider building a social network of people who work for Company X. Clearly, the full-time employees should be included. Which of the following groups would you also include?

- Part-time employees
- Contractors who are hired to come in and work temporarily for Company X for a few weeks
- People from other companies who come and work at Company , but are paid by their home company (e.g., a security company monitoring the grounds at Company X)
- People who do business with Company X but who do not work there and are not employed there (e.g., vendors who sell products to Company X)
- People who work for companies who do business with Company X but who are not involved directly in any transactions

- **Defining Edges:**

- Edges represent relationships in networks, but relationships vary in strength and type, and they often change over time. Which ones should be included?

Consider an extension to the Company X example. Say you have selected the nodes in the Company X network to be full- and part-time employees only. Now, you must decide when to connect two nodes with an edge. Given two people with the following types of interactions, would you add an edge between them or not?

- Two people work in the same department and work closely on many projects. They spend several hours every day working together.
- One person works for another (a superior/subordinate relationship).
- Two people are in the same department. They participate in department-wide discussions on a mailing list and see one another at monthly departmental meetings, but do not work together on any projects.

