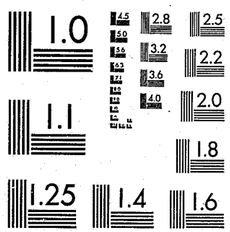
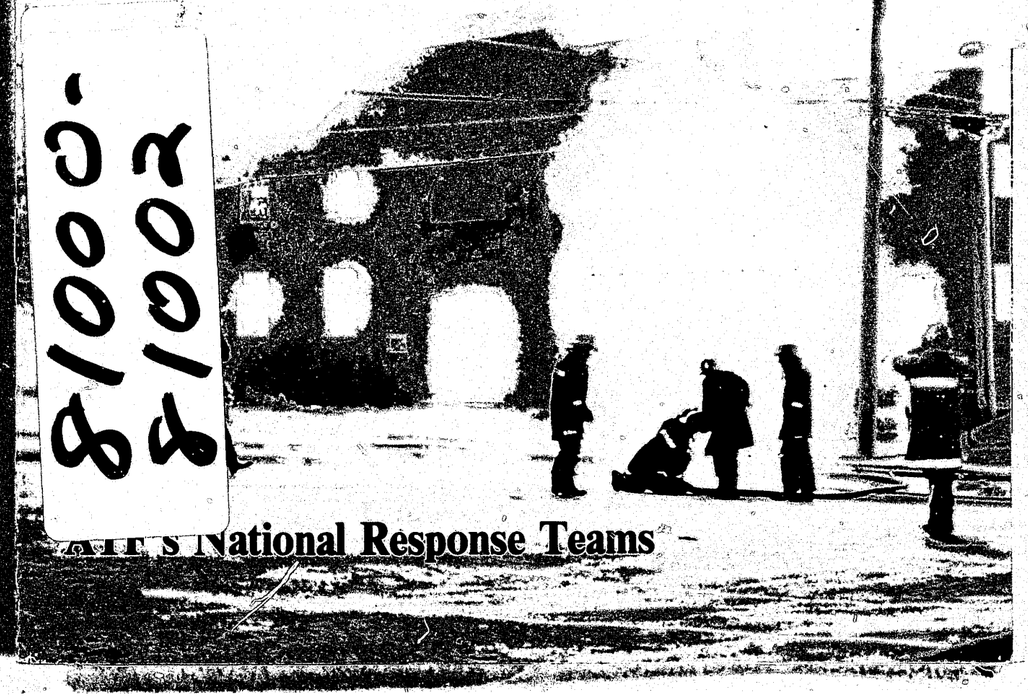


FBI LAW ENFORCEMENT BULLETIN

DECEMBER 1981

Arson!



FBI's National Response Teams

Social Network Analysis:

An Aid in Conspiracy Investigations

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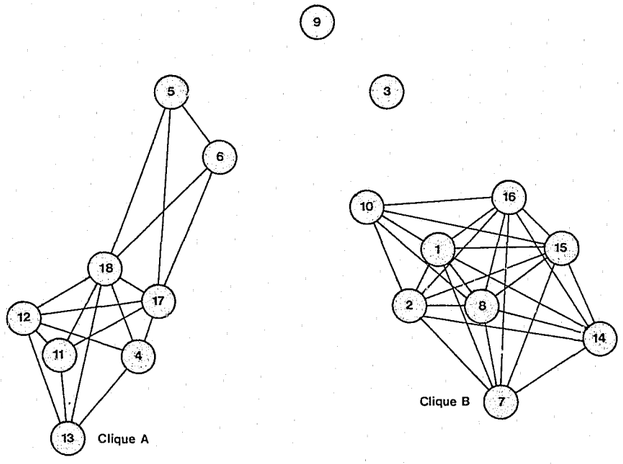
All criminal enterprises share similar properties which, if recognized, can aid in investigating conspiratorial crime. While conducting a complex conspiracy investigation, police officers not only must identify the key participants but also grasp the nature of the interconnections between conspirators to determine the scope of an illicit operation. One process, social network analysis, can assist in penetrating and simplifying those complex interpersonal connections.

Social network analysis is a technique for describing interaction patterns between people to better understand and predict behavior.[1] To perceive the concepts of this process and the law enforcement applications, consider the following hypothetical example in which one social network analysis technique can be applied.

Special Agent Davis

Chart 1

Individuals Present Together Two or More Times



Police in a western city received information of an organized fencing operation being run by members of a local gang. The operation appeared to be centered at a tavern, which was also a popular gathering place for gang members. Police also learned that a person identified as Bert Bey recently indicated he had access to stolen rifles which were for sale for $50 each. Since, at this stage of the investigation, the police were interested in learning more about the scope of this fencing operation and the people connected with it in order to develop suspects, they decided to watch the tavern during the evening hours for a short period of time to determine who may be involved.

From the surveillance, 18 people believed to be connected with the group were identified. Using social networking techniques, the officers converted their observations of people arriving at and departing from the tavern into a network diagram showing the structure of interpersonal relations within the group. (See chart 1.) From this picture, police determined connections between group members and began to focus logically on those they considered to be suspects and who potentially would be most knowledgeable about the crime.

What the police officers did was identify the people they observed at the tavern. Then, over a period of time, they charted who was present with whom. The format used is illustrated in table 1. Table 1 is a matrix which includes suspects identified by name and the time periods they appeared at the tavern.[2] Using network analysis techniques, the officers then developed the network diagram, chart 1, which disclosed the interpersonal group connections.[3]

In looking at the chart, the officers learned that the group is split into two clearly defined cliques. Bert Bey, the original suspect, is individual 16 and is part of clique B. The core members of clique B (chart 2) and prime suspects to focus upon appear to be individuals 2, 7, 8, 14, and 15. Because these individuals are the central members, they may be controllers of the operation or key links to others who may or may not frequent the tavern. So, using this technique, the officers were able to focus their efforts early in the course of the investigation upon key gang members and make some behavioral predictions of those individuals who may be involved in a crime.

Network analysis as a law enforcement technique does more, however, than construct a picture of the relationships between people. It allows the investigator to deal better with the characteristics of those links to predict criminal behavior. Used as an aid, it offers the opportunity to penetrate deep into the structure of interpersonal relationships between people of investigative interest. By comprehending the patterns of linkages, an investigator not only will see more clearly cliques of interest but also will have an additional tool to better understand attitudes and behaviors unique to each clique. Other social network characteristics, such as leadership patterns and the nature of information exchanged between individuals, may also be disclosed and used to estimate the extent of criminal involvement shared between individuals and groups. In addition, by applying this type of analysis, key connections to people not previously linked to a criminal act or illicit enterprise can be developed.

Chart 2

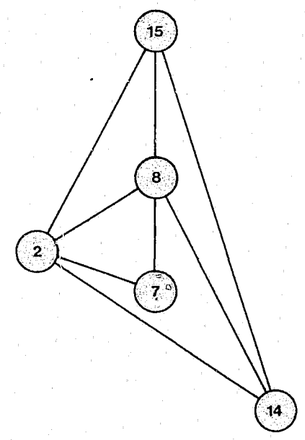


Table 1

	Time Periods													
	June 1			June 2					June 3				June 4	
	8p.m. to 10p.m.	10p.m. to 11p.m.	11p.m. to 3a.m.	8p.m. to 9p.m.	9p.m. to 10p.m.	10p.m. to 12a.m.	12a.m. to 2a.m.	2a.m. to 3a.m.	8p.m. to 10p.m.	10p.m. to 12a.m.	12a.m. to 1a.m.	1a.m. to 3a.m.	9 p.m. to 11p.m.	11p.m. to 2a.m.
1) Fred Corley	0	1	0	1	0	0	0	1	0	0	0	1	0	0
2) Richard McGood	0	1	0	1	0	0	1	1	0	1	0	1	1	0
3) Gordon Waid	0	0	0	0	0	1	0	0	0	0	0	1	0	0
4) Thomas Smith	0	0	0	1	1	1	0	0	0	0	0	1	0	0
5) Basil Malone	1	0	0	0	0	1	0	0	0	0	0	0	0	0
6) Archy Hope	1	0	0	0	0	1	0	0	0	0	0	0	0	0
7) Horace McLain	0	1	1	1	0	0	1	1	0	1	0	1	0	0
8) Feltus Robb	0	1	1	0	0	1	1	1	0	1	0	1	1	0
9) Simon Henry	0	0	0	0	0	1	0	1	0	0	0	1	0	0
10) Justin Harvey	0	1	0	1	0	1	0	0	0	0	0	1	0	0
11) Larry Earp	0	0	0	1	1	1	0	0	1	0	1	1	0	1
12) Reid Raney	0	0	0	0	1	1	0	0	1	0	1	1	0	1
13) John Seitz	0	0	0	0	1	1	0	0	1	0	0	1	0	0
14) Silas Weisel	0	1	1	1	0	1	1	1	0	0	0	1	1	0
15) Pedro Conner	0	1	0	1	0	0	1	0	0	0	0	0	1	0
16) Bert Bey	0	1	0	0	0	0	1	1	0	0	0	1	0	0
17) Robert Ensor	1	0	0	1	1	0	0	0	1	0	0	1	0	0
18) Alvin Cox	1	0	0	1	1	1	0	1	1	0	1	0	0	1

The Concept

Understanding group structure and analyzing the connections between people involved in illegal activities must begin with an understanding of how group relations evolve. Criminal networks operate in the same way as all other social networks. Relationships between people rest upon shared values, interests, and characteristics. Individuals are linked together through common bonds that develop through shared goals.[4]

Group structure may be important to some criminal investigations, including racketeering enterprises, narcotics operations, illegal gambling, and business frauds. Inquiry into how conspirators divide their responsibilities to accomplish an illegal task offers insight into how an illicit enterprise should be investigated and who should be targeted. By examining members' roles, relationships, and personalities, the nature and extent of conspiratorial involvement may be identified.[5]

An important property of any group is the stabilization of relationships among members and the function each member must accomplish to carry out an activity. A group strongly influences the behavior of its members by setting and enforcing unwritten rules. "If a person wants to stay in a group, he will be willing to conform to the rules which the group sets up."[6] Take as an example a case where group members are cooperating in obtaining and disposing stolen property. If the informal rules of the group include a requirement that members provide assistance in locating buyers or at least show complacency toward that crime, it follows that for a member to continue to be accepted within those circles, he must participate to some degree, if only passively.

Groups pressure members to conform to certain unwritten rules. That social force eliminates some from the group and filters others into subgroups or cliques bound together in ways which are possible for the investigator to uncover. As one social scientist explained, people choose others as friends based upon a complex interactional process. Where activities between associates are mutually rewarded, common attitudes, sentiments, and behaviors result.[7] Increased interpersonal contact leads to an ever-increasing involvement in and knowledge of another's activities. As people drift into subgroups, their shared values converge. People sort themselves into cliques which are characterized by a kind of consensus[8] and which consist of individuals whose activities and social characteristics are similar.[9]

From these social forces that influence people in varying ways to select friends and associates emerge relatively stable patterns allowing the group to accomplish its objectives. This role structure is maintained by rules and social pressures that regulate what, within that group, is acceptable and what is not. These behavior patterns can be used by an investigator as building blocks to understand not only how a group under investigation functions but also those expectations associated with each individual's position in the network and the extent of his or her conspiratorial involvement.

". . . pertinent network relationships, . . . may provide the foundation to measure the extent of suspect involvement."

It follows that knowledge of how and through whom social pressure is applied may offer the investigator an advantage in understanding the relations between people involved in crime and in structuring the direction of future inquiries. If criminal activity is suspected of certain individuals within a group, a look at the network associations will offer clues to identify through whom the best information is available to the investigator and with whom the suspect may conspire to break the law.

Knowledge of an individual's social network provides the investigator some opportunity to better understand the personalities under investigation. In network terms, one would expect to locate people in central network positions who would appear more persistent in involving others and moving the group toward its objectives. Additionally, a group may also contain socially oriented individuals who are more passive and agreeable, and therefore, more susceptible to group pressures. Or it may contain selfish and vulnerable individuals who may be targets for development as sources of information.[10]

The information and observations collected by an investigator can be used to chart interpersonal relationships between people of investigative interest. Links between people may involve other than criminal connections, but pertinent network relationships, when understood in terms of their meaning to criminal activity, may provide the foundation to measure the extent of suspect involvement. The network links may also help extend the investigation logically along a path built upon an understanding of who will probably be involved with whom and to what degree. Network analysis is a tool that constructs this picture of individual involvement in or potential knowledge of criminal activity.

The framework of a network structure is built upon a variety of elements that allow the visual display of personal relationships. Influences upon group structure are far-ranging. Psychological studies include a focus on how people perceive differences in the world around them and how they categorize people and objects in predictable ways.[11] The links that tie people together, as reported in social science literature, include a multitude of components. Specific transactions between people have been studied and a number of elements discovered which disclose social similarities. Studies include the importance of role similarities such as husband, father, club member, family status, citizenship, nationality, religion, occupation, political party affiliation, economic status, and race as important components for social science purposes.[12] Social similarities are measured by some social scientists in terms of the amount and intensity of social interaction between two people, such as having each other as friends, acquaintances, neighbors, or coworkers.[13] Similarities or differences may also be measured by racial, regional, sex, age, role, educational, class, occupational, religious, and ethnic differences.[14] Studies also focus upon the importance of elements exchanged, such as greetings, civilities, conversation, information, visits, work assistance, interaction, sentiment, conversation, joking behavior, personal service, and cash assistance, as useful components to build the links that tie people together.[15]

While consideration of the wide range of factors that link people together may be interesting to social scientists, limited measurements seem more appropriate for investigations. Friendships, common affiliations, business connections, and people observed together, or help with financial problems and job assistance, are a few components which may be gathered in investigations and offer more practical application.

Where more detailed network analysis is appropriate, an investigator may want to gather and analyze the interpersonal network relationships by counting the number of instances in which people interact and by noting who initiates and terminates the interactions. This provides weight and direction to the network links.[16]

Where people are linked to others through the social relations identified above, they are also tied to society through membership bonds with various groups and organizations.[17] People are also the links connecting groups to other groups. Knowledge of these ties between groups may be important sources of investigative information when used to understand conspiratorial links between criminal groups and to measure cooperation and mutual assistance provided to groups of interest.

From the behavioral elements collected, it is possible then to use this information to construct a picture of the important linkages that exist between people under investigation or display the interconnections of targeted groups involved in a criminal enterprise.

Social Distance

Social distance is a concept that may be applied usefully to investigations. The social distance built upon the similarities between people and groups can be measured and treated in a way that is similar to measuring physically the distance between two points.[18] Where social distance may not be directly analogous to physical distance, concepts of both nearness (features in common) and distance (features separating people and groups) can be scaled in useful ways.[19] "Just as the location of a point . . . is determined by values of . . . coordinates, so a man's location in social space is determined by the values of many coordinates. . . ."[20]

With the application of some principles of matrix mathematics to behavioral information gathered on the important links between people and groups, group structure can be disclosed, relationships can be put into a more useful perspective, subgroupings can be displayed in easily understandable form, and the meanings of interpersonal connections not previously suspected can be revealed.

A matrix representation of known interactions and relationships records links between individuals or groups or links between people and events. Discussions pertaining to the step-by-step procedures involved in constructing a matrix are fully explained in other publications and will not be discussed here.[21] However, manipulation of this data will reveal people in cliques; isolate brokers, individuals connected with others, flow of information, patterns of influence, and potential coalitions; and permit other types of analysis discussed later in this article.

Once the matrix is constructed, matrix manipulation to produce the network is possible either manually[22] or through available multidimensional scaling computer programs. Inexpensive multidimensional scaling computer programs are capable of constructing network relationships for groups.[23] This type of scaling is a powerful technique when applied to information disclosing interpersonal relationships. The scaling process not only aids in understanding whatever patterns of relationships are hidden in the matrix but also allows the interconnections to be displayed in easily understood graph form with meaningful social distance relationships.

Manual manipulations are relatively simple for small groups; however, as networks grow to over 10 to 15 individuals or nodes, the work becomes time-consuming. Several other techniques are available, also for use with other computer programs.[24]

From the matrix representation of relationships, the characteristics of the linkages developed between people can be examined to understand and predict criminal behavior. The persons represented become "nodes" of a graph, and the lines are linkages (friendships, helping, influence, personal service) representing the social relationships or criminal connections of people of investigative interest. Out of this network, patterns of linkages develop.[25] With this information, the investigative focus goes beyond individual involvement of persons suspected of criminal activity to a better understanding of the nature of the links in terms of their meaning to a person's potential involvement in crime. Any person of interest can be understood in terms of his connections, as well as the interconnectedness of his associates. A clearer picture evolves of who is connected with whom, how tightly, and what that connection may mean in terms of illicit activity.

From the introductory example in this article, the clique structure shown in chart 1 was based upon people appearing together in one place over a period of time. From this initial representation, the investigator may wish to include additional connections as more information is gathered. To accomplish this, again he or she would construct a matrix listing names of individuals of interest along the side and across the top or bottom and create a record of known components further linking individuals of interest. (See table 2.) The matrix may be symmetrical, as in table 2, or it may record weighted relationships, for example, where one person is observed seeking out another more than he is sought. If weighted links are used, the individuals along the side of the matrix should represent those seeking out others, while those named across the top or bottom are the ones sought.

For example, if during a surveillance several people were observed arriving or departing together or conversing outside of the tavern, an additional matrix constructing those connections may reveal more of the group's structure. Table 2 is a matrix which records the number of times individuals were seen together. As the investigation proceeds, other components may be uncovered and used as aids in developing a better understanding of the links between people. From the additional matrices constructed, further network diagrams may be developed showing not only key participants in a crime but also potential communication channels and important people who, though not directly involved, may act as brokers or links between participants and people who are in a position because of their network location to manipulate others.[26] If, for example, chart 3 is constructed from additional observations and Gordon Waid (3) appears connected with Fred Corley (1) in clique B and Archy Hope (6) in clique A, the investigator should consider Gordon a potential broker who may be the important source through whom stolen property is flowing.

Table 2

Frequency of Meetings Between Individuals

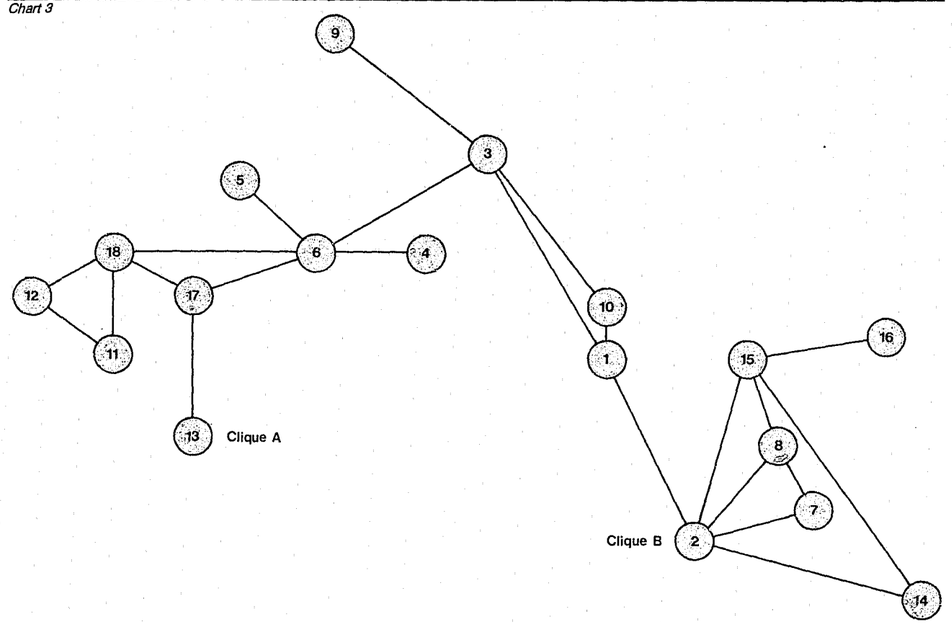
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1) Fred Corley																		
2) Richard McGood			6															
3) Gordon Waid																		
4) Thomas Smith																		
5) Basil Malone																		
6) Archy Hope		2	3			6												
7) Horace McLain		7																
8) Feltus Robb		7					8											
9) Simon Henry			4															
10) Justin Harvey	11		3															
11) Larry Earp																		
12) Reid Raney										9								
13) John Seitz																		
14) Silas Weisel		4												4				
15) Pedro Conner		6					7								5			
16) Bert Bey																		
17) Robert Ensor						6							5					
18) Alvin Cox						6				8	9						7	

(Note: Numbers across the bottom represent the same individuals listed numerically. All data is hypothetical.)

Flow

Flow, as a concept, is the direction in which exchanges between people move. Flow of either information, interaction, influence, or stolen property, though discussed briefly before, should be mentioned here. Who is linked to whom and how closely, or through whom and how closely, can be an aid in determining information of importance to an investigation. If an investigator is interested in tracking how stolen property will likely be disseminated within the group, knowledge of the network structure will help. If chart 3 represents an updated network constructed from the original surveillance and adjusted to include subsequent knowledge of known associations and

Chart 3



connections, some revealing possibilities exist. If, for example, the investigator learns individual 15 (Pedro Conner) is offering stolen guns for sale, from the group structure he can hypothesize that the original suspect, Bert Bey (16), is supplied by Pedro. The investigator now can estimate through whom Pedro may be getting his guns or at least who is probably in a position to know about Pedro's activities. Since he is most closely associated with individual 8 (Feltus Robb), Feltus may be a likely suspect. Pedro also is linked, though not as closely, with individual 2 (Richard McGood), individual 14 (Silas Weisel), and individual 16 (Bert Bey), the original suspect. The investigator may want to explore those relationships as suppliers or distributors for individual 15 (Pedro). If stolen property begins to be offered by individuals connected with clique A, then the possibility arises that the people connecting the two groups are brokers.

The network displayed in chart 3 may also aid in developing witnesses and informants as the case progresses and be of assistance later when explaining in court the complex connections between conspirators. On the other hand, it may be possible to predict who, by virtue of network position, will be relatively isolated from information or group activity. If the investigator is receiving information from individual 13 (John Seitz), the investigator knows from John's position in the network that John probably knows more about the activities of clique A and less about clique B and seems to be most closely connected with individual 17 (Robert Ensor). Ensor, in turn, appears to get his information mostly from individual 18 (Alvin Cox) and individual 6 (Archy Hope).

For law enforcement purposes, it may be useful to predict who will potentially get an item of information or who will likely be asked to help and by whom. The network diagram may also aid in focusing efforts to learn what types of messages, in fact, flow between individuals at various points in the network structure, as well as aid in estimating the volume of information a particular person is likely to receive.

Relative Influence

A suspect's network position and the nature of the transactions between individuals of investigative interest can disclose the degree to which people, at given points, are subject to influence and allow an estimate for investigative purposes of the likelihood a person at a particular point in the network will be involved in criminal activity. If the

investigator knows that Feltus Robb (8) is involved, the accessibility and closer social proximity of individual 7 (Horace McLain) to Feltus Robb (chart 3) affects the likelihood Horace McLain and probably even Richard McGood (2) not only will have important information about Feltus but also may be involved to some extent in his crimes. The greater accessibility and closer social distance of individual 8 (Feltus Robb) to individual 7 (Horace McLain) may also affect Robb's potential ability to manipulate McLain. Information can be gathered and converted to an interaction matrix measuring, for example, the degree to which individual McLain sought out and talked to Robb. If Robb was sought out more frequently, he is in the more powerful and influential position. The mutually reciprocated exchange of interaction (in this case seeking out vs. sought after) indicates equal influence, and the unequal flow of seeking out behavior is evidence of unequal power and prestige.[27]

Centrality

Centrality is also a network concept with application to police work. It is an index of a person's accessibility and pertains to the number of network paths which pass through him.[28] While the group from chart 3 is divided into two major clusters, central individuals exist within and between clusters. From clique B, for example, individual 2 (Richard McGood) is in a position to affect the flow of communication, information, or maybe stolen property to and within that clique, thereby increasing his ability to gain power by manipulating people and information.[29] Individual 3 (Gordon Waid) is also central in terms of his overall group position and is even in a more powerful leadership position.

"Understanding which people are in the best network position to control information and manipulate others offers a tool for determining the direction an investigation should take."

Understanding which people are in the best network position to control information and manipulate others offers a tool for determining the direction an investigation should take. If a case is pursued based upon a preconceived notion of a group's structure which does not match the true criminal connections within, then the investigative focus may be misdirected. A group's apparent hierarchial structure need not necessarily match its true conspiratorial links.[30]

Centrality has to do with the degree an individual controls the flow of information, goods, and services.[31] Formal and informal leaderships consequently are disclosed in a network representation that displays the structure based upon interaction and important criminal links. The individuals who appear as leaders in some situations may be unimportant in a criminal investigation. Leadership tends to be differentiated into two functions.[32] The person who appears to be the most liked, the social leader, may be less important to a matter under investigation. "Task specialists," people who are less motivated to be liked and more inclined to move the group toward accomplishing its tasks, may be more important focuses of investigative activity.

Group Cohesiveness

Density, i.e., the degree to which members are in touch with each other as an index of potential communication, is an element of importance.[33] The density of relationships (group cohesiveness) is a measure of a network structure which may become evident from network charting. The degree of connection or oneness an individual has with a group is an aid to understanding the distinctions between cliques within a group in terms of members attitudes or criminal involvement.

Cohesive groups have clear boundaries, are difficult to enter and leave, and have members with a stronger sense of belonging.[34] These groups will be more difficult to penetrate in terms of developing information sources from within or in terms of outsiders gaining access to tightly held information within the group. Clique structure pictured in network form becomes even more important in investigations connected with such highly cohesive groups as motorcycle gangs, youth gangs, hate groups, or other groups with ritualized behavior patterns, including initiations, regular meetings, and other ceremonies.

Group-to-Group Analysis

Principles of network analysis may also serve law enforcement agencies in examining and understanding intergroup connections. The strategic network position of one group among many may give insight into the nature of those intergroup ties. The relationships people have with those associated with other groups serve to provide the links which tie groups together.[35] Groups have a network environment similar to individuals' contact networks.[36] The group network may be subjected to analysis to predict likely conspiratorial connections or sources of information. Groups central in a network may be the logical focus of intensified investigation. The network diagram may predict how stolen property is dispersed or where group members would turn for aid in solving a problem or harboring a fugitive from justice.

Conclusion

As one can see, networking is more than a map of linkages between individuals and groups. It is an investigative technique, using social science principles, that allows the investigator a deeper understanding of the behavior he observes and allows him to use his observations coherently and systematically to simplify and provide direction to complex conspiracy cases. For law enforcement purposes, the investigator may select a few components from the complex relationships between people and groups and break them down into a few significant connections to predict behavior of individuals systematically linked.

Out of the many elements that link people and determine their relative distance in social space, a few can be selected to develop the partial network of investigative interest. Although the elements used to construct the network must be understood only as guides, meanings can be derived from and given to this partial network, which discloses potential conspiratorial connections. When the sets of observed relations between individuals of investigative interest are charted as lines or links, conclusions can be drawn about the patterns those connections take.

When the network is perceived, the behavior of people of interest within the network is better understood. The meanings people of interest attribute to their connections can be further developed, so can the implications of those connections in terms of a person's potential of involvement in crime or the influence conspirators have over others. Network analysis is an important part of a conspiracy investigation and should not be overlooked as an investigative aid. **FBI**

Footnotes

[1] Claude S. Fischer, *Networks and Places: Social Relations in the Urban Setting* (New York: The Free Press, 1977), p. 33.

[2] Matrix data used was collected in a study by Allison Davis, Burleigh B. Gardner, and Mary R. Gardner, *Deep South: A Social Anthropological Study of Caste and Class* (Chicago: University of Chicago Press, 1941) and hypothetically adapted to the examples shown.

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[4] Jeremy Boissevain, *Friends of Friends* (New York: St. Martin's Press, 1975), p. 33.

[5] For an explanation of the technique of determining personality, predicting leadership, and probable coalitions from observations of interpersonal relations, see Robert Freed Bales, *Personality and Interpersonal Behavior* (New York: Holt, Rinehart, and Winston, 1970).

[6] Leon Festinger, Stanley Schacter, and Kurt W. Back, *Social Pressures in Informal Groups* (New York: Harper, 1950), p. 91.

[7] William J. Chambliss, "The Selection of Friends," *Social Forces,* vol. 43, 1965, p. 372.

[8] Theodore M. Newcomb, "The Study of Consensus," in *Sociology Today: Problems and Prospects,* eds. Robert K. Merton, et al. (New York: Basic Books, 1959). p. 288.

[9] Lois M. Verbrugge, "The Structure of Adult Friendships Choices," *Social Forces,* vol. 56, No. 2, December 1977, p. 576.

[10] B. M. Bass, *Social Behavior and the Orientation Inventory: A Review,* Technical Reports G, Contract NONR-624 (14), November 1965.

[11] Fred Attneave, "Dimensions of Similarity," *The American Journal of Psychology,* vol. LXIII, No. 4, October 1950.

[12] Boissevain, supra, p. 28; Pitirim Sorokin, *Social and Cultural Mobility* (New York: Free Press, 1959). p. 5.

[13] Emory S. Bogardus, "A Social Distance Scale," *Sociology and Social Research,* vol. 17, 1933, p. 265.

[14] Emory S. Bogardus, *Social Distance* (Yellow Springs, Ohio: Antioch Press, 1959), pp. 30–78.

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[16] Charles H. Hubbell, "The Effect of Weighted Links in Communication Networks," *Sociological Theories in Progress,* eds. Joseph Berger, et al. (New York: Houghton Mifflin, 1972). p. 260.

[17] Erving Goffman, *Relations in Public Microstudies of Public Order* (New York: Harper and Row, 1971). p. 100.

[18] David D. McFarland and Daniel J. Brown, "Social Distance as a Metric: A Systematic Introduction to Smallest Space Analysis," in *Bonds of Pluralism; The Form and Substance of Urban Social Networks,* ed. Edward O. Laumann (New York: John Wiley and Sons, 1973). p. 214.

[19] Ibid, p. 215.

[20] Sorokin, supra, p. 5

[21] Leon Festinger, "The Analysis of Sociograms Using Matrix Algebra," *Human Relations,* vol. 11, No. 2, 1949. See also, Breiger, supra, p. 181; James L. Stinson and Edward S. Heyman "Analytic Approaches For Investigating Terrorist Crimes," *Clandestine Tactics and Technology Series* (Gaithersburg, Md.: International Association of Chiefs of Police, Inc., 1980); Walter R. Harper and Douglas H. Harris, "The Application of Link Analysis to Police Intelligence," *Human Factors,* vol. 17, No. 2, 1975, p. 158.

[22] Festinger, supra.

[23] Joseph B. Kruskal and Myron Wish, *Multidimensional Scaling* (Beverly Hills, Calif.: Sage 1978).

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