CHAPTER 6

Weak Ties

BRIDGES

The San Francisco Bay is crossed by seven bridges. The ones first built, the Dumbarton and the San Mateo, are not the most important but rather were built in the early part of the 20th century where the bay is shallower and where the engineering challenges were not as great. The most important bridge in terms of traffic is the San Francisco–Oakland Bay Bridge, constructed a decade after the first two. Its importance lies not only in the fact that it connected the two largest cities in the Bay Area at the time, Oakland and San Francisco. It is important also because distances between population centers were drastically reduced. San Franciscans not taking a ferry boat could get to Oakland only through a lengthy detour down the peninsula to the San Mateo Bridge and the East Bay from Modesto to Oakland. The trip to Marin County across the Golden Gate north of San Francisco was much worse. The importance of a bridge must be a function of the way it reduces distances in a region.

The concept of a *bridge* is also useful in networks and graphs. Consider the communication network in Figure 6.2.

The deletion of the edge between Vertices 1 and 2 would affect only the distance between themselves; it would increase from 1 to 2, but no other pair of vertices would be affected. The connection between 1 and 3, however, is more important. If it were deleted the distances between 1 and 3, 1 and 4, 1 and 5, and 1 and 6 would be increased. Any information originating at Vertex 1 would take longer to diffuse to the group, and vice versa.

The edge between Vertices 3 and 4 is clearly the most important in reducing distances between vertices; it is the Oakland Bay Bridge of this network. The distances between nine pairs are reduced by its presence, more than any other edge, and the degree of reduction is also the greatest; what would be two disconnected components without it becomes one.

Definition. A bridge is an edge whose deletion from a graph causes the number of components to increase.

Clearly bridges are an extreme example of the effect of one edge. We can order edges in terms of the degree to which their removal or addition

Figure 6.1. The seven San Francisco Bay bridges.

Figure 6.2. A network with a bridge.

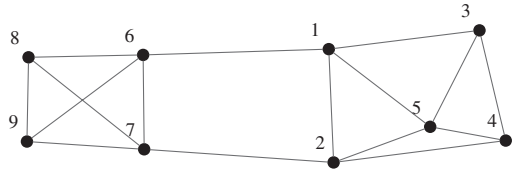

Figure 6.3. A network with local bridges.

affects distances in a graph. Following Granovetter (1973) we will define a *local bridge of degree n* as one whose deletion increases the distance between the two involved vertices from 1 to n. For example, look at Figure 6.3 (from Figure 1 in Granovetter, 1973)

The 6-1 tie is not a bridge; its removal does not increase the number of components. But it is a local bridge of degree 3 because the next shortest path between 6 and 1 is of length 3: from 6 to 7 to 2 to 1.

THE STRENGTH OF WEAK TIES

Now that we've gotten some of the mathematical preliminaries out of the way, let's tackle a substantive issue. How do people find out about jobs? Are relatives, close friends, acquaintances, employment agencies, or newspaper advertisements the most useful sources about jobs? Mark

Granovetter, a sociology graduate student, tried to answer this question in his PhD research. He sent questionnaires to about 200 people in the Boston area who had changed jobs or recently been employed and succeeded in interviewing about 100 of them. All of these were what he called "professional, technical, or managerial" workers; they were not blue-collar workers.

Granovetter was interested in how his respondents found out about their current jobs. Economists like to assume that buyers and sellers in the marketplace, including the marketplace for labor, have "perfect information." This means that all workers know about all the job possibilities for which they are qualified. Such a model might be not too unreasonable if most workers found their jobs through advertisements or through employment agencies. However, Granovetter found that more than half found out about the job opening that led to their current employment through personal contacts; they knew someone who knew about the job opening. Specifically, 56% found their current job through personal contacts, only 19% through advertisements or employment agencies, and 19% through direct application to the firm that hired them (the remaining 7% used other methods or did not answer the question).

Thus, not surprisingly, the model used by economists is misleading. The information people possess about job possibilities is affected by their placement within networks. Let us give you a few examples from Granovetter's book:

> Edward A., during high school, went to a party given by a girl he knew. There, he met her older sister's boy friend, who was ten years older than himself. Three years later, when he had just gotten out of the service, he ran into him at a local hangout. In conversation, the boy friend mentioned to Mr. A that his company had an opening for a draftsman; Mr. A applied for the job and was hired. (1973, 76)

> Norman G's daughter was in nursery school, where she met the daughter of a lawyer who consequently became friendly with him. When Mr. G. quit his job, the lawyer told him of an opening in the accounting area of a firm which was one of his clients. He applied, and was hired. (1973, 78)

Note how indirect this knowledge is. Granovetter found that many of the paths between the job and the new employee were surprisingly indirect; the person who told her about the job was often someone she did not know very well. Edward found out about the job from his sister's old boyfriend, Norman from another parent in his child's nursery school. Granovetter tried to assess the strength of the relationships between the job seeker and the person who informed him of the job using easy-to-answer questions in interviews and questionnaires. The questions he asked were how often his job seekers saw the person who told them about their new jobs and

whether the person was a friend, a relative, or a business contact. Using these questions, Granovetter distinguished between "strong" and "weak" ties. Strong ties exist when people see each other frequently over long periods of time. The relationship is close and intimate. Weak ties are the opposite; weakly tied individuals see one another infrequently, and their relationships are casual rather than intimate.

Granovetter had good reasons for expecting that strong ties would be more useful than weak ties. Those with whom one has strong ties have one's interests at heart. They will give the job seeker whatever valuable information they have. They might also be expected to exert whatever influence they have on behalf of the job seeker. Moreover, the greater frequency of contact means that they have more opportunities to advise the job seeker and have better information about his interests and skills.

Despite all these good reasons why job seekers might be expected to get more and better information from those with whom they had strong ties, the opposite was actually the case. Job seekers almost always found out about the new jobs from people they saw occasionally (less than once a week but at least once a year) or rarely (less than once a year). They also did not find out about their new jobs from friends or relatives (only 31% did). In addition, the jobs that were found through weak ties were on the average better than the jobs found through strong ties; they were better paying, and the workers were more satisfied.

Granovetter did not have adequate information to definitely pinpoint why weak ties were more valuable. He did, however, offer an insightful conjecture, one that has proven to be valuable for others studying the diffusion of information in networks. A person's close friends and relatives who are likely to move in his own social circles are likely to know one another. Therefore, the information they provide is likely to be redundant; what he hears from one friend he is likely to have heard from others as well because they talk to one another and they are themselves exposed to the same sources of information.

On the other hand, one's acquaintances are likely to come from different social circles. They are likely to be different from the job seeker herself and different from each other. Therefore, they are exposed to different sources of information. Each of them will tell the job seeker things she has not heard from other acquaintances or friends.

One's good friends, relatives, and others one sees frequently are likely to have relations with each other, but this is not true of one's acquaintances. Figure 6.4 gives the diagram of this situation.

The people in ego's strong-ties network tend to be tied to one another. The people in ego's weak-ties network may not even know one another. One's weak ties all live in different worlds, and therefore each supplies one with unique information unavailable from other sources. Granovetter suggests that there is a forbidden triad when there are strong ties. If A is connected to B by a strong tie and A is connected to C by a strong tie, then it is impossible for there to be no ties between B and C. Hence, the triad

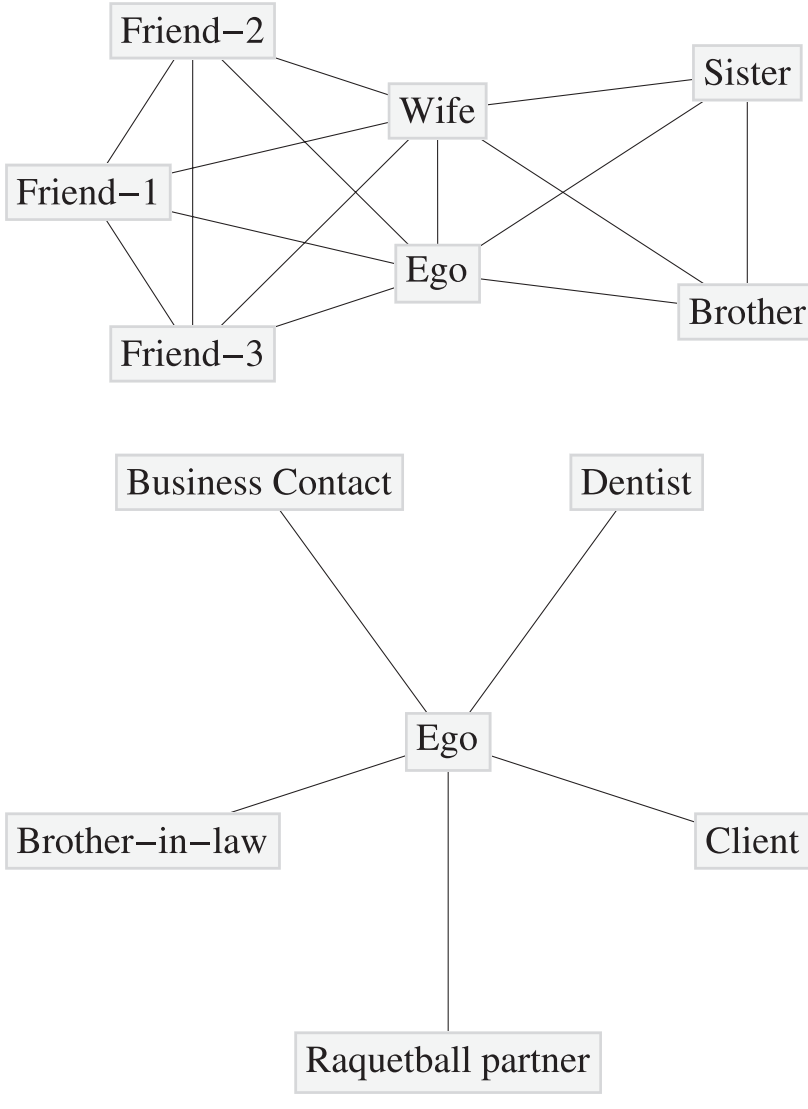

Figure 6.4. Networks of strong and weak ties.

given Figure 6.5 should occur seldom or not at all. We discuss the idea of certain micro configurations not occurring in Chapter 13.

Granovetter is suggesting that strong ties have a weakened form of transitivity; if A has a strong tie with B and B with C, then there will be a ties, strong or weak, between A and C.

The consequence of the forbidden triad is that strong ties will almost never be bridges or local bridges; bridges and local bridges, which provide new information to the individual, will be weak ties exclusively. If strong

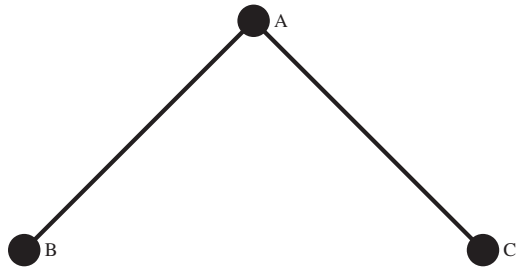

Figure 6.5. The forbidden triad.

ties were a bridge and either one of its nodes had strong ties to a third person, and then the triangle would be complete, the third tie would be strong or weak, and so the initial bridging ties would not in fact be a bridge.

Now, the important point is that information about a job (or about anything) else will diffuse more widely and more quickly because of nontransitive weak ties, which are more likely to bridge otherwise unconnected social worlds (bridges) or at least shorten dramatically the distances between nodes (local bridges).

Chapter Demonstrations

Finding Bridges tests your understanding of bridges and local bridges.

EXERCISES

1. In the notebook *Finding Bridges* the edges in random graphs are colored red if they bridges and green if they are local bridges. Generate random graphs until you are able to predict successfully which edges are bridges and which edges are local bridges. Infer from your experiences what criterion the computer is using to identify local bridges.
2. Use the demonstration *Transitivity Game* (Chapter 4) until you make no mistakes. The demonstration lists the number of intransitive triads and the minimum number of arcs to be added to create a transitive network. Why are these two numbers not always the same?
3. Which of the following six relations are likely to be more transitive and which less. Pick out the three more transitive relations.

   (a) Facebook "friend"
   (b) Kin
   (c) Close personal friend
   (d) Coworker in an office
   (e) Share a taxi ride
   (f) Has sex with