

Chapter 7

The Social Capital of Structural Holes

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INTRODUCTION

This chapter — drawn in large part from lengthy review elsewhere of argument and evidence on social capital (Burt, 2000) — is about current work on the social capital of structural holes. I begin broadly with social capital in metaphor, get more specific with four network mechanisms that define social capital in theory (contagion, prominence, closure, and brokerage across structural holes), then focus on three categories of empirical evidence on the fourth mechanism: evidence of rewards and achievement associated with brokerage, evidence of creativity and learning associated with brokerage, and evidence on the process of bridging structural holes.

SOCIAL CAPITAL METAPHOR

Figure 1 is an overview of social capital in metaphor and network structure. The diagram is a road map through the next few pages, and a reminder that beneath general agreement about social capital as a metaphor lie a variety of network mechanisms that can make contradictory predictions about social capital.

Cast in diverse styles of argument (e.g., Coleman 1990; Bourdieu and Wacquant 1992; Burt 1992; Putnam 1993), social capital is a metaphor about advantage. Society can be viewed as a market in which people exchange all variety of goods and ideas in pursuit of their interests. Certain people, or certain groups of people, do better in the sense of receiving higher returns to their efforts. Some people enjoy higher incomes. Some more quickly become prominent. Some lead more important projects. The interests of some are better served than the interests of others. The human capital explanation of the inequality is that the people who do better are more able individuals; they are more intelligent, more attractive, more articulate, more skilled.

Social capital is the contextual complement to human capital. The social capital metaphor is that the people who do better are somehow better connected. Certain people or certain groups are connected to certain others, trusting certain others, obligated to support certain others, dependent on exchange with certain others. Holding a certain position in the structure of these exchanges can be an asset in its own right. That asset is social capital, in essence, a concept of location

effects in differentiated markets. For example, Bourdieu is often quoted as in Figure 1 for defining social capital as the resources that result from social structure (Bourdieu and Wacquant 1992, 119, expanded from Bourdieu 1980). Coleman, another often-cited source as quoted in Figure 1, defines social capital as a function of social structure producing advantage (Coleman 1990, 302; from Coleman 1988, S98). Putnam (1993, 167) grounds his influential work in Coleman's metaphor, preserving the focus on action facilitated by social structure: "Social capital here refers to features of social organization, such as trust, norms, and networks, that can improve the efficiency of society by facilitating coordinated action." I echo the above with a social capital metaphor to begin my argument about the competitive advantage of structural holes (Burt 1992, 8, 45).

———— Figure 1 About Here ————

So there is a point of general agreement from which to begin a discussion of social capital. The cited perspectives on social capital are diverse in origin and style of accompanying evidence, but they agree on a social capital metaphor in which social structure is a kind of capital that can create for certain individuals or groups a competitive advantage in pursuing their ends. Better connected people enjoy higher returns.

NETWORK MECHANISMS

Disagreements begin when the social-capital metaphor is made concrete in terms of network mechanisms that define what it means to be "better connected."

Connections are grounded in the history of a market. Certain people have met frequently. Certain people have sought out specific others. Certain people have completed exchanges with one another. There is at any moment a network, as illustrated in Figure 2, in which individuals are variably connected to one another as a function of prior contact, exchange, and attendant emotions. Figure 2 is a generic sociogram and density table description of a network. People are dots. Relations are lines. Solid (dashed) lines connect pairs of people who have a strong (weak) relationship.

In theory, the network residue from yesterday should be irrelevant to market behavior tomorrow. I buy from the seller with the most attractive offer. That seller may or may not be the seller I often see at the market, or the seller from whom I bought yesterday. So viewed, the network in Figure 2 would recur tomorrow only if buyers and sellers come together as they have in the past. Recurrence would have nothing to do with the prior network as a causal factor. It would be only a by-product of buyers and sellers seeking one another out for their personal best exchange.

Selecting the best exchange, however, requires that each person has information on available goods, sellers, buyers, and prices. This is the point at which network mechanisms enter the analysis. The structure of relationships among people and organizations in a market can affect, or replace, information.

Network Contagion and Prominence as Social Capital

Replacement happens when market information is so ambiguous that people use network structure as the best available information. Such assumption underlies discussion of network contagion and prominence as social capital (to the left in Figure 1).

For example, transactions could be so complex that available information cannot be used to make a clear choice between sellers, or available information could be ambiguous such that no amount of it can be used to pick the best exchange. White (1981) argues that information is so ambiguous for producers that competition is more accurately modeled as imitation. Producers in White's model deal with the ambiguity of market information by focusing instead on their position relative to other producers. Markets emerge as separate cliques of interdependent producers. White (Chapter 6, this volume) provides a sketch of the broader argument, and empirical support can be found for even simple versions of the argument (e.g., Burt 1992, 197-208; cf. Baker 1984).

More generally, presumptions ambiguous market information underlie social contagion explanations of firms adopting policies in imitation of other firms (e.g., Greve 1995; Davis and Greve 1997; see Strang and Soule 1998, for review; Burt 1987, on network mechanisms that drive contagion), or people more likely to

undertake an entrepreneurial venture if people they know are doing so (Abell, 1996, on legitimation networks as social capital). Zuckerman's (1999) market model is an important development in that the model goes beyond predicting where producer conformity is most likely, to describe penalties that producers pay for deviating from accepted product categories, and the audience (mediators) that enforce penalties.

Information quality is also the problem addressed in Podolny's concept of status as market signal (Podolny 1993; Podolny, Stuart and Hannan 1997; Podolny 2001). Podolny (1993) describes how investors, not able to get an accurate read on the quality of an investment opportunity, look to an investment bank's standing in the social network of other investment banks as a signal of bank quality. Banks higher in status are able therefore to borrow funds at lower cost and enjoy higher margins.

Network contagion and prominence could be studied as social capital, but they are more often discussed as other concepts. Contagion can be an advantage in that social structure facilitates the transmission of beliefs and practices between certain people and organizations (a theme in Bourdieu's discussion of cultural capital), but it is more familiar as the mechanism for imitation in institutional theory (e.g., Strang and Soule 1998). Network prominence has long been studied as an advantage for people (e.g., Brass 1992) and organizations (e.g., Podolny 1993), but it is more often discussed in contemporary economics and sociology as reputation or status.

Network Closure as Social Capital

The network mechanisms typically discussed as social capital are the last two in Figure 1, closure and brokerage. In these mechanisms, networks do not replace information so much as they affect the flow of information and what people do with it.

Closure and brokerage both begin with the assumption that communication takes time, so prior relationships affect who knows what early. Information can be expected to spread across the people in a market, but it will circulate within groups before it circulates between groups. A generic research finding is that information circulates more within than between groups — within a work group more than between groups, within a division more than between divisions, within an industry more than between industries (e.g., Festinger, Schachter and Back 1950, is often

cited as an early exemplar in this research). For example, the sociogram in Figure 2 shows three groups (A,B,C), and the density table at the bottom of the figure shows the generic pattern of in-group relations stronger than relations between groups in that diagonal elements of the table are higher than off-diagonals (each cell of a density table is the average of relations between individuals in the row and individuals in the column). The result is that people are not simultaneously aware of opportunities in all groups. Even if information is of high quality, and eventually reaches everyone, the fact that diffusion requires an interval of time means that individuals informed early or more broadly have an advantage.

Networks with closure — that is to say networks in which everyone is connected such that no one can escape the notice of others, which in operational terms usually means a dense network — creates advantage by lowering the risk of cooperation. The argument is associated with Coleman (1988, 1990), but Putnam's (1993) application to community development greatly expanded the audience for the argument (for review, see Portes 1998; Woolcock and Narayan 2001; also see Portes and Mooney, Chapter 12, this volume, for review and comparative analysis of three communities to illustrate how the social capital of closure can be contingent on other material and institutional resources).

———— Figure 2 About Here ————

Coleman's argument is that closure does two things for people in the closed network. First, it affects access to information (Coleman 1990, 310; cf. 1988, p. S104): "An important form of social capital is the potential for information the inheres in social relations. . . . a person who is not greatly interested in current events but who is interested in being informed about important developments can save the time required to read a newspaper if he can get the information he wants from a friend who pays attention to such matters." For example, noting that information quality deteriorates as it moves from one person to the next in a chain of intermediaries, Baker (1984; Baker and Iyer 1992) argues that markets with networks of more direct connections improve communication between producers, which stabilizes prices, the central finding in Baker's (1984) analysis of a securities exchange.

Second, and this is the benefit more emphasized by Coleman, network closure facilitates sanctions that make it less risky for people in the network to trust one another. Illustrating the trust advantage with rotating-credit associations, Coleman (1988, S103; 1990, 306-307; see Biggart 2000, for a closer look at how such associations operate) notes; “But without a high degree of trustworthiness among the members of the group, the institution could not exist — for a person who receives a payout early in the sequence of meetings could abscond and leave the others with a loss. For example, one could not imagine a rotating-credit association operating successfully in urban areas marked by a high degree of social disorganization — or, in other words, by a lack of social capital.” With respect to norms and effective sanctions, Coleman (1990, 310-311; cf. 1988, S104) says; “When an effective norm does exist, it constitutes a powerful, but sometimes fragile, form of social capital. . . . Norms in a community that support and provide effective rewards for high achievement in school greatly facilitate the school’s task.” Coleman (1988, S107-S108) summarizes; “The consequence of this closure is, as in the case of the wholesale diamond market or in other similar communities, a set of effective sanctions that can monitor and guide behavior. Reputation cannot arise in an open structure, and collective sanctions that would ensure trustworthiness cannot be applied.”

Coleman’s closure argument is prominent with respect to social capital, but it is not alone in predicting that dense networks facilitate trust and norms by facilitating effective sanctions. In sociology, Granovetter (1985; 1992, 44) argues that the threat of sanctions makes trust more likely between people who have mutual friends (mutual friends being a condition of structural embeddedness): “My mortification at cheating a friend of long standing may be substantial even when undiscovered. It may increase when the friend becomes aware of it. But it may become even more unbearable when our mutual friends uncover the deceit and tell one another.” There is an analogous argument in economics (the threat of sanctions creating a reputation effect, e.g., Tullock 1985; Greif 1989): Mutual acquaintances observing two people (a) make behavior between the two people public, which (b) increases the salience of reputation for entry to future relations with the mutual acquaintances, (c) making

the two people more careful about displaying cooperation, which (d) lowers the risk of trusting the other to cooperate.

Structural Holes as Social Capital

Where closure creates advantage by lowering the risk of cooperation, the fourth network mechanism in Figure 1, brokerage, creates advantage by increasing the value of cooperation. The argument draws on network concepts that emerged in sociology during the 1970s; most notably Granovetter (1973) on the strength of weak ties, Freeman (1977) on betweenness centrality, Cook and Emerson (1978) on the benefits of exclusive exchange partners, and Burt (1980) on the autonomy created by complex networks. More generally, sociological ideas elaborated by Simmel (1955 [1922]) and Merton (1968 [1957]) on the autonomy generated by conflicting affiliations are mixed in the hole argument with concepts of monopoly power and oligopoly to produce network models of competitive advantage.

The weaker connections between groups in Figure 2 are holes in the social structure of the market. These holes in social structure — or more simply, structural holes — create a competitive advantage for an individual whose network spans the holes (Burt, 1992). The structural hole between two groups does not mean that people in the groups are unaware of one another. It only means that the people are focused on their own activities such that they do not attend to the activities of people in the other group. Holes are buffers, like an insulator in an electric circuit. People on either side of a structural hole circulate in different flows of information. Structural holes are an opportunity to broker the flow of information between people, and control the projects that bring together people from opposite sides of the hole.

Information Benefits of Bridging Structural Holes

Structural holes separate nonredundant sources of information, sources that are more additive than overlapping. There are two network indicators of redundancy: cohesion and equivalence. Cohesive contacts (contacts strongly connected to each other) are likely to have similar information and so provide redundant information.

Structurally equivalent contacts (contacts who link a manager to the same third parties) have the same sources of information and so provide redundant information.

Robert and James in Figure 2 have the same volume of connections, six strong ties and one weak tie, but Robert has something more. James is connected to people within group B, and through them to friends of friends all within group B. James can be expected to be well informed about cluster B activities. Robert is also tied through friends of friends to everyone within group B, but in addition, his strong relationship with contact 7 is a conduit for information on group A, and his strong relationship with 6 is a conduit for information on group C. His relationship with 7 is for Robert a network bridge in that the relationship is his only direct connection with group A. More, his relationship with contact 6 meets the graph-theoretic definition of a network bridge: break the relationship and there is no connection between groups B and C. More generally, Robert is a broker in the network. Network constraint is an index that measures the extent to which a person's contacts are redundant (Burt 1992). James has a constraint score twice Robert's (30.9 versus 14.8) and Robert is the least constrained of the people in Figure 2. Network betweenness, proposed by Freeman (1977), is an index that measures the extent to which a person brokers indirect connections between all other people in a network. Robert's betweenness score of 47.0 shows that almost half of indirect connections run through him. His score is the highest in Figure 2, well-above the average 6.5 score, and much higher than James' below-average 5.2 score.

Robert's bridge connections to other groups give him an advantage with respect to information access. He reaches a higher volume of information because he reaches more people indirectly. Further, the diversity of his contacts across the three separate groups means that his higher volume of information contains fewer redundant bits of information. Further still, Robert is positioned at the cross-roads of social organization so he is early to learn about activities in the three groups. He corresponds to the opinion leaders proposed in the early diffusion literature as the individuals responsible for the spread of new ideas and behaviors (Burt 1999). Also, Robert's more diverse contacts mean that he is more likely to be a candidate discussed for inclusion in new opportunities. And there is a feedback loop in which

benefits beget more benefits: Robert's early access to diverse information him more attractive to other people as a contact in their own networks.

Control Benefits of Bridging Structural Holes

The information benefits make Robert more likely to know when it would be valuable to bring together certain disconnected contacts, which gives him disproportionate say in whose interests are served when the contacts come together. More, the holes between his contacts mean that he can broker communication while displaying different beliefs and identities to each contact (robust action in Padgett and Ansell 1993; see Breiger 1995, on the connection with structural holes; cf. Hargadon 1998, on knowledge brokers). Simmel and Merton introduced the sociology of people who derive control benefits from structural holes: The ideal type is the tertius gaudens (literally, "the third who benefits," see Burt 1992, 30-32, for review).

Robert in Figure 2 is an entrepreneur in the literal sense — a person who adds value by brokering connections between others (Burt 1992, 34-36, and "Adaptive Implementation" below). Bringing together separate pieces is the essence of entrepreneurship. There is no value to a venture if it only connects people already connected. As Stewart (1990, p. 149, deleting quotation marks and citations from original) reports from economic anthropology, entrepreneurs focus on: "those points in an economic system where the discrepancies of evaluation are the greatest, and ... attempt to construct bridging transactions. Bridging roles are based on the recognition of discrepancies of evaluation, which requires an edge in information about both sides of the bridge. Because this requires an information network, bridgers will commit time, energy, travel, and sociability to develop their personal networks. For many entrepreneurs, their most significant resource is a ramifying personal network." In terms of the structural-hole argument, structures rich in holes are entrepreneurial networks, and network entrepreneurs are people who build interpersonal bridges across structural holes. Speeding the process toward equilibrium, network entrepreneurs operate somewhere between the force of corporate authority and the dexterity of markets, building bridges between disconnected parts of markets and organizations where it is valuable to do so.

There is tension here, but not the hostility of combatants so much as the uncertainty of change. In the swirling mix of preferences characteristic of social networks, value is created by network entrepreneurs strategically moving accurate, ambiguous, or distorted information between people on opposite sides of structural holes in the routine flow of information. The information and control benefits of bridging the holes reinforce one another at any moment in time, and cumulate together over time. Thus, individuals with networks rich in structural holes are the individuals who know about, have a hand in, and exercise control over, more rewarding opportunities. The behaviors by which they develop the opportunities are many and varied, but opportunity itself is defined by a hole in social structure.

HOLE HYPOTHESIS

In sum, the hypothesis is that in comparisons between otherwise similar people like James and Robert in Figure 2, it is Robert who has more social capital. Specifically, using Figure 3 as a frame of reference for the next few pages, the hole hypothesis has three components: Robert has an advantage in seeing productive new ideas, bringing the ideas to fruition, and so obtaining higher returns to his efforts.

First is the question of what to do. What projects are available? On which should we focus? With early access to diverse, often contradictory, information and interpretations, people whose networks span structural holes can expect to find themselves synthesizing new understandings, seeming to others to be gifted with creativity. Putting aside the individuals involved, creativity and learning will occur more often where relationships bridge structural holes.

Next is the question of implementation. Established ideas have ready constituency and allocated budget. New ideas typically have neither. The more innovative the idea, the lower the probability that constituency or budget exists a priori. Social capital offers an advantage in knowing who to connect for support, how to connect them, and when. Implementation responsive to new and changing circumstances can be distinguished as adaptive implementation, and social capital facilitates it. Networks rich in structural holes (a) provide a broad base of referrals to customers, suppliers, alliances and employees for a project, (b) improve due

diligence on potential customers, suppliers, alliances, employees, financing, and alternative organization models, and (c) increase the probability of knowing which of alternative ways to pitch the project will most appeal to specific potential customers, suppliers, or other sources of support. Thus, individuals rich in the social capital of structural holes are not only more likely to be creative in seeing opportunities, they are also more likely to launch projects to take advantage of the opportunities. And (d), the projects they launch are more likely to reach fruition because network entrepreneurs are more likely to anticipate and adapt to the problems that will inevitably arise. They are aware of trouble sooner, more flexible in re-shaping a project to adapt to exogenous change (vividly illustrated in networks of drug traffic, Williams 1998; Morselli 2001; or health insurance fraud, Tillman and Indergaard 1999), and more able to control the interpretations others give to the project by tailoring solutions to the specific individuals brought together for the project.

———— Figure 3 About Here ————

The third category in Figure 3 is about benefits — achievement and rewards as a result of action taken. Adaptive implementation, and the creativity and learning associated with it, together create an association between brokerage and benefits. In fact, studying the association with benefits is a logical place in which to begin research on the social capital of structural holes because the first two component effects in Figure 3 are implicit in the association. There is little incentive to look for brokerage effects on creativity, learning, or adaptive implementation, if brokerage has no association with achievement and rewards. Benefits is where I begin my review. There is evidence of brokerage associated with more positive evaluations, more successful teams, faster promotion, and higher compensation.

INDIVIDUAL AND GROUP BENEFITS

Three categories of evidence show achievement and rewards associated with brokerage. Lab experiments with small-group exchange networks show that resources accumulate in brokers, people with exclusive exchange relations to otherwise disconnected partners (e.g., Cook and Emerson 1978; Cook et al. 1983; Markovsky, Willer and Patton 1988; see Willer 1999, for review).

Census data on economic transactions have been used to describe how producer profit margins increase with structural holes in networks of transactions with suppliers and customers. Burt (1983) described the association in 1967 with profits in American manufacturing markets defined at broad and detailed levels of aggregation, and extended the results to include nonmanufacturing through the 1960s and 1970s (Burt 1988, 1992). Burt, Guilarte, Raider and Yasuda (2002) refined the nonlinear form of the model to more accurately describe the association between performance and market network, and extended the results through the early 1990s. Using profit and network data on markets in other countries, similar results have been found in Germany during the 1970s and 1980s (Ziegler 1982), Israel in the 1970s (Talmud 1994), Japan in the 1980s (Yasuda 1996), and Korea in the 1980s (Jang 1997).

Third, archival and survey data on interpersonal relations have been used to describe the career advantages of having a contact network rich in structural holes. An early, widely known, study is Granovetter's (1995 [1974]) demonstration that white-collar workers find better jobs faster through weak ties that bridge otherwise disconnected social groups (see Burt 1992, 25-30, on weak ties across structural holes). Lin worked with several colleagues to present evidence of the importance of ties to distant contacts for obtaining more desirable jobs (e.g., Lin, Ensel and Vaughn 1981; Lin and Dumin 1986; Lin 1999). Similar empirical results appear in Campbell, Marsden and Hurlbert (1986), Marsden and Hurlbert (1988), Flap and De Graaf (1989), Boxman et al. (1991), Lin and Bian (1991), Wegener (1991), Bian (1994, Chapter 5), and in more recent empirical studies (Leenders and Gabbay 1999; Lin, Cook and Burt 2001). Lin (1999, 2001) provides an integrative review of such research through a focus on networks as a resource for status attainment.

In particular, organizations have been a fruitful site for network studies of social capital. Burt (1992, 1995, 1997, 1998) and Podolny and Baron (1997) present survey evidence from probability samples of managers in two high-technology electronics firms showing that senior managers with networks richer in structural holes are more likely to get promoted early (see Burt 2000, Figure 3C, for data graph and discussion). Burt, Hogarth and Michaud (2000) present evidence from a French

chemical firm of salary increasing with the structural holes in a manager's network, and Burt (1997, 2001) presents evidence of higher bonus compensation to investment officers with networks richer in structural holes (see Burt 2000, Figure 3D and 3E, for data graphs and discussion). Mehra, Kilduff and Brass (2000) find that supervisors in a small high-technology company give higher performance evaluations to employees whose networks bridge otherwise disconnected parts of their organization. Mizruchi and Sterns (2001), studying loan officers in a large commercial bank, show that the officers whose networks span structural holes in the firm (in the sense of being less dense and less hierarchical) are more likely to be successful in bringing a deal to closure. Working with more limited data, Sparrowe and Popielarz (1995) innovatively reconstruct past networks around managers to estimate the effects of holes in yesterday's network on promotion today (cf. Hansen 1999, 93), Gabbay (1997) shows that promotions occur more quickly for sales people with strong-tie access to structural holes (cf. Meyerson 1994, on manager income as a function of strong ties), and Gabbay and Zuckerman (1998) show that expectations of promotion are higher for research and development scientists whose networks are richer in spanning structural holes.

Information and control benefits to individuals aggregate to the management teams on which they serve. For example, Rosenthal (1996) studied the performance of teams in several Midwest manufacturing plants. Troubled by the variable success of total quality management (TQM) teams, and inspired by Ancona and Caldwell's (1992b) demonstration that networks beyond the team are associated with team performance, Rosenthal wanted to see whether the structure of external relationships had the effect predicted by the hole argument. Studying TQM teams across plants operated by a midwest manufacturing company, she shows that more successful teams are composed of people with less constrained networks beyond the team (see Burt 2000, Figure 3B, for data graph and discussion). Hansen (1999) studied new-product teams in one of America's leading electronics and computer firms, a firm segmented by geography and product lines into 41 divisions. The network data are aggregate in that Hansen asked the R&D manager in each division to describe the extent to which people in his or her division

had frequent and close working relationships with other divisions. Team performance is measured by the relative speed with which a team moves from initiation (first employee dedicated to the project) to completion (product released to shipment). Faster solutions are to be expected from teams with the social capital of bridge relationships that span the structural holes between divisions, and Hansen found that teams reached completion more quickly when they were in divisions with frequent and close relations to other divisions. Hansen, Podolny and Pfeffer (2000) study the interpersonal networks around the teams. Each team member was asked to name intra-division contacts from whom he or she had regularly sought information and advice, then asked about relations between the contacts. Teams more quickly completing their assigned task contained people with more non-redundant contacts beyond the team (measured by “advice size” and “sparseness”).

Related results are reported by Krackhardt and Stern (1988) on higher performance in student groups with cross-group friendships, and in numerous studies of inter-organization networks (also see Leana and Van Buren 1999, on corporate social capital): Fernandez and Gould (1994) on organizations in broker positions within the national health policy arena being perceived as more influential, Provan and Milward (1995) on higher performing mental health systems that have a hierarchical, rather than a dense, network structure, Geletkanycz and Hambrick (1997) on higher company performance when top managers have boundary-spanning relationships beyond their firm and beyond their industry, Pennings, Lee and Witteloostuijn (1998) on the survival of accounting firms as a function of strong partner ties to client sectors, Stuart and Podolny (1999) on the higher probability of innovation from semiconductor firms that establish alliances with firms outside their own technological area, McEvily and Zaheer (1999) on the greater access to competitive ideas enjoyed by small job manufacturers with more non-redundant sources of advice beyond the firm (and see McEvily and Marcus 2000, on the lower absorptive capacity of these organizations when their sales network is concentrated in a single customer), Sørensen (1999) on the negative effect on firm growth of redundant networks beyond the firm, Llobrera, Meyer and Nammacher (2000) on the importance of non-redundant networks to the development of Philadelphia's

biotechnology district, Ahuja (2000) on the higher patent output of organizations that hold broker positions in the network of joint ventures or alliances at the top of their industry, Baum, Calabrese and Silverman (2000) on the faster revenue growth and more patents granted to biotechnology companies that have multiple kinds of alliance partners at start-up, Koput and Powell (2000) on the higher earnings and survival chances of biotechnology firms with more kinds of activities in alliances with more kinds of partner firms, and Podolny (2001) on the higher probability of early-stage investments surviving to IPO for venture-capital firms with joint-investment networks of otherwise disconnected partners.

Suggestive results come from research in which networks beyond the team are inferred from the demography of the people within the team. Ancona and Caldwell (1992a) provide a study of this type describing 409 individuals from 45 new-product teams in five high-technology companies. Teams were distinguished by managerial ratings of innovation, member reports on the volume of communication outside the team (Ancona and Caldwell 1992b, distinguish types of communication), functional diversity (members from multiple functions) and tenure diversity (members vary in their length of time with the firm). Structural holes are implicit in the boundaries between corporate divisions and the boundaries between cohorts of employees in that each division or cohort is presumed to have its own unique perspectives, skills, or resources. A team composed of people from diverse corporate functions spans more structural holes in the firm, and so has faster access to more diverse information and more control over the meaning of the information, than a team composed of people from a single function. For tenure diversity, replace the timing and control advantages of access to more functionally diverse information with the same advantages stemming from access to information that differs between employees long with the firm who are familiar with how things have worked before and newer employees more familiar with procedures and techniques outside the firm.

More innovative solutions are to be expected from teams with the social capital of bridge relationships that span the structural holes between divisions (see “Creativity and Learning” below for detailed discussion), and Ancona and Caldwell

report higher managerial ratings of innovation for teams with more external communication, and more external communication by teams drawn from diverse functions.

Tenure diversity has the opposite effect. Ancona and Caldwell report some benefits of tenure diversity associated with higher evaluations of team performance, but the aggregate direct effect of tenure diversity is lower performance. Presumably, people drawn from widely separate employee cohorts have more difficulty with communication and coordination within the team.

The conflicting results are brought together in a productive way by Reagans and Zuckerman (2001) in their study of performance in 223 corporate R&D units within 29 major American firms in eight industries. They report higher levels of output from units in which scientists were drawn from widely separate employee cohorts (implying that their networks reached diverse perspectives, skills and resources outside the team) and there is a dense communication network within the unit. In other words, the negative association between performance and tenure diversity reported by Ancona and Caldwell could have been positive if the density of communication within the team had been held constant. Tenure diversity (or other kinds of diversity, see Williams and O'Reilly 1998) can be disruptive because of the difficulties associated with communicating and coordinating across different perspectives, but when communication is successful (as implied by a dense communication network within the team), team performance is enhanced by the timing and control advantages of the team having access to more diverse information. This is as Ancona and Caldwell initially predict, and as predicted by the hole argument (also see Dyer and Nobeoka 2000, a case study of Toyota's supplier network in which Toyota promotes coordination among diverse suppliers by investing in infrastructure to facilitate knowledge transfer between suppliers and emphasizing the identity suppliers share as members of the network).

This is a productive interpretation of Reagans and Zuckerman's analysis because it links team networks and performance with the performance effects of structural holes in market networks. The aggregate profit margin for a market increases with the organization of producers in the market and the disorganization of

suppliers and customers (Burt 1992, 91-97). The market model applied to team performance predicts that high performance teams will be those in which member networks beyond the team span structural holes (giving the team access to diverse perspectives, skills and resources), and strong relations within the team provide communication and coordination (so the team can take advantage of its access to diverse perspectives, skills and resources; see Burt 2000, Figure 5, on the complementary social capital of network closure and structural holes).

At the same time that group performance is enhanced by the social capital of its members, organization social capital can enhance employee performance. For example, Bielby and Bielby (1999) describe a decade of data on the careers of almost nine thousand film and television writers. Social capital in their study is held by the talent agency that represents a writer. About half of the writers had no representation (52% in 1987, down to 38% in 1992; Bielby and Bielby 1999, 73). A quarter had the traditional representation of an agency that “finds work . . . and in exchange it receives a 10-percent commission from the client’s earnings.” (Bielby and Bielby 1999, 66). The remaining quarter of the writers were advantaged by having what Bielby and Bielby (1999, 66-67) describe as “core” representation; representation by an agency that brokers connections between functional areas to propose whole projects in which the writer is a component: “Instead of seeking out projects for their clients, they initiate projects on their own. They negotiate unique arrangements with the talent guilds and cultivate long-term relationships with those who finance, produce, and distribute new projects.” Bielby and Bielby (1999, 70, 72) do not have network data, so they reduce social capital to binary distinctions between those who have it and those who do not; nevertheless, they obtain strong evidence of more likely employment and higher compensation for writers affiliated with the agencies that have it (cf. Yair and Maman 1996, on the social capital of songwriters attributable to their country’s network position among other countries; Jacob, Lys and Neale 1999, on the more accurate company earnings predictions from analysts employed in brokerage houses providing the information advantages of many other analysts and specialists in the company’s industry).

CREATIVITY AND LEARNING

Anecdotal evidence of brokerage enhancing creativity can be found in the remarks of prominent creatives. In an often-cited lecture on the influence of commerce on manners, Adam Smith (1982 [1766], 539) noted that; “When the mind is employed about a variety of objects it is some how expanded and enlarged.” Swedberg (1990, 3) begins his book of interviews with leading academics working across the boundary between economics and sociology with John Stuart Mills’ (1987 [1848], 581) opinion: “It is hardly possible to overrate the value . . . of placing human beings in contact with persons dissimilar to themselves, and with modes of thought and action unlike those with which they are familiar. . . . Such communication has always been, and is peculiarly in the present age, one of the primary sources of progress.” Moving to more contemporary and practical creatives, Jean-René Fourtou, as CEO of the \$17-billion-in-sales French chemical and pharmaceutical company Rhône-Poulenc, observed that top scientists were stimulated to their best ideas by people outside their own discipline. Fourtou emphasized le vide — literally, the emptiness; conceptually, what I have discussed as structural holes — as essential to creative work (Stewart 1996, 165): “Le vide has a huge function in organizations. . . . Shock comes when different things meet. It’s the interface that’s interesting. . . . If you don’t leave le vide, you have no unexpected things, no creation. There are two types of management. You can try to design for everything, or you can leave le vide and say, ‘I don’t know either; what do you think?’” (cf. Hatch 1999, on the importance of empty places to the integrated improvisation among jazz musicians playing together, and by analogy to the integrated improvisation of managers working together). An analogy can be drawn to Merton’s (1948) view of serendipity in science. Expanding on research’s familiar passive role in testing theory, Merton discusses active roles that research can play in shaping theory, one of which is the serendipity pattern in which an “unanticipated, anomalous, and strategic datum” exerts pressure for initiating theory (p. 158). Serendipity must involve an unanticipated result (datum) inconsistent with established facts or the theory being tested, but the third attribute, strategic, is the key that distinguishes Merton’s view. The strategic value of a research result lies in its implications for

generalized theory (Merton 1948, 159), which refers to: "what the observer brings to the datum rather than to the datum itself." Strategic value is created when the observer sees how a research result has implications for what to other people seems to be unrelated theory. The creative spark on which serendipity depends, in short, is to see bridges where others see holes.

A more explicit network perspective underlies Yair and Maman's (1996) conclusion that certain songwriters had a better chance of winning the Eurovision Song Contest because of their country's network position among other countries. Erickson (1996) innovatively measured network diversity for a cross-section of people in the security industry (guards, not financial analysts) by asking whether they have friends and acquaintances in 19 disparate occupations. The more diverse their non-kin contacts (i.e., the more occupations in which they have friends and acquaintances), the broader their knowledge of diverse cultural genres; sports, art, books, restaurants, and business magazines (see Erickson 2001, for the method applied to an informal local economy showing that participants with more diverse contact networks enjoy higher earnings). In his panoramic analysis of the history of philosophy, Collins (1998) presents sociograms of the intergenerational social networks among philosophers to illustrate his argument that the philosophers of greatest repute tend to be personal rivals representing conflicting schools of thought for their generation (Collins 1998, 76); "The famous names, and the semi-famous ones as well who hold the stage less long, are those persons situated at just those points where the networks heat up the emotional energy to the highest pitch. Creativity is the friction of the attention space at the moments when the structural blocks are grinding against one another the hardest."

Brainstorming groups are another source of evidence. Laboratory and field studies show two things: (a) Groups generate fewer, and fewer high-quality, ideas than the same number of people working separately, yet (b) people in these studies report that groups generate more ideas and higher personal performance within groups (e.g., Diehl and Stroebe 1987; Mullen, Johnson and Salas 1991, for review; Paulus, Larey and Ortega 1995, for field illustration in an organization). The connection to social capital is that performance is significantly improved if individuals

come to the brainstorming group from heterogeneous backgrounds (Stroebe and Diehl 1994, 293-297). The value of group brainstorming depends on the group facilitating the exchange of ideas across structural holes that separate members in the absence of the group. This is a useful analogy because (a) it fits with the story emerging about the social capital of groups increasing as a function of network density inside the group combined with bridge relationships spanning structural holes outside the group (see "Individual and Group Benefits" above), and (b) it means that the brainstorming studies which analyze group process can be used to better understand the process of brokerage. For example, Sutton and Hargadon (1996) describe processes by which a firm, IDEO, uses brainstorming to create product designs, and then clarify in Hargadon and Sutton (1997) the brokerage function served by the brainstorming. The firm's employees work for clients in diverse industries. In the brainstorming sessions, technological solutions from one industry are used to solve client issues in other industries where the solutions are rare or unknown. The firm profits, in other words, from employee bridge relationships through which they broker the flow of technology between industries (see Hargadon 1998, for comparative analysis of other organizations that similarly profit from being "knowledge brokers;" cf. Allen and Cohen 1969, on gatekeepers; Lazega and Pattison 2001, on network management of the status auction).

Detailed network data underlie Giuffe's (1999) analysis of photographers who received National Endowment for the Arts photography grants or had solo shows in a New York City gallery. Studying the network of gallery affiliations among the photographers over time, she finds three structurally distinct careers; peripheral careers of photographers who drop in and out of the gallery world, "long unbroken careers" in a "tight knit clique" of densely interconnected photographers, and "long unbroken careers" in "loose knit networks" of sparsely interconnected photographers. In terms of structural holes, the peripheral photographers had the least social capital, those with a clique career had little, and those with a career in loose knit networks had the most (cf. Sediatis 1998, especially 373-374, on the greater flexibility, adaptability, and volume of business in Russian commodity markets created by organizers who had little previous contact with one another).

Relative social capital has a statistically significant association with relative success measured by critical attention to a photographer's work. Giuffe counted the number of reviews each of the photographers received over the study decade in the two major trade magazines, Art News and Art in America. The peripheral photographers received the least attention, photographers with a clique career received slightly more, and those with a career in a loose-knit network received the most.

Experience seems to be the answer to questions about where, when, or how people learn about brokering connections across structural holes. Evidence comes from experiments with people learning social structures. Using DeSoto's (1960) experimental design for measuring the difficulty of learning a social structure, Freeman (1992) asked college students to learn the relationships in a small network that contained a structural hole (missing connection between persons 1 and 4). Errors occurred when students failed to recall a relationship that existed, but the most frequent error was to fill in the structural hole by saying that the two disconnected people were connected. Janicik (1998) used DeSoto's design but with older (M.B.A.) students and added a control for the network around each student in his or her most recent or current job. Students who held a job in which they were exposed to structural holes learned the network significantly faster, in particular because they quickly recognized the structural hole in the network. If Freeman's undergraduates lived in small, dense friendship networks, as is typical of college students, then the summary conclusion from Freeman's and Janicik's experiments is that experience matters: People who live in a network that contains structural holes are more likely to recognize the holes in their next network.

There is related evidence from fieldwork. Gargiulo and Benassi (2000) describe managers in the research consulting unit of a large Italian firm. They measure "coordination failure" as the extent to which a manager consults with people not relevant to his assigned projects. They show that coordination failures are significantly more likely for managers with small, dense networks (cf. Barker 1993). Lofstrom (2000) asked key individuals (scientists, physicians, and engineers) how much they learned from their firm's participation in an alliance intended to develop or extend a medical device technology. Individuals with a higher number of

non-redundant contacts, especially contacts within their own firm, were more likely to report that they had “learned a great deal” in the alliance. Burt (2001) describes change in the colleague networks of bankers over a four-year period, focusing on the decay of the relationships, bridges, that span structural holes. The rate of decay is high (nine out of ten disappear from one year to the next), but significantly lower for bankers who have more experience with such relationships. In as much as the bridges are social capital associated with bonus compensation, and bridge relationships are less subject to decay when they involve people more experienced with bridges, the conclusion is that social capital accrues to those who already have it.

There is also indirect evidence at the level of organizations. Granting that technological change can affect social structure (e.g., Barley 1990, 92-95, provides a clear illustration with network data), social structure has its own effects on an organization’s ability to productively manage technological change. Electronics and biotechnology have been favored research sites for studying such network effects, with Walter Powell (e.g., Powell and Brantley 1992; Powell, Koput and Smith-Doerr 1996; Powell et al. 1999; Koput and Powell 2000) and Toby Stuart (Stuart 1998; Stuart, Hoang and Hybels 1999; Stuart and Podolny 1999; Stuart and Robinson, 2000) prominent ports of entry into the work. More generally, Kogut (2000) builds on a series of studies (e.g., Shan, Walker and Kogut 1994; Zander and Kogut 1995; Kogut and Zander 1996; Walker, Kogut and Shan 1997) to propose a network theory of the firm in which value is derived from a firm’s ability to create and lay claim to knowledge derived from its membership and participation in networks (cf. Nahapiet and Ghoshal 1998, on social capital and knowledge; Powell and Smith-Doerr 1994, on information issues in the economic sociology of networks, especially with respect to interorganization networks).

More specifically, accumulating empirical research shows that structural holes are a correlate of organizational learning, often discussed in terms of an organization’s ability to learn — what Cohen and Levinthal (1990, 128) describe as an organization’s absorptive capacity: “the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends,” which can

be studied in terms of industry factors that facilitate absorption (e.g., Cohen and Levinthal 1990) and external networks that enhance an organization's absorptive capacity (e.g., Cockburn and Henderson 1998; see Knoke 2001, 362ff. for secondary review). To the extent that the information and control benefits of bridging structural holes enhance organizational learning, the following hypothesis should be true: Organizations with management and collaboration networks that more often bridge structural holes in their surrounding market of technology and practice will learn faster and be more productively creative. This is the hypothesis that Lofstrom (2000) uses to interpret her observation that people in medical-device alliances report more learning when they have a broader network of non-redundant contacts. The hypothesis is related to Ancona and Caldwell's (1992a) report that teams judged more innovative had more external communication with contacts in diverse corporate functions (and see the evidence on group brainstorming in the next section). The hypothesis is explicit in several studies cited in the previous section: McEvily and Zaheer (1999) report greater access to competitive ideas for small job manufacturers with more non-redundant sources of advice beyond the firm (and McEvily and Marcus 2000, show lower absorptive capacity for these organizations when their sales network is concentrated in a single customer). Stuart and Podolny (1999) report a higher probability of innovation from semiconductor firms that establish alliances with firms outside their own technological area. Comparing the biotechnology districts in Minneapolis and Philadelphia, Llobrera, Meyer and Nammacher (2000) attribute the growth and adaptation of Philadelphia's district to its many overlapping but non-redundant networks around organizations in the district. Ahuja (2000) reports higher patent output for organizations that hold broker positions in the network of joint ventures or alliances at the top of their industry. Baum, Calabrese and Silverman (2000) study Canadian companies in biotechnology for their growth in revenues, number of patents granted, and the extent to which a company had multiple kinds of alliance partners at start-up. Companies with a heterogeneous mix of alliance partners tended to enjoy faster revenue growth, and a dramatic advantage in obtaining patents. Koput and Powell (2000) report higher earnings and survival chances of biotechnology firms with more

kinds of activities in alliances with more kinds of partner firms. Podolny (2001) argues that the information and control advantages of structural holes should be a competitive advantage for venture-capital firms detecting and developing ventures at an early stage of development. He studies panel data on investments from 1981 through 1996 to distinguish venture-capital firms that span structural holes in the sense that they bring together as co-investors other firms that are not investing together. Under attractively stringent controls for autocorrelation, Podolny (2001) finds that: "As a venture capital firm acquires a 'deal-flow' network that is rich in structural holes, the firm makes a greater proportion of its investments in the earlier stages." This, in addition to the earlier cited finding of more early-stage investments surviving to IPO for the venture-capital firms whose co-investment network span structural holes.

Whatever the explanation for these results – bridging structural holes enhances an individual's ability to learn, or more intelligent people learn faster and so better report holes in the social structure around them – there is an association between structural holes and learning. The implication is that the social capital of structural holes cumulates over a career so it is critical to encounter holes early in the career (Burt 2001; cf. Sørensen 2000, on the cumulative effects of social heterogeneity on mobility). Managers with experience of structural holes are more likely to see the holes in a new situation, and so enjoy the enhanced performance associated with spanning the holes, and so be promoted to more senior positions, which broadens their opportunities to add value by brokering connections across structural holes.

ADAPTIVE IMPLEMENTATION

Evidence on this category in Figure 3 is primarily in the form of episodic anecdotes, in part because the processes by which people bridge structural holes are so varied and sensitive to context. Still, available evidence is suggestive of general processes, and consistent with other evidence of value created by brokerage across structural holes.

Illustrative Cases

Case materials developed for business education are a rich source of information on bridging holes because much of business leadership is about bringing together ill-connected functions, organizations, or market segments — in other words, it is about building bridges across structural holes. Almost no cases discuss social capital per se (lack of academic jargon is a feature of the materials), and not all are about network entrepreneurs (many are about routine business practices). Where change is intended to create value, however, there is always a story — richer in some cases than others, of course — about brokerage and network entrepreneurs.

For example, Harvard Business School's John Clendenin case describes a middle manager making more efficient the flow of components between Xerox's regional operations in the late 1980s (Eisenstat, 1993). Regional operations had evolved independently such that each region had its own inventory systems. The independence made sense in Xerox's early days. By the time of the case, logistics technology had progressed to the point where it would be more efficient to ship components in a just-in-time production system rather than leave components on shelves as inventory. There was now value to bridging the structural holes between the regional operations. The problem was that regional leaders had good reasons to prefer the status quo. The case is about how Clendenin overcame resistance to bridge the disconnected regional operations, adding substantial value to Xerox and growing his group in proportion.

Brokerage processes in larger organizational perspective are described in a complement of INSEAD cases on strategic alliances involving the visionary biochemist, Alejandro Zaffaroni. The earlier of the two cases describes interests over the course of the 1977-1982 alliance between Swiss pharmaceutical giant, Ciba-Geigy, and California company, ALZA, that Zaffaroni founded in 1968 to develop products involving controlled-release drug delivery (Doz and Angelmar 1991; also see Doz 1988; Doz and Hamel 1998). The more recent case consists of videotaped interviews with key people in California company, Affymax, founded by Zaffaroni in 1988 to develop products to accelerate the drug-discovery process, and British pharmaceutical giant, Glaxo-Wellcome, that purchased Affymax in 1995

(case still in production when this chapter was written). In both cases, Zaffaroni's small, thriving, entrepreneurial company was to create new products, and the large, bureaucratic partner was to commercialize; Ciba-Geigy doing clinical tests and marketing for ALZA drugs, Glaxo-Wellcome integrating Affymax discovery products into large-scale drug development.

Zaffaroni is precisely a network entrepreneur as discussed in this chapter and the cases describe how he does it. One of the Affymax leaders in the video case describes Zaffaroni's critical value to the enterprise (*italics added*): ". . . he is reading and thinking very widely. He is totally unafraid of any new technology in any area of human creativity. He has wonderful contacts with people in many different areas, so he sees the bridges between otherwise disparate fields. Then he places them in front of you. The way he works is to give it to you — and instantly you can see what he is driving at; there is some potential technology synergy or some business opportunity. Then he leaves it with you. He trusts, the wonderful thing I like about him, is that he trusts you to see whether there is value or not. He delegates responsibility, scientific and managerial, to people. You know that he has picked you. You know that he trusts you, he has picked you to have certain qualities, and he is not going to second-guess you." More, Zaffaroni institutionalizes his bridges with interdisciplinary workshops involving prominent outsiders, and his own reputation for success and high moral standard in bringing people together. In fact, one of the Affymax leaders praises Zaffaroni as a source of instruction precisely on the adaptive implementation variable in Figure 3: "So, at a personal level, he [Zaffaroni] is very good to be around, because you learn how to deal with people, get the best out of them, and how to deal with problems when they inevitably arise."

The communication and trust processes with which Zaffaroni establishes bridges across disciplinary lines within his companies carry over to bridges with outside partners. The Ciba-Geigy alliance failed. The Glaxo-Wellcome merger works. Both inter-organization bridges were strategically sound in the value they could provide, and both linked a small, entrepreneurial firm with a partner large and bureaucratic. Implementation differed. Communication and trust were not strategic issues in planning the Ciba-Geigy alliance, in some part because such issues were

deemed irrelevant: ALZA was discovered, then handed over to Ciba-Geigy for commercialization. Over the course of the alliance, however, it became clear that the alliance required coordination between the firms before and after ALZA product was handed to Ciba-Geigy. Made wiser by the Ciba-Geigy experience, Zaffaroni and his counterparts in Glaxo-Wellcome took communication and trust as a central issue in planning the merger linkage between Affymax and Glaxo-Wellcome. An organization was created inside Glaxo-Wellcome that was a clone of Affymax. The clone was integrated into Glaxo-Wellcome's production operations and Affymax was left to run as it had outside the company as a source of insider knowledge about how to operate the clone.

The virtues of the business-education case materials are interpersonal detail and case variety. To describe brokerage in wider perspective, if less detail, there are archives on historical figures. For example, Caro (1982, Chapter 15) describes Lyndon Johnson's creation of a Washington power base in 1933 from the "Little Congress," through which he brokered connections between journalists and prominent people in government. Dalzell (1987, Part I) describes Francis Lowell's role as broker in creating the American cotton industry. DiMaggio (1992, especially 129-130) describes Paul Sachs' role as broker in establishing the Museum of Modern Art in New York; "Sachs could employ his talents precisely because his strong ties to sectors that had previously been only weakly connected — museums, universities, and finance — placed him at the center of structural holes that were critical to the art world of his time." Padgett and Ansell (1993) describe Cosimo de Medici's use of his contacts with opposing elite family factions to establish his Medicean political party in Renaissance Florence. McGuire and Granovetter (2000) describe Samuel Insull's use of his network of contacts in finance, politics, and technology to shape the electric utility industry at the turn of the century (also Granovetter on page 65 of this volume; cf., Seditis 1998, account of Russian commodity markets created by organizers who had little previous contact with one another, and Granovetter, pp. 66ff., this volume, on "The Social Construction of Economic Institutions," especially on polycentric networks facilitating economic cooperation).

These several cases could have been cited in the section "Creativity and Learning" in as much as the cases describe people creating via brokerage a new organization or industry. In the same vein, much of the work I cited in the section "Creativity and Learning" could have been cited in this section as description of how bridges are built across structural holes. The distinction is a fine line since creativity, learning, and adaptive implementation are so interwoven in practice. Case examples cited in this section simply provide more detail on the process of bridging structural holes.

Bridge Processes

The question remains of how to generalize across the cases. There are two directions in which to proceed. One is to generalize case content to describe the ways in which brokerage occurs. See Hargadon (1998) for an example, Aldrich (1999, Chapter 4) and Thornton (1999) for broad review, Aldrich in particular for intuitions about the changing role of networks over the course of a venture (cf. Doz and Hamel 1998; Van de Ven et al. 1999; see Steier and Greenwood 2000 for case-study description with respect to structural holes, Podolny 2001 for results across cases). Although an obvious site for research on the network forms of social capital, quantitative research on networks in entrepreneurship has been limited to the most rudimentary of network data (with rare exceptions such as Stuart, Hoang and Hybels' 1999, analysis of prominent affiliations speeding a venture's time to IPO in biotechnology). I discuss elsewhere the potential value, and current shortcomings, of network data in entrepreneurship (Burt 2000, 370-372). At the risk of oversimplifying the case-specific details on brokerage, I conclude from the casework that successful network entrepreneurs stand out for their skills in (a) communicating across differences of opinion, (b) reasoning from the interests of the other, (c) establishing mechanisms that build trust and reputation, and (d) re-structuring the organization or market where the current structure is a problem.

Hole Processes

A second direction of generalization is to leave open the question of how bridges get established and instead study process in terms of the structural hole bridged.

There is abundant evidence of the achievement and rewards associated with brokerage, but the value created by a bridge can be expected to decrease as more bridges are built across the same structural hole. When the first entrepreneurs benefit from synthesizing information across a structural hole, others join them, and the value of bridging the hole decreases. If Figure 2 were an academic market, for example, and Robert produced a useful idea because of a Group A technology he discovered from Contact 7, other academics in Robert's line of work would be expected to develop relationships with contacts in Group A, eventually eliminating the structural hole between the two groups (e.g., contacts 1 and 2 are positioned to quickly draw on their ties to Group A).

The rate of decline in value is a question for future research, but the functional form of the decline is probably nonlinear. Imagine X-Y coordinates where Y is the value of building a strong relationship across a structural hole and X is the number of such relations that exist. The value of Y at X equal one would be the value of the first bridge across the hole, the value at X equal two would be the value of the second bridge, and so on. No one knows how Y decreases across increasing X, but it seems likely that the decrease is steeper for the first few bridges than for the last few. Value is certainly eliminated long before everyone eligible to span the hole has done so. Holes are closed by individuals, not populations (or, in network jargon, a high density of bridges is not required to close a hole; the first few bridges suffice). To cite familiar academic work, the acclaim that Hannan and Freeman (1977) received for synthesizing organization theory from sociology and population biology, was much higher than the acclaim accorded subsequent elaborations within the population ecology of organizations. The acclaim that Granovetter (1985) received for so clearly making the case that economic transactions are contingent on their sociological context was higher than the acclaim accorded subsequent elaborations within the embeddedness metaphor. In fact, the nonlinear decline in value is probably a nonmonotonic decline in benefits. Whatever the functional form of

decline in value with additional entrants, cost must decrease more quickly because the first entrant has to create both product and market. Problems revealed by the first entrant can be anticipated and avoided by subsequent entrants. Whatever the benefits to the first who bridges a structural hole, benefits are probably higher for the next few entrants, then decreasing for subsequent entrants.

Social Order of Equilibrium

Value declines with subsequent entrants down to some equilibrium level at which value is marginally higher than the cost of bridging the hole. Regardless of the rate of decline in value, there is no competitive advantage at system equilibrium to a network that spans structural holes because sufficient people have networks across the structural holes so as to eliminate the value of additional people spanning them. Network entrepreneurs have moved the market to equilibrium by eliminating holes in the market where it was valuable to do so. So viewed, the social capital of structural holes is about a short-run advantage on the path to equilibrium. At equilibrium, the advantage is gone.

Social Order of Disequilibrium

That is, unless the system is forever on its way to equilibrium. Short-run advantages of brokerage could be a long-run advantage, for example, if information grows quickly out-of-date, as seems to be the case for senior managers (see Mintzberg 1973; Stinchcombe 1990, on the short half-life of information in organizations). The process could run as follows: As an industry of managers and organizations moves toward equilibrium, managers with more social capital have an advantage in identifying and developing the more rewarding opportunities. Technological change and events create new priorities, so the industry begins moving toward a new equilibrium. Again, managers with more social capital have an advantage in identifying and developing the more rewarding opportunities. If the industry is subject to repeated change such that information grows quickly out-of-date, then managers with more social capital have a continuous competitive advantage, which

would be visible as the association between brokerage and benefits illustrated in Figure 3.

Further, a short-run brokerage advantage can become a long-run advantage if bridges are not absorbed into the social structure around a hole. Distinguish passive from active structural holes. A hole is passive if bridges across it are readily absorbed into the surrounding social structure. The paragraph above on the "Social Order of Equilibrium" assumes passive holes. Each bridge is secure in that information flows freely across it, thereby diminishing the value of subsequent bridges across the same structural hole.

A structural hole is active if interests attached to the hole resist bridges. For example, interests can be configured such that they compete to bridge the hole so a bridge established by one group is subject to erosion by the other groups. Progress toward equilibrium with the establishment of a bridge is destabilized, resulting in a continuous disequilibrium around the structural hole. There are numerous illustrations in the sociological literature, such as Simmel's (1902, 185-186) brief description of Incan rule over subject provinces and Venician expansion onto the mainland, or Barkey's (1994) description of local governors competing against bandits to be the legitimate representative of Turkish rule. For this chapter, consider Finlay and Coverdill's (1999, 2000) work on structural holes among managers, human-resource staff, and executive headhunters. Headhunters offer advantages to a hiring manager: faster search (headhunter has up-to-date data on suitable candidates; "What people are paying me for is somebody with experience to step in to do something right away."), broader search (headhunter knows attractive candidates happy where they are who wouldn't apply for an advertised job, and can recruit from customer or supplier organizations from which recruitment by the hiring manager could threaten his organization's relationship with the raided customer or supplier), and more successful search (headhunter puts time into selecting candidates suited to the job because their compensation depends on their candidate accepting the job). The complication is that the hiring manager's organization has a human resources staff (HR) responsible for recruiting, so brokerage for the headhunter involves matching candidates with the hiring manager while buffering the

manager from HR. The tension is indicated by the headhunter phrase for HR staff, “weenies,” and their characterization by one industry trainer, as people who “didn’t have the personality to become morticians” (Finlay and Coverdill 1999, 20). Bridging structural holes in this case involves a simultaneous process of creating holes. As Finlay and Coverdill (1999, 27) conclude: “When headhunters buffer hiring managers from HR or when they shield a client from a competitor, they open gaps in these relationships that the headhunters themselves then bridge. The success of headhunters, and their attractiveness to employers, rests on this dual function of creating and filling holes.”

Then there are the holes around which interests explicitly oppose a bridge, and so ensure continuing disequilibrium as new entrants try alternative ways of bridging the hole. Tilly (1998) provides a richly substantiated overview of the forms resistance can take when a group is advantaged by a structural hole (see esp. pp. 8-11, 84-86). Tilly describes social mechanisms that preserve paired insider-outsider categories such as legitimate versus illegitimate, our class versus theirs, citizens versus foreigners, and other pairs of asymmetric categories defined by income, education, age, gender, ethnicity, and so on. Tilly’s boundaries between social categories are examples of the structural holes discussed in this chapter. His four mechanisms preserving boundaries describe interests opposing bridges across structural holes. Adapting the mechanisms to this chapter, a structural hole will be active if (a) it provides an opportunity for insiders on one side of the hole to exploit outsiders on the other side, (b) permits insiders to hoard opportunities from outsiders, (c) makes it easier for insiders to construct new organization based on existing models in which insiders are advantaged, or (4) daily routines and valued social ties of aid, influence, and information gathering have adapted to the hole.

The fourth mechanism, “adaptation” in Tilly’s analysis, is particularly important because it is a way in which passive structural holes often become active. A passive hole will become active over time if people and groups invest in behaviors and beliefs adapted to the hole. For example, the Clendenin case cited above begins with structural holes between Xerox’s regional operations. Initially, the holes were passive. No one set out to create them. The holes simply reflected technological

limits of production at the time that the regional operations were created. Over time, however, people had adapted to the separate regional operations. Each region developed its own performance benchmarks, financial systems, and production control systems. Clendenin's idea of integrating production across regions required people to give up their local systems in favor of an integrated central system — and the change was rejected by the regional managers. Managing the resistance was a critical element in Clendenin's successful brokerage.

The Clendenin case illustrates resistance when people adapt daily routines and behaviors to otherwise passive structural holes. Resistance will be stronger if adaptation moves deeper, to fears and beliefs. Resistance will be especially forceful against bridges between groups with conflicting beliefs, or to a group prohibiting relationships of the kind represented by a proposed bridge (cf. Burt 1992, 42-44, on network indicators of the depth of a structural hole). For example, Keller (1989, Chapter 6) describes how senior-level distrust between General Motors and the United Auto Workers reversed successful labor-management collaboration in the Van Nyes plant to establish a team-based production system.

A way to think about active structural holes is to ask why a hole observed is not already closed. If there is value to bridging the hole, why hasn't someone already done so? Consider two companies, MY-CD.com and Musicmaker.com, founded in 1998 to bridge the structural hole between music producers and customers. Instead of producers guessing demand, pressing a batch of CDs, and distributing through retail stores, the idea was that a customer could go to a website, select music, and have it pressed on a CD made just for that customer. Implementation differed between the two companies. MY-CD focused on assembling technological and financial resources needed to create and operate the site, treating as passive the hole between producers and customers. Even before Napster emerged as a challenge, MY-CD was, in the words of one observer, "a forlorn-looking site that seems to be barely alive." The problem was getting record companies to release current popular titles. Producers feared the internet as a threat to property rights. Musicmaker, in contrast, focused on assuaging record-company concerns about the internet; the founders were senior people from record companies, and the company

was largely owned by record companies. Between personal ties and ownership control, Musicmaker was given access to current hits such that a senior Musicmaker officer could say at the end of 1999 that: ". . .we've been able to do business on terms that the record companies could accept."

Eventually, bridges can emerge across active holes. Barth (1967) describes a structural hole in the economy of a tribe, the Fur, in central Africa. The Fur had a prohibition against exchanging labor or beer for money; it was shameful to work for a wage ("though some men have worked as migrant labor elsewhere," Barth 1967: 153; see Zelizer 1994, on socially enforced conceptual boundaries between kinds of money) and shameful to sell beer (Barth 1967, 155-156): "Some women also brew beer and bring it for sale in the market-place. Though there is no dearth of buyers, especially as the afternoon wears on, the sale of beer is regarded as immoral and the women who do so are looked upon as immodest." The Fur adapted beer parties as a conversion medium (Barth 1967, 153): "In the simplest form, two more friends may decide to work together for company, in which case they jointly cultivate each other's field in turn, he whose field is being cultivated providing a pot of beer for their joint consumption." Barth (1967:171) tells of an entrepreneur, an Arab from the north, who put to profit the hole in the Fur economy. (Outsiders often play this role, e.g., Siamwall 1978, on Chinese middlemen in the Thai economy; Light and Karageorgis 1994, on socially excluded ethnicities for whom entrepreneurial activities are their route into society.) The Arab entrepreneur purchased grain in an area where the price was low, brewed beer from the grain, used the beer to pay for Fur labor on his tomato crop, and sold the tomato crop for a substantial profit. "On an investment of £5 worth of millet, he obtained a return of more than £100 for his tomatoes." The success drew others over the next two years (Barth 1967, 171-172): "more merchants, and some local people, adopted the strategy with results nearly as spectacular." There are social sanctions with which the Fur could have thwarted the entrepreneurs, but after three years of activity, at the close of Barth's fieldwork with the Fur, no reaction had emerged to block the entrepreneurs. In the words of this chapter, it looked as though a bridge had been absorbed into the surrounding social structure.

Active structural holes illustrate how the information and control benefits of brokerage can be such a competitive advantage in adaptive implementation: Network entrepreneurs are more likely to know through their personal contacts who would benefit from a proposed bridge, whose interests would be hurt, and who is likely to react. In other words, when people with little social capital try to establish bridge relationships across active structural holes, their bridges are more likely to collapse from resistance, and so continue the disequilibrium of the hole. More broadly, the social capital of structural holes is about change — about discovering and developing opportunities to add value with bridges across holes in the existing structure. It is, in short, a story about the social order of disequilibrium (note economist Joy's 1967, 184-185, effort to analyze Barth's work on the Fur in terms of an equilibrium model in preference to anthropologist Barth's "straight observation of disequilibrium conditions.").

CONCLUSIONS

Empirical evidence on the social capital of structural holes comes from research on diverse substantive questions, and the evidence is expanding quickly. Much of the work reviewed here is new; often published in the last couple years or not yet published, and often at a preliminary stage of development. Accordingly, the evidence reviewed here is based on network data of uneven quality. However, the one consistent finding from comparative study across populations with detailed network data (Burt 2000) is that dense networks are associated with substandard performance. A general conclusion from the review here, and review elsewhere of detailed network data, is that brokerage across structural holes is social capital. For individuals and groups, networks that span structural holes are associated with creativity and learning, adaptive implementation, more positive evaluations, more successful teams, early promotion, and higher compensation.

Two qualifications have been touched upon in the review. First, brokerage appears to be the source of value added, but network closure can be critical to realizing the value. As evidence, brokerage across structural holes is more valuable to people who have few competitors, more valuable for groups within which people

are closely interconnected, and more valuable in markets within which organizations are closely interconnected (Burt 2000, Figure 5). Second, only insiders, “the right kind of people,” have direct access to the social capital of brokerage. Outsiders have to borrow. Among senior managers, for example, insiders are typically older men, outsiders include women and young men (Burt 1998, 2000, Table 2). The outsider proposing an idea that bridges groups has to borrow social capital in the sense that she has to work through a strategic partner, a person who has the social capital of a network that spans structural holes.

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e.g., Bourdieu: “. . . social capital is the sum of the resources, actual or virtual, that accrue to an individual or group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition.”

e.g. Coleman: “Social capital is defined by its function. It is not a single entity but a variety of different entities having two characteristics in common: They all consist of some aspect of social structure, and they facilitate certain actions of individuals who are within the structure. Like other forms of capital, social capital is productive, making possible the achievement of certain ends that would not be attainable in its absence.”

Social Capital Metaphor
advantages that individuals or groups have because of their location in social structure

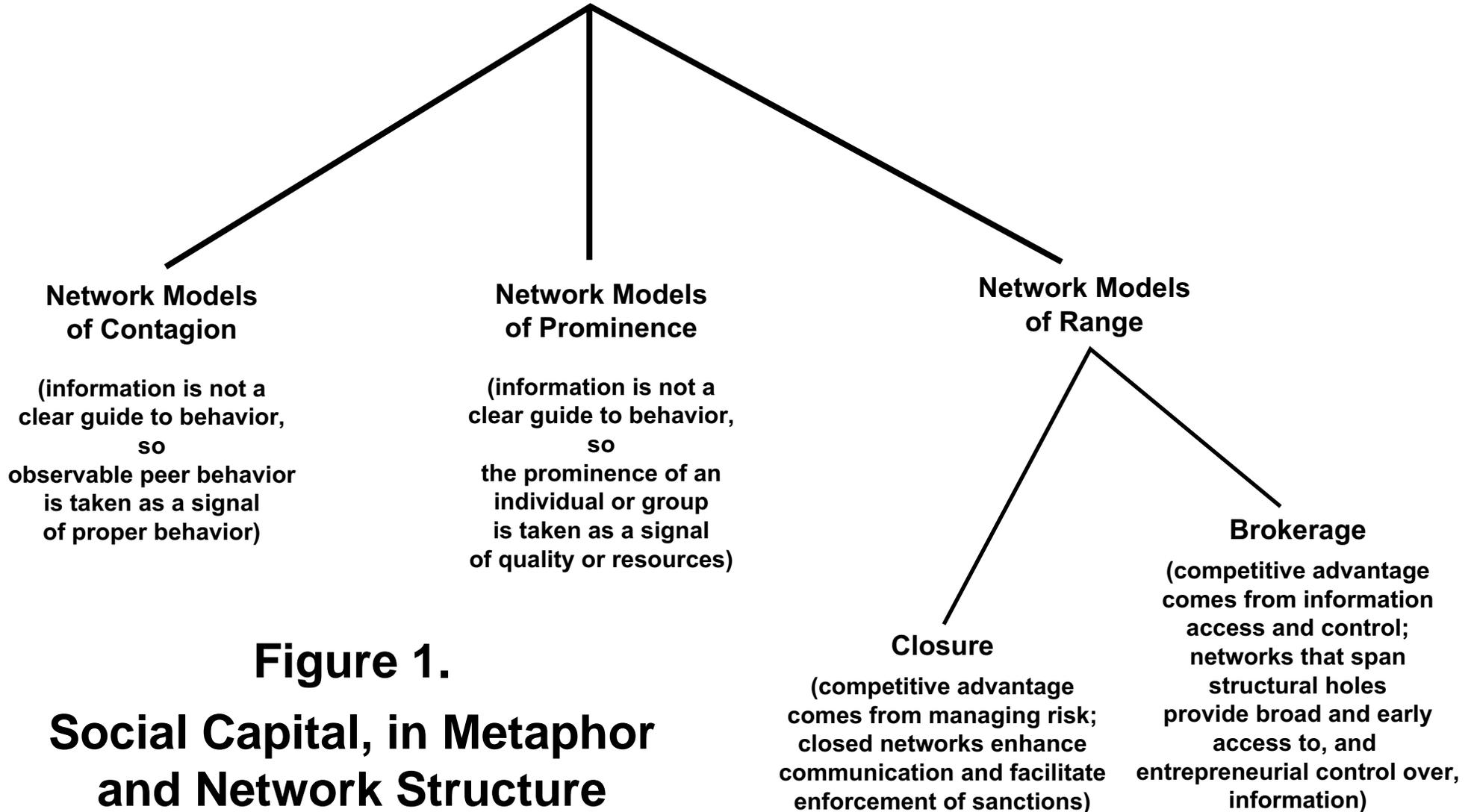
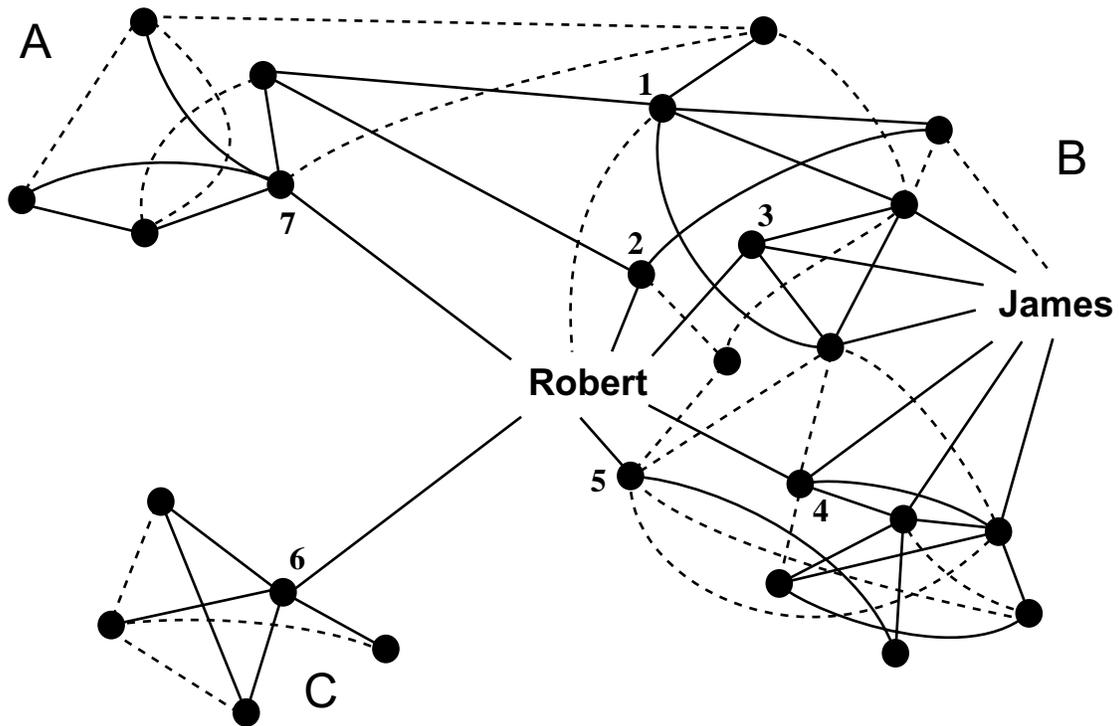


Figure 1.
Social Capital, in Metaphor and Network Structure

Figure 2. Social Organization.



Density Table of Relations Within and Between Groups

.65		Group A (5 people and 8 ties; 5 strong, 3 weak)	
.05	.25	Group B (17 people and 41 ties; 27 strong, 14 weak)	
.00	.01	.65	Group C (5 people and 8 ties; 5 strong, 3 weak)

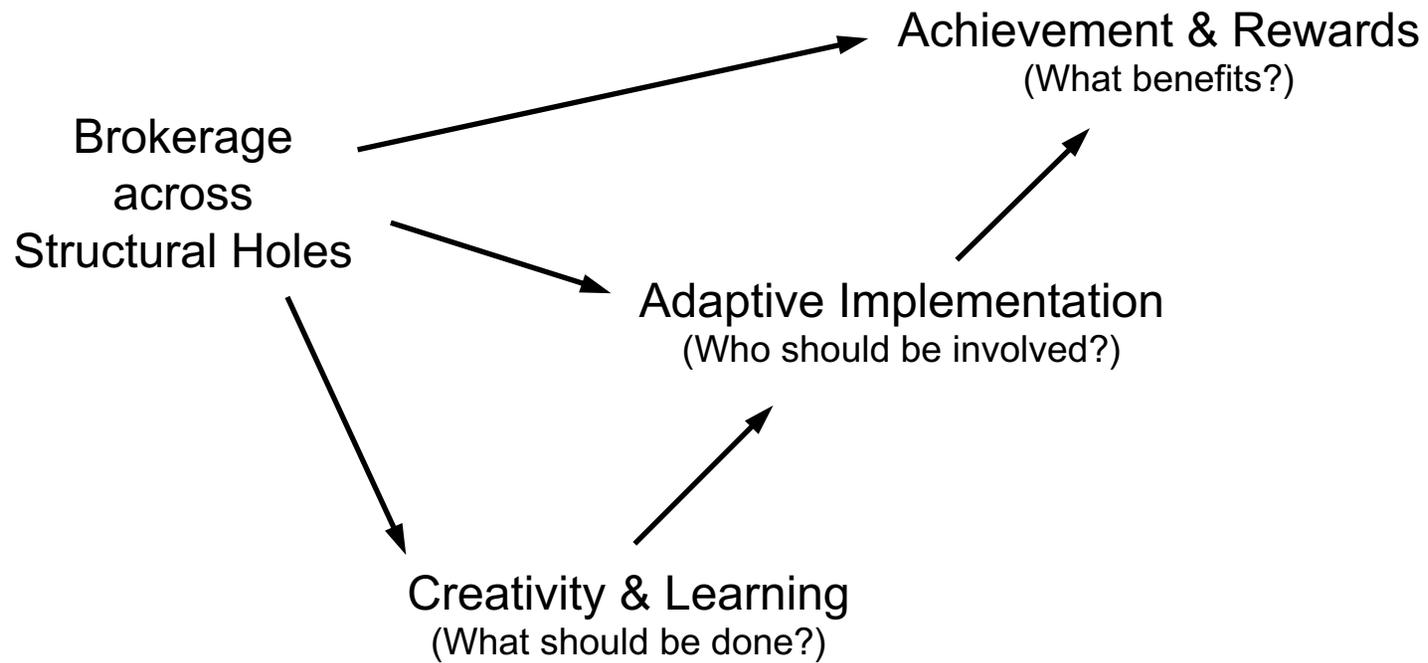


Figure 3. Evidence Categories for the Hole Hypothesis.