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SOCIAL NETWORK AND CREATIVITY

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ABSTRACT: This chapter is in three parts. I first sketch the connection between information and network structure, which is foundation for a network-creativity association. I then discuss illustrative evidence of network associations with good ideas, creative work, and delivered performance — which together illustrate my central point that creativity is an act of network brokerage. I close discussing network implications for future research on creativity, focusing on two new areas: the overlapping effects of micro versus macro network structure (Is it your network or your position in their network?), and the idea of illegitimate creativity (Will the audience accept you as a creative?).

KEYWORDS: creativity, performance, social network, structural hole, network broker

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In theory, social networks are not essential to creativity. People are creative when they produce novel and useful ideas or works. Creativity is a judgment about the produced idea or work. The fact that people are not equally creative encourages stories about the people associated with creative acts being more intuitive, smarter, or otherwise blessed with a predisposition to creativity. Hero stories of creative individuals and teams abound in the popular press. However, whatever a person's predisposition to creativity, the social network around them can be responsible for creativity displayed. Not essential in theory, social networks in practice can be a deciding factor in who emerges among us as creative individuals. How that is so is the subject of this chapter, which is in three parts. I first sketch the connection between information and network structure, which is foundation for a network-creativity association. I then discuss illustrative evidence of network associations with good ideas, creative work, and delivered performance — which together illustrate my central point that creativity is an act of network brokerage. I close discussing network implications for two areas of new research on creativity: the overlapping effects of micro versus macro network structure, and the idea of illegitimate creativity

FOUNDATION: SOCIAL NETWORK AND INFORMATION

Foundation for the network-creativity association is provided by two facts established during the 1950s “golden age” of social psychology (especially Festinger et al., 1950; Asch, 1951; Leavitt, 1951; Katz and Lazarsfeld, 1955) that allow the structure of social networks to proxy for the distribution of information: (1) people cluster into groups as a result of interaction opportunities defined by the places where people meet; and (2)

communication is more frequent and influential within than between groups such that people in the same group display similar behavior and beliefs.¹

Sticky Information

Within their group, people tire of repeating arguments and stories explaining why they believe and behave the way they do. They invent phrasing, opinions, symbols and behaviors that contribute to defining what it means to be a member of the group. Beneath familiar arguments and experiences are new, emerging arguments and experiences awaiting a label, the emerging items more understood than said within the group. What was once explicit knowledge interpretable by anyone becomes tacit knowledge meaningful primarily to insiders. Over time, information in the group becomes “sticky” – nuanced, interconnected, implicit meanings difficult to understand in other groups (Von Hippel, 1994). For reasons of a division of labor, in which groups specialize on separate bits of work, or variation due to the independent evolution of separate social groups (Salganik, Dodds, and Watts, 2006) — holes tear open in the flow of information between groups. These holes in the social structure of communication, or more simply “structural holes,” are missing relations indicating where information is likely to differ on each side of the hole and not flow easily across the hole. In short, the bridge and cluster structure of social networks is a proxy for the distribution of information in a population, indicating where information is relatively homogeneous (within group) and where information is likely heterogeneous (between groups).

———— Figure 1 About Here ————

For example, Figure 1 is a sociogram of the social network among senior leaders in a large European healthcare organization. Each symbol is a person. Lines between symbols indicate relationships between people. People are close together in the

sociogram to the extent that they have a strong connection with each other and with the same colleagues (spring embedding algorithm, Borgatti 2002). Note the clusters. To the east in the sociogram, company leaders in the United States are strongly connected with one another with little connection overseas. To the northeast in the sociogram, company leaders in Asia are strongly connected to one another with little connection outside Asia. To the southeast in the sociogram, an important group in the company's research and development operations floats cut off from the rest of company leadership. Business practice varies between the clusters. People in the R&D cluster are guided by state-of-the-art scientific practice. They explain and describe their activities in terms of science. People in the American cluster are adapted to American legal code, business practice, and local institutions. Similarly, people in the Asian, European, front office, and back-office clusters are efficient with their local language, within the social and professional institutions associated with each cluster.

Network Brokers: Breadth, Timing, and Arbitrage

The connections between groups in Figure 1 are "bridge" relations. A bridge in graph theory is a link that connects two people not otherwise connected, but it is customary to discuss as bridges any connection between groups unlikely to otherwise coordinate with each other. The people labeled "Bill" and "Bob" in Figure 1 are "network brokers" (along with several others identified by the letter "B" in the figure) and their network behavior "brokerage." Characterized by their location in social structure, network brokers correspond to Merton's (1949; Gouldner, 1957) "cosmopolitans," Katz and Lazarsfeld's (1955) "opinion leaders" (see Burt, 1999, 2005: 84-86, on network brokers versus opinion leaders), and, more distantly, Schumpeter's and Hayek's touchstone images of what it means for a person to be an entrepreneur (Burt, 2005:Chp. 5, for details).

Network brokers like Bill and Bob have three information advantages over people who do not have bridge connections: breadth, timing, and arbitrage. With respect to breadth, Bill and Bob's bridge relations across groups give them access to more diverse information. Bob looking at European operations can see where certain practices in America could be an improvement. Bill looking at European operations can see where certain practices in Asia could be an improvement. With respect to timing, Bill and Bob are positioned at crossroads in the flow of information between groups, so they are early to learn about activities in other groups and are often the person introducing to one group information from another. There is no one other than Bob and Bill positioned to look at European operations through an American or Asian lens. Bill and Bob are more likely to know when it would be rewarding to bring together separate groups, which gives them disproportionate say in whose interests are served when the contacts come together, which brings in arbitrage: Network brokers have an advantage in translating opinion and behavior familiar from one group into the dialect of a target group. Bob and Bill can express their proposals from overseas in terms familiar to their European colleagues.

The information advantages of network brokers are less about getting novel information than they are about applying novel interpretations to existing information, and combining previously disparate bits of information into novel interpretations. For one thing, technology continues to expand our exposure to information such that getting information is not as difficult as making sense of information. Second, the benefit of access to structural holes does not come from indirect access. It comes from direct access to disconnected people (Burt 2010). It is one thing to hear about diverse knowledge and practice that defines an opportunity. It is quite another to recognize and develop the opportunity (Soda, Tortoriello, and Iorio, 2018). Diverse information is readily available from professionals, social media, or word of mouth. It is easy to look up

a business concept in Wikipedia and cite a reputable article on the concept. It is quite another to know the concept well enough to transform it into concepts familiar to a target audience. Experience coordinating people with different understandings develops in one a talent for converting and synthesizing information between groups. People behaving as network brokers develop skill with analogy, metaphor, and simile. They develop tolerance for ambiguity, for conflict between contrasting colleague understandings, for seeing when the time is ripe to propose new combination of knowledge or practice. The social capital of brokering structural holes is a kind of forcing function for human capital (Burt, 2010). Relative to a person who has spent all their time in a single business function, a person connected to multiple business functions is more likely to see a novel solution that integrates or synthesizes knowledge and practice across functions. The same holds for recombinant information across industries, countries, products, or channels.

In sum, the structural holes in a network are potentially valuable contexts for action, brokerage is the act of coordinating across a hole via bridges between people on opposite sides of the hole, and network brokers are the people who build the bridges and become more able brokers as they gain experience with diversity in their immediate social environment. Brokers 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, translating what is known here into what can be understood to be valuable over there. Network brokers are the social mechanism that clears a sticky-information market.

CREATIVITY IS AN ACT OF NETWORK BROKERAGE

To their European colleagues, Bill and Bob in Figure 1 are likely to appear creative. The European colleagues are not familiar with Asian or American operations, so good ideas

articulately proposed by Bill or Bob (from their contacts overseas) look like creative innovations to their European colleagues. For example, suppose that Bob and Jim in Figure 1 have the same idea for an entrepreneurial spin-off from the organization. Jim knows how to express the idea in terms of American operations. The more nuanced the idea, the more embedded in American operations, and the more different the American versus European operations (as indicated by the structural hole in Figure 1 between the two), then the less successful Jim will be in explaining the value of the idea to potential investors at the European headquarters. Jim can only explain in terms of American operations. In contrast, Bob is embedded in European operations and familiar with American operations, so he is better positioned to explain the value of the idea to potential investors in familiar terms.

Put yourself in the position of a manager working with a high-priced management consultant, Ana. You lead a team addressing a general problem in your company operations. A viable solution has not developed within the team, so you hire Ana. After becoming familiar with your company and the problem, Ana suggests solution XYZ and offers a list of cautions and enthusiasms specific to your company. XYZ sounds like a good way to manage the problem. You and your team are dazzled: "Ana is a genius. What a creative person." No, Ana just gets out more than you do. Ana learned about solution XYZ in the course of working with a previous client. People in the prior client organization had initiated and worked out the bugs in XYZ so they knew what it did well and where it required monitoring. For the prior client, XYZ became a taken-for-granted commodity element in their operations. Ana is a network broker. Like a mother bird who eats worms out of the ground and regurgitates them in a form digestible for her chicks, Ana took the XYZ solution from the prior client, shrouded it in the language of your company, and sold it to you as an idea tailored for your company. And her seemingly facile effort is worth the several hundred thousand you will pay Ana. She saved you the

time and effort and risk involved in your team detecting and evaluating alternative solutions. You are at a conference some months later and a friend in another company mentions that he is working on the problem for which you adopted XYZ. You suggest that he might consider doing X and Y and Z. “Terrific idea. That’s really creative.”

In short, creativity is an act of network brokerage. Ideas and works are not inherently creative. An idea deemed creative by this audience can be no more than familiar commodity to that audience. Value is decided by the audience. Network brokers move complex information from a place where it is a commodity to places where it will be valuable. Experienced, intelligent people have an advantage in brokerage as they do in most intellectual tasks, but the essential variation is in the audience. Every time a network broker moves information to a place where it is valued, it is an act of creativity — Ana to you, you to your friend in the other company. Creativity lives in relationships, not people. Thus the network proverb: “The easiest way to feel creative is to find people more ignorant than yourself.” (*New York Times*, 2004, May 22, page A17). The proverb sounds cynical, hypocritical, but it is at once true, inclusive, and practical. It is how individuals — some clever and some not — can all create value by re-using proven knowledge in new combinations and applications.

Note that the network role in creativity is one of facilitation (or inhibition), not necessity. Consider the following quote in which an executive explains the creativity and success of a prominent biotech entrepreneur: “His value as a scientist is that he is reading and thinking very widely. He is totally unafraid of any new technology in any area of human creativity. And he reads voluminously. He has wonderful contacts with people in many different areas, and he sees the bridges between otherwise disparate fields.”² The first three sentences are about the entrepreneur as an individual. He reads and thinks widely about any new technology in any area of human creativity. That

activity benefits from intelligence, education, and access to a good library/internet, but it does not depend on the entrepreneur's social network. People in closed networks can read widely just as easily as people in open networks.

But they don't. Confirmation bias sharpens our eyes to detect things consistent with what we already know or suspect, and we typically work under time pressure such that we do not get around to investigating novel things that catch our interest. Enter the network. It is referenced in the last sentence in the above quote: The entrepreneur has contacts in many different areas. He sees bridges between otherwise disparate fields. In other words, the entrepreneur's network alerts him to structural holes where brokerage could be valuable. People who socialize with people of diverse belief and behavior are at higher risk of seeing new combinations; in the words of the above quoted executive, network brokers are at higher risk of seeing "bridges between otherwise disparate fields." You are more likely to bump into things you didn't know you didn't know, pressuring you to re-think what you thought you knew. When you re-think what you know, the pieces come together in a slightly different way. Taking on unusual work assignments can lead to such a re-thinking (Kleinbaum, 2012). The extreme case is immigration, which asks for adaptation to a whole new social and cultural environment. Not surprisingly, immigrants are disproportionately the source of good ideas that develop into intellectual property (Maddux and Galinsky, 2009; Godart et al., 2015; Weiner, 2016). The inescapable diversity of surrounding oneself with friends who hold contradictory beliefs and practices makes a person accustomed to resolving inconsistency between friends, increasing one's skill in playing with alternative ways of thinking, and enhancing skill with recombinant knowledge. Even just growing up in a hometown of diverse populations is associated with currently building more diverse

networks (Wood, Kleinbaum and Wheatley, 2019). At the other extreme, by protecting a person from diverse belief and behavior, a closed network of homogeneous friends is prophylactic against such skill. Friends in a closed circle share stories reinforcing their stereotyped image of us, and their social support attributing failure to forces other than ourselves can obscure the wisdom failure could provide. Closed networks are the habitat of idiot savants (see Adams, 2019, for entertaining application to American society).³

The core network prediction about creativity is that network brokers, like Bob in Figure 1 with his connections to multiple groups, are more likely to be discussed as creative — relative to managers embedded in closed networks, like Jim (Burt, 2000:362-367, 2004). The prediction has empirical support. Network brokers score high on creativity when creativity is measured by supervisor summary opinion of a subordinate's work (Perry-Smith 2006; Zhou et al. 2009; Jang 2017; Carnabuci and Quintane 2018; and Soda, Stea, and Pedersen 2019, for results with self-reported creativity, which they find highly correlated with supervisor ratings), by executive opinion of manager ideas for improving the organization (Burt 2004, 2005, Chap. 2), or by external critical opinion of final product (Fleming and Marx 2006; Fleming, Mingo, and Chen 2007; deVaas, Vedres, and Stark 2015; Soda, Mannucci, and Burt, 2021). Other factors held constant, network brokers come up with more creative ideas, produce more creative work, and deliver higher performance.

Good Ideas

Let me illustrate. Figure 2A displays the network-creativity association with respect to good ideas. Taken from early work on the network origin of good ideas (Burt, 2004), the graph summarizes data on 455 supply-chain managers in a large American electronics company. Each manager was asked to write online his or her best idea for improving

the value of the company's supply chain. The company's two executive vice presidents rated each idea from 1 to 5 for its value to the company. Their average evaluation defines a manager's location on the vertical axis in Figure 2A.

———— Figure 2 About Here ————

Managers are distinguished by their networks on the horizontal axis in Figure 2A, from network brokers at the left (like Bob in Figure 1, note the network illustration below the horizontal axis to the left) to managers embedded in closed networks to the right (like Jim in Figure 1). Networks were measured by asking each manager to name the colleagues with whom he or she had the most frequent and substantial work contact, then asking them to describe relations with and between the named colleagues (similar to the network data displayed in Figure 1). Managers are distinguished on the horizontal axis by network constraint, an index measuring the extent to which a manager's network time and energy are consumed by one group. Multiplied by 100 so I can talk in terms of points of constraint, a constraint score of 100 indicates that a person's contacts are all strongly connected with one another (no access to structural holes). Constraint decreases toward zero with the extent to which a person has many contacts (network size or degree), increases with the extent to which the person's network is closed by strong direct connections between contacts (network density), and increases with the extent to which the person's network is closed by an individual through whom contacts are strongly connected indirectly (network hierarchy or centralization). Related popular measures of brokerage opportunities in a person's network are the number of nonredundant clusters in the network (effective size), or a count of the structural holes to which the person has monopoly access (Freeman's 1977 betweenness, see Burt, Kilduff, and Tasselli, 2013: 531-534, for comparative discussion).

The data in Figure 2A cluster along a nonlinear negative association between good ideas and network constraint. The more closed a manager's network, the lower

the rating executives gave the manager's idea. The Figure 2A association is robust to controls for a manager's job rank, experience, education, job function, and company division (Burt, 2004:381).

Note the importance of having poor ideas in the analysis. To the extent everyday people think about creativity, they want to be more creative rather than less. It is natural therefore to focus on obviously creative ideas, and emulate the qualities of people who propose creative ideas. Interested in networks, I could focus on ideas at the top of the executive rating scale, and ask what kinds of networks surround the people who proposed those ideas. The data in Figure 2A show that the networks associated with good ideas are large, open networks rich in structural holes. The problem with that research strategy is that I would not know how often the same kind of network is associated with poor ideas. In a population of investment bankers, most everyone has a large, open network, but only a subset of the bankers are credited with coming up with the good ideas that guide the bank. Generalizing from people known to have proposed good ideas is an example of an inference problem discussed as a halo effect in business (Rosenzweig, 2007) or more generally, sample selection bias (Morgan and Winship, 2007). The power of the data in Figure 2A is that across managers with diverse kinds of networks, executive rating of ideas systematically increase with the extent to which a manager's network is rich in structural holes.

How much do a manager's experience and intelligence matter? Initially I expected less experienced, less intelligent managers to be the people in closed networks, which I expected from network theory to be the source of pedestrian ideas and work. I was wrong about the ability of people in closed networks. It is not that they are unable. The problem is that they are specialized (cf. Merluzzi and Phillips, 2016, on over-specialized M.B.A. students hoping to be hired by investment banks). The supply-chain managers in Figure 2A are useful on this point. I do not have intelligence scores for the managers,

but I know their education, job rank, and years of experience. None of these human capital factors matter for executive opinion of a manager's idea (Burt, 2004:381). The 455 managers are similarly middle aged, with similar educations, and the majority had been in the industry for many years. The strong correlate of positive executive opinion is having relations to disconnected parts of the company, as illustrated in Figure 2A. The more closed the network around a manager, the more likely the manager has an idea the executives see as trivial, or has an idea the executives dismiss out of hand, or does not offer an idea (Burt, 2004:381).

Looking through the 455 idea texts, I had a sense that the texts from managers in closed networks included more specialized language specific to their work site such as program and technical terms. Within a closed network, people know similar things, so shared understanding of familiar things can be assumed. That assumption, valid for local conversations, does not apply to conversations with outsiders, especially senior executives at corporate headquarters. I did not measure the extent to which managers use language specific to their work site, but I can measure the extent to which they use language likely to be familiar to the executive judges. I ran the 455 idea texts through the language software LIWC (Pennebaker, Mehl, and Niederhoffer, 2003), which reports the percent of words found in the LIWC dictionary. The average idea text from the managers has 79.32 words in the LIWC dictionary, 33.67 words not in the dictionary. Technical and local terms are not in the dictionary. The first row of Table 1 shows that more words in the idea texts from network brokers are in the LIWC dictionary. With respect to dismissing ideas, an executive judge explained (Burt, 2004:379): "for ideas that were either too local in nature, incomprehensible, vague or too whinny, I didn't rate them." The second row of the table shows that the managers embedded in closed networks are more likely to have their idea dismissed by both executive judges as not worth rating.

———— Table 1 About Here ————

Creative Work

Of course, creating a valuable product is a process, not an event. Good ideas morph as they wind their way from inception to delivery through colleague opinions and technical issues. What begins as a good idea finishes as one of many possible implementations, the original idea subject to re-framing or re-imagining each step along the way (see Lingo and O'Mahony 2010; Rahman and Barley 2017, for illustrative detail, Latour 2008:5 for the succinct phrasing that design “is never a process that begins from scratch: to design is always to redesign”). Network advantage at the beginning and end of the creative process is likely advantage at critical decision points during the process (Stuart and Sorenson, 2007; Sorenson and Stuart, 2008; Anderson, Potocnik, and Zhou, 2014; Perry-Smith and Mannucci, 2017; though good ideas seem to be used to impress friends more often than improve operations, Burt, 2004: 389-394).

Figure 2B displays an illustrative network-creativity association with respect to work product. Taken from a recent network study of creative work (Soda et al., 2021), the graph summarizes data on all 200 producers, directors, and writers who worked on episodes of the British television show, *Dr. Who*. The negative associations in Figure 2B replicate results from other studies in which industry experts see less creativity in the work of people in closed networks, typically closed team networks (Fleming and Marx, 2006; Fleming et al., 2007; deVaas et al., 2015).

Two measures of creativity are reported in Figure 2B: a contributor's most creative work, and the number of episodes in which he or she contributed high quality work. The hollow dots summarize expert opinion on a 1 to 5 scale of the creativity of a person's most-creative contribution in their role as a producer, director, or writer (right-hand vertical axis). Given the episodes on which a person worked, each evaluated for the

person's creativity, what is the highest score the person ever received? The dashed line through the hollow dots in Figure 2B shows that network brokers reach a high level of creativity in their best work. The more closed the network, the less creative the best work (-.87 correlation).

The tendency for network brokers to reach higher levels of creativity in their best work cumulates across episodes. Network brokers end up contributing to multiple episodes rated as highly creative. The solid dots in Figure 2B describe the number of episodes on which a person worked that experts judged as highly creative for the contributor's role as a producer, director, or writer (left-hand vertical axis). Notice how the highly-creative work is concentrated to the left in Figure 2B. Network brokers not only reach a higher level of creativity in their best work (dashed line in the graph), they more frequently reach high levels of creativity (solid line in the graph; -.80 correlation with log network constraint).

The above paragraph reads as though contributors worked as individuals. In fact, they worked in teams. For Figure 3B, an individual's network of colleagues is constructed from a person's history of teams. Figure 3 illustrates team histories generating low versus high network constraint scores. Consider a director indicated by person A in Figure 3. In the first row of Figure 3, director A is in a team with three colleagues, typically a producer and two writers. He worked with the same three people on his previous episode of Dr. Who, and worked with the same three people on the episode before that. When the team history is aggregated, director A has a network of three colleagues, all maximally connected with each other, where the connection between persons A and B is the number of episodes on which they both worked. Network constraint is a high 92.6 points, which would put director A close to the extreme right in Figure 2B. By working with the same colleagues again and again, director A in the first row of Figure 3 is expected from a 92.6 constraint score in Figure 2B to have a

personal best of low creativity (dashed line in Figure 2B), and to never have worked on an episode the experts judge highly creative (solid line near zero).

———— Figure 3 About Here ————

In the second row of Figure 3, director A comes to the current team with a more varied history. He worked with B and C on the previous episode, and with B on a prior episode. D was brought in, recommended by C from C's prior work with D. In the second row, director A has an aggregate network of five variably connected colleagues. Network constraint is 59.9 points; about average. With director A's history, and a 59.9 constraint score, Figure 2B shows that he would be unlikely to produce an episode deemed highly creative (solid line in Figure 2B), but would be likely to reach a level of creativity in his best work that is higher than the level reached by the people in the first row of Figure 3 (dashed line).

Finally, in the third row of Figure 3, director A comes to the current team with the most diverse history (of the three histories in Figure 3). The current team involves contributors who rarely work with one another. Director A has eight weakly connected colleagues. Network constraint is a below-average 33.1 points. Working with colleagues from diverse histories, director A in the third row of Figure 3 is expected from a 33.1 constraint score in Figure 2B to have worked on at least one episode the experts judge highly creative (solid line in Figure 2B), and to have a personal best creativity rating in the high 4s (dashed line).

In sum, Figure 2B illustrates cross-sectional evidence of the expected network association with creative work, in this case team work. The evidence is cross-sectional in that aggregate networks are correlated with measures of maximum and cumulative creativity across a history of projects. Soda et al. (2021) show that the network-creativity association is robust to controls for episode content, contributor experience, contributor

role (producer, director, writer), and they extend the analysis to study the association over time.

Delivered Performance

Creativity is only one of the performance metrics associated with network brokers. The networks associated with creativity are also associated with work evaluations more positive than peers, compensation higher than peers, more likely recognition as a leader, and promotion faster than peers. The robust nature of the success-brokerage association is illustrated in Figure 2C with data on a few thousand managers and executives in the United States and Europe. With each of the ten management populations combined in Figure 2C, a manager's performance relative to peers (vertical axis) is measured by a Studentized residual from an equation in which raw performance is adjusted for correlates in the population (e.g., job rank, job function, location, age, education, gender, etc.). A score of zero indicates a manager whose success is what would be expected in his or her study population for someone with his or her characteristics. Positive numbers indicate managers ahead of expected. Negative numbers indicate managers below expected. For the horizontal axis, a network around each manager is computed from survey, email, or 360 data (details in the source publication, Burt, 2019b). As predicted by network theory, a manager's relative success decreases as his or her network becomes more closed (and the $-.74$ correlation in Figure 2C is similar across managers within the United States $[-.75]$ and Europe $[-.73]$, as well as a thousand Chinese managers not presented here $[-.78]$, Burt, 2021: Fig. 2).

IMPLICATIONS FOR FUTURE RESEARCH

Given a network association with creativity (Figures 2A and 2B) — similar to the network association with performance in general (Figure 2C) — what we know about

the network-performance association can be used to generate ideas for creativity research. Replication is an obvious implication. How robust is the evidence? Replication is our protection against overgeneralizing results from unusual study populations, and management research is prone to idiosyncratic results given our reliance on access to managers in a particular division or company (e.g., Figure 2A), or participants in a particular activity (e.g., Figure 2B). A result is not a fact until it is reported in a substantial probability sample from a heterogeneous population, or in multiple, diverse study populations (e.g., Figure 2C). In that spirit, what does the network-creativity association look like in diverse study populations and in domains other than business? It should be found in science, politics, nonprofits, as well as the arts and humanities (for popular press, search the internet for content linked to the phrase “everything is a remix”). Looking over time, how does inevitable network decay and renovation affect the association (Zaheer and Soda, 2009; Burt and Merluzzi, 2016; Quintane and Carnabuci, 2016)? How does the network effect mix with personality (Mehra, Kilduff, and Brass, 2001; Zhou et al., 2009; Baer, 2010; Burt, 2012) and culture (Morris and Leung, 2010)? How does the association vary with broker tactics (Soda, Tortoriello, and Iorio, 2018)? I discuss these questions and others elsewhere with respect to research on network brokerage (Burt, 2021). Here, I sketch two implications of the network-creativity association for creativity research in particular.

Micro versus Macro Network Structure

I have focused on the network around a person (known as a personal network, or an ego-network, Perry, Pescosolido, and Borgatti, 2018), but the network around any one individual is embedded in a broader network across the population from which the individual is drawn. For example, Bob is a network broker in Figure 1 between his organization’s European and American operations. I display at the top of Figure 4, Bob’s

personal network pulled out of the broader management network. Bob has the same network in Figure 1 and Figure 4, and the abundance of structural holes in Bob's network indicated by his low network constraint score of 20.1 implies that Bob is one of the more creative managers in the population.

When viewed in the broader context of Figure 1, however, Bob's network has additional qualities. For example, it has a level of status in the management network (Podolny, 1993). Bob has a personal connection with the head of the company's European operations (triangle symbol) and Bob is the only European who has a personal connection with the CEO of American operations (triangle). The senior people with whom Bob is connected not only hold high job rank, they are especially well connected occupants of high-rank jobs. Connections with well-connected people mean that Bob has high status in the management network. If Bob turns out to be one of the company's more creative executives, how much of his creativity comes from his access and confidence associated with occupying a high-status position (van den Born, Mehra, and Kilduff, 2018), rather than from the breadth, timing, and arbitrage advantage of his access to structural holes in his network?

Bob is also structurally unique. His network is unlike anyone else's. He is similar to several people in terms of being a network broker. Bill is another network broker, as are the several people marked with a "B" in Figure 1. But Bob is the only network broker connecting European and American operations. How much of Bob's creativity comes from him occupying a unique position in the management network (He sees things differently because he has a unique perspective on things), rather than from the breadth, timing, and arbitrage advantage of his access to the structural holes in his network?

These alternatives, two among many, raise a micro-macro question. With respect to the above paragraphs, are the network-creativity associations in Figures 2A and 2B

in some part associations with network status, or having a structurally unique position in the broader management network?

The question will not be easy to answer because micro and macro network variables are often highly correlated. Figure 4 illustrates the point. The horizontal axis for the graph in Figure 4 is the same as in Figure 2A, defined by the level of constraint in the personal network around each of the 455 supply-chain managers: brokers to the left, and clique managers in closed networks to the right. The vertical axis in Figure 4 describes manager status and structural uniqueness (Burt, 2004:364, displays the broader network). Status is the usual eigenvector measure, here normalized by the average score, so a status score of 1.0 indicates a manager of average status, a status score of 2.0 indicates a manager of status twice the average, and so on. The solid line through solid dots in Figure 4 shows that network brokers have high status on average, while managers in closed networks tend to have low status on the periphery of the management network. Lines through the hollow dots in Figure 4 show that network brokers also tend to occupy structurally unique positions in the management network. The solid line through hollow dots in Figure 4 describes average distances to other managers (network brokers are more distant on average), and the dashed line through hollow dots describes average distances to a manager's the five closest people (lower than the overall average, but network brokers are still more distant from closest colleagues than are managers in closed networks).⁴

———— Figure 4 and Table 2 About Here ————

To sort out the alternative network stories, Table 2 displays correlations among good ideas, constraint, status, and structural uniqueness. Each network variable has a statistically significant association with good ideas when used separately to predict good ideas. Good ideas are less likely in more closed networks (-7.55 t-test with constraint), more likely from a manager high in network status (6.85 t-test), and more likely from

managers who occupy more unique positions in the management network (4.27 t-test). Network constraint is the primary predictor when all three network variables predict together, but correlations among the network variables are so high that the balance could shift to another network variable with minor change in the network correlations with good ideas — as could be expected in another study population, or even a replication in the same study population. The point is that creativity is likely to be associated with both micro and macro network structure. Sorting out the most active network mechanism requires replication studies, and more detail on creative acts.

Illegitimate Creativity

Studies of performance and network brokerage reveal contingency on social standing. People with low social standing in a population often enjoy little or no advantage from network brokerage in the population (Burt, 1997, 1998, 2021; Rider, 2009; Burt and Merluzzi, 2014). Divide the people in a study population into two categories: insiders (people with social standing sufficient to operate as a network broker) versus outsiders (people with social standing insufficient in the study population to operate as a network broker). Most management populations I have studied contain no outsiders. Everyone is eligible to operate as a network broker. Where outsiders exist, however, their presence and treatment is starkly apparent.

———— Figure 5 About Here ————

The graphs in Figure 5 are the same as Figure 2C — relative performance is predicted by level of network constraint — except insiders are distinguished from outsiders in Figure 5. Perhaps the most familiar indicator of social standing in management studies is job rank. Figure 5A contains the same people displayed in Figure 2C but here managers in senior job ranks (solid line through solid dots) are distinguished from managers in job ranks at the bottom of the ranks deemed eligible as

a source of good ideas (dashed line through hollow dots). People in the lower job ranks, who seem to be outsiders to senior management, show no compensation benefit from network brokerage.⁵

Figure 5B is six months after a merger. Before the merger, both companies had strong, contradictory cultures, and a history of using one another as an icon of what we do not want to be. After the merger, senior managers from the acquired company carried the stigma of their legacy. They were outsiders. Senior people in the acquiring company ostentatiously displayed disdain for behavioral stereotypes attributed to the acquired company, and did not wish to be seen following advice from legacy managers from the acquired company. The solid line through solid dots in Figure 5B shows substantial returns to brokerage for managers in the acquiring firm. The dashed line through hollow dots shows negligible compensation returns for managers from the acquired company (and note the absence of any hollow dots in the upper-left in Figure 5B; able leaders from the legacy company, outsiders in the post-merger company, left for jobs elsewhere).⁶

In Figure 5C, senior men enjoy substantial returns to brokerage, but women and junior men are punished if they try to behave like a network broker. Their promotions are delayed. The women and junior men are outsiders to senior management. The benefits of networks rich in structural holes were the domain of senior men (in the study population at the time when the Figure 5C data were gathered).⁷

The illustrative results in Figure 5 show the network-performance association contingent on audience acceptance of a person as a network broker. To the extent that creativity is an act of network brokerage, the same contingency can be expected in creativity. Overlooked creative acts by outsiders can be termed “illegitimate creativity.” Expect in Figure 5A that important creative ideas are attributed to people in senior job ranks rather than junior ranks. In Figure 5B, they are attributed to leaders in the

acquiring firm, and especially not to people from the legacy acquired firm. In Figure 5C, important creative ideas are attributed to senior men, and especially not to women, or to youngsters with insufficient experience. People are more likely to recognize creative acts from people like us, insiders, rather than people we view as not one of us. I dare say we have each of us at one time or another ignored outsider creativity as arrogant, uninformed, inarticulate, or even crazy. The people of low social standing in each of the Figure 5 graphs can offer creative ideas, but the noise will go unnoticed until it comes out of an appropriate insider. Having your creative ideas overlooked in favor of insiders offering the same ideas is a disincentive to offer additional creative ideas, and living as an outsider among insiders can be expected to erode confidence and sense of worth (Burt 2010:216-218), which can have its own a negative effect on displayed creativity (Isen, Daubman, and Nowicki, 1987; Amabile et al., 2005). In short, people not accepted as network brokers are unlikely to be creative. As it turns out, consistent with the prediction, good ideas in Figure 2A are less likely to come from managers in lower job ranks, among whom Figure 5A shows that compensation is not associated with network brokers (mean executive ratings are 1.63 for ideas from managers in the lower two ranks, 2.42 for managers in more senior ranks, 6.08 t-test, $P < .001$). The importance to network brokers of social standing in a target audience raises interesting and tractable empirical questions for research into creativity as an act of network brokerage.

CLOSE

This chapter has been in three parts. I sketched the connection between information and network structure, which is foundation for a network-creativity association. I then discussed illustrative evidence of network associations with good ideas, creative work, and delivered performance — which together illustrate my central point that creativity is

an act of network brokerage. I closed discussing network implications for future research on creativity, focusing on two new areas: the overlapping effects of micro versus macro network structure (Is it your network or your position in their network?), and the idea of illegitimate creativity (Will the audience accept you as a creative?).

NOTES

¹Portions of this section are adapted from broader introductions to the network theory for other audiences: Burt (2010) for management, Burt, Kilduff, and Tasselli (2013) for psychology, Burt and Soda (2017) for strategy, Burt (2019a) for entrepreneurship, Burt (2021) for sociology.

²The quote is from a video, privately shared by Yves Doz, of his 1998 interview with Russell Howard at Affymax talking about the Affymax founder, Alejandro Zaffaroni.

³There are, of course, exceptions in which cohesion enhances exchanges among diverse people in a group, thereby providing the benefits of network brokerage (Leavitt, 1996; Farrell, 2001; Aral and Van Alstyne, 2011; Brothers, 2018; see Burt, 1992:44-45, on structural autonomy; and cf. Soda, Stea, and Pedersen, 2019), but these are heroic exceptions to be celebrated. Closed networks are more often composed of homogeneous belief and behavior.

⁴Each manager has a profile of 454 relations with each other manager. Euclidean distance between the profiles for two managers measures the extent to which the two managers are connected differently in the management population: $d_{ij} = \sum_k (z_{ik} - z_{jk})^2$, $i \neq k \neq j$, where z_{jk} is the strength of connection between managers j and k , and d_{ij} is the squared Euclidean distance between managers i and j . Sort the 454 distances between manager i and each other manager, from closest colleague to colleague furthest away. The hollow dots in Figure 4 describe average distance to all other managers (solid line), and average distance to a manager's five closest colleagues (dashed line).

⁵Predict an individual's annual compensation by the following (plus intercept and residual terms): $\alpha S + \beta(\log C) + \lambda S(\log C) + \sum_k b_k X_k$, where, S is a binary variable distinguishing people with high social standing in Figure 5, C is network constraint on the horizontal axes in Figures 2

and 5, and various success factors X_k in the population are held constant. The beta coefficient in the model measures the cost of network constraint to people with low social standing (dashed lines in Figure 5), and lamda (λ) is the expected negative adjustment for people with high social standing (difference between the slopes of the dashed and solid lines in each graph). Figure 5A describes compensation to supply-chain managers in a large electronics company, holding constant job function, age, education, division, and geographic location (Burt 2004:371). Of the five job ranks distinguished in the analysis, the bottom two are distinguished here as low social standing. Repeating the prediction in the original analysis but now with level and slope adjustments for S, the success-brokerage association is negligible for managers in the bottom two ranks (0.50 t-test for beta, $P \sim .61$) and substantial for managers in the higher ranks (-4.88 t-test for lambda, $P < .001$).

⁶Continuing the previous footnote, Figure 5B describes compensation to managers in the merged organization holding constant job rank, age, function, and geography. Removing compensation differences associated with the control variables, the success-brokerage association is negligible for people acquired from the legacy firm (1.02 t-test for beta, $P \sim .31$) and significant for people who worked in the acquiring firm (-3.81 t-test for lambda, $P < .001$).

⁷Continuing the previous two footnotes, Figure 5C describes age at promotion to senior rank in a computer company holding constant manager job rank, function, location, education, and seniority (Burt 1992:126-131). Analysis revealed that women in all ranks, and men in the most junior of the senior ranks, suffered promotion delay when they had a network rich in structural holes. Repeating the prediction in the original analysis, but now with level and slope adjustments for S (a dummy variable distinguishing senior men), the success-brokerage association shows delayed promotions to women and junior men who are network brokers (2.32 t-test for beta, $P \sim .02$) while promotions to senior men are delayed when they are not a network broker (-5.27 t-test for lambda, $P < .001$). Casual readers of Figure 5C in the source article often infer that women and junior men in all organizations are denied the benefits of network brokerage. The inference is incorrect. Disadvantage is specific to a study population at the time it is observed (on age discrimination, see Burt 2018). Figure 5C is a rare exception, not the rule.

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Table 1.
Network Brokers Use More Familiar Language

	Network Brokers: Relatively Open Networks	Average Networks	Clique Managers: Relatively Closed Networks	Probability No Difference
Familiar Text	56.32	46.67	34.34	P < .001
Idea Dismissed	14.38%	36.94%	43.42%	P < .001

NOTE — Columns distinguish the bottom, middle, and top third of managers on network constraint in the Figure 2A population (horizontal axis in the figure). “Familiar Text” is the number of words in a manager’s text that are familiar in the sense that they are found in the LIWC language software dictionary. Probability test is based on a -9.49 z-score from a Poisson regression of word count over the three network categories (-1, 0, and 1), controlling for number of words in the manager’s idea text. “Idea Dismissed” is the percent of managers whose idea is dismissed by the executives as not worth rating. Probability test is based on a 5.14 chi-square with 2 degrees of freedom, controlling for number of words in the manager’s idea text.

Table 2.
Micro and Macro Network-Creativity Associations

	Regressions (t-tests)		Correlations			
	Each Predictor Separately	All Three Predictors	Good Idea	Network Constraint	Network Status	Structurally Unique
Network Constraint	-7.55	-4.09	-.33	1.00		
Network Status	6.85	2.51	.30	-.63	1.00	
Structurally Unique Position	4.27	0.15	.19	-.46	.51	1.00

NOTE — The three network variables are log scores to capture the nonlinear association with good ideas (Figure 2A). First column is the vertical axis in Figure 2A regressed across each network variable separately. Second column is all three network variables in same regression. Network status is eigenvector of network (solid line through solid dots in Figure 4). Structurally unique position is average Euclidean distance from manager to all other supply-chain managers (solid line through hollow dots in Figure 4).

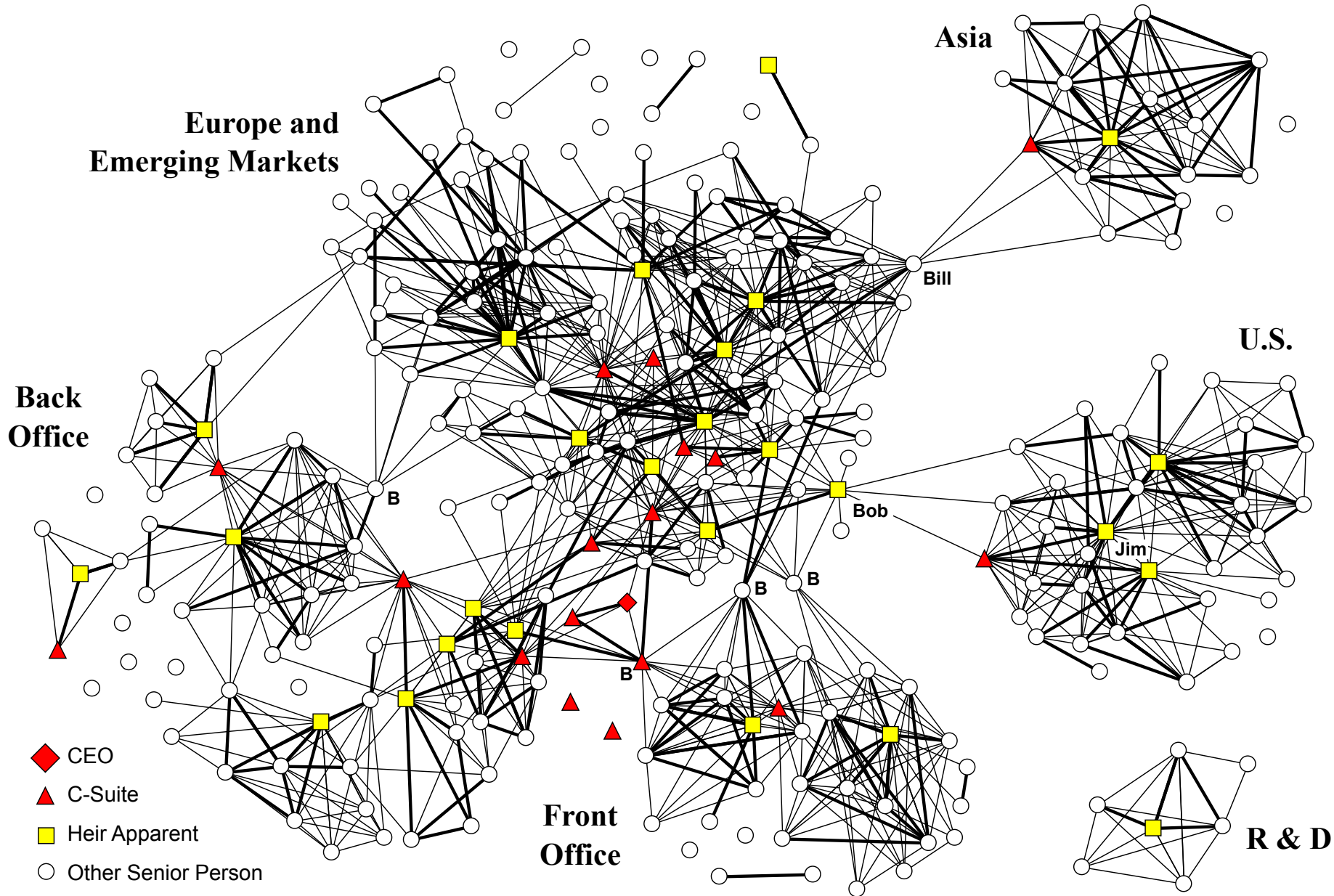


Figure 1. Social Network at the Top of a Leading E.U. Company

Lines indicate frequent and substantive work discussion; bold lines especially close relations. Reprinted with permission (Burt, 2019a).

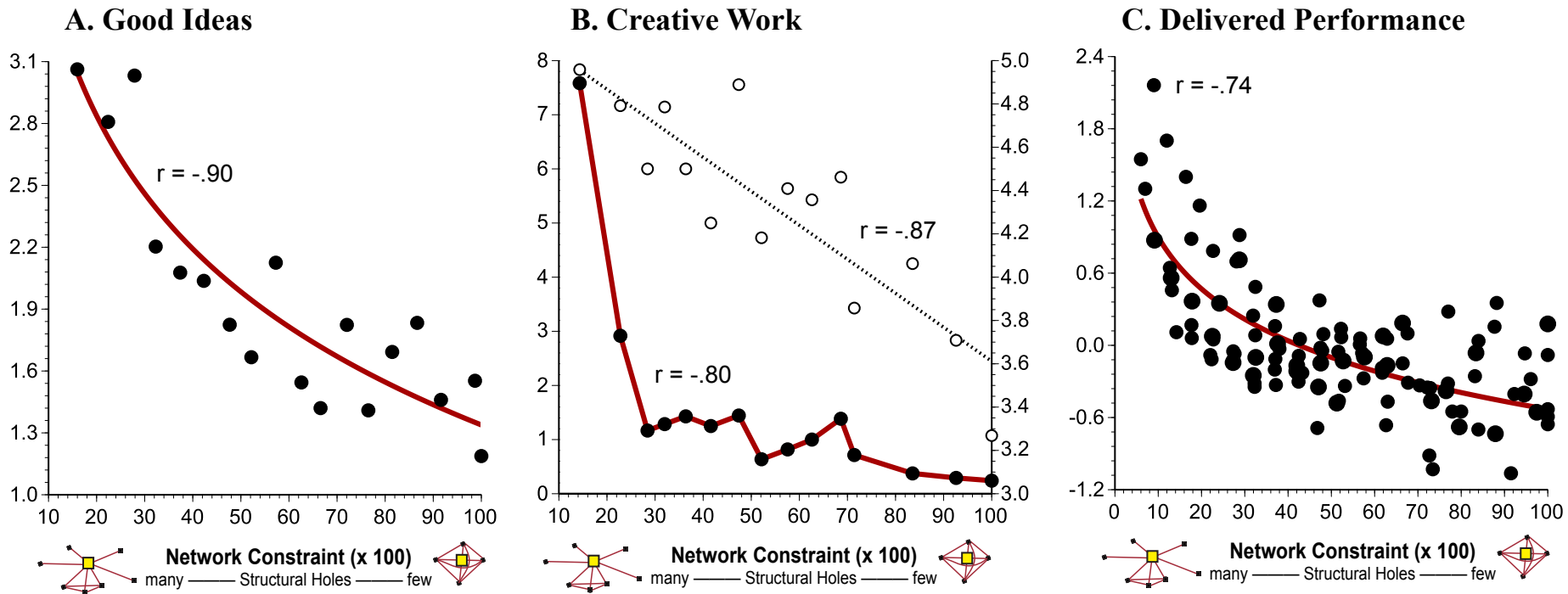


Figure 2. Network-Creativity Associations

NOTE — Plotted data are average scores on X and Y within five-point intervals of network constraint (horizontal) in each study population. Correlations are computed from the plotted data for the displayed association. Vertical axis in graph A is executive rating of the value of 455 manager best ideas for improving company operations (adapted from Burt, 2004: 382). Two vertical axes in graph B are based on expert evaluations of the episode-specific creativity of 200 writers, directors, and producers in the Dr. Who television series (adapted from Soda, Mannucci & Burt, 2018: Figure 6). Axis to the right in graph B is the highest level of creativity a person reached in any episode (dashed line through hollow dots). Axis to the left is the cumulative number of “highly creative” episodes on which a person worked over their career with the series (solid line through solid dots). Vertical axis in graph C is z-score performance relative to peers for 3,179 managers in ten European or U.S. firms, where performance is measured with in study populations by annual evaluations, compensation, or early promotion (see text; graph adapted from Burt, 2019b: 38).

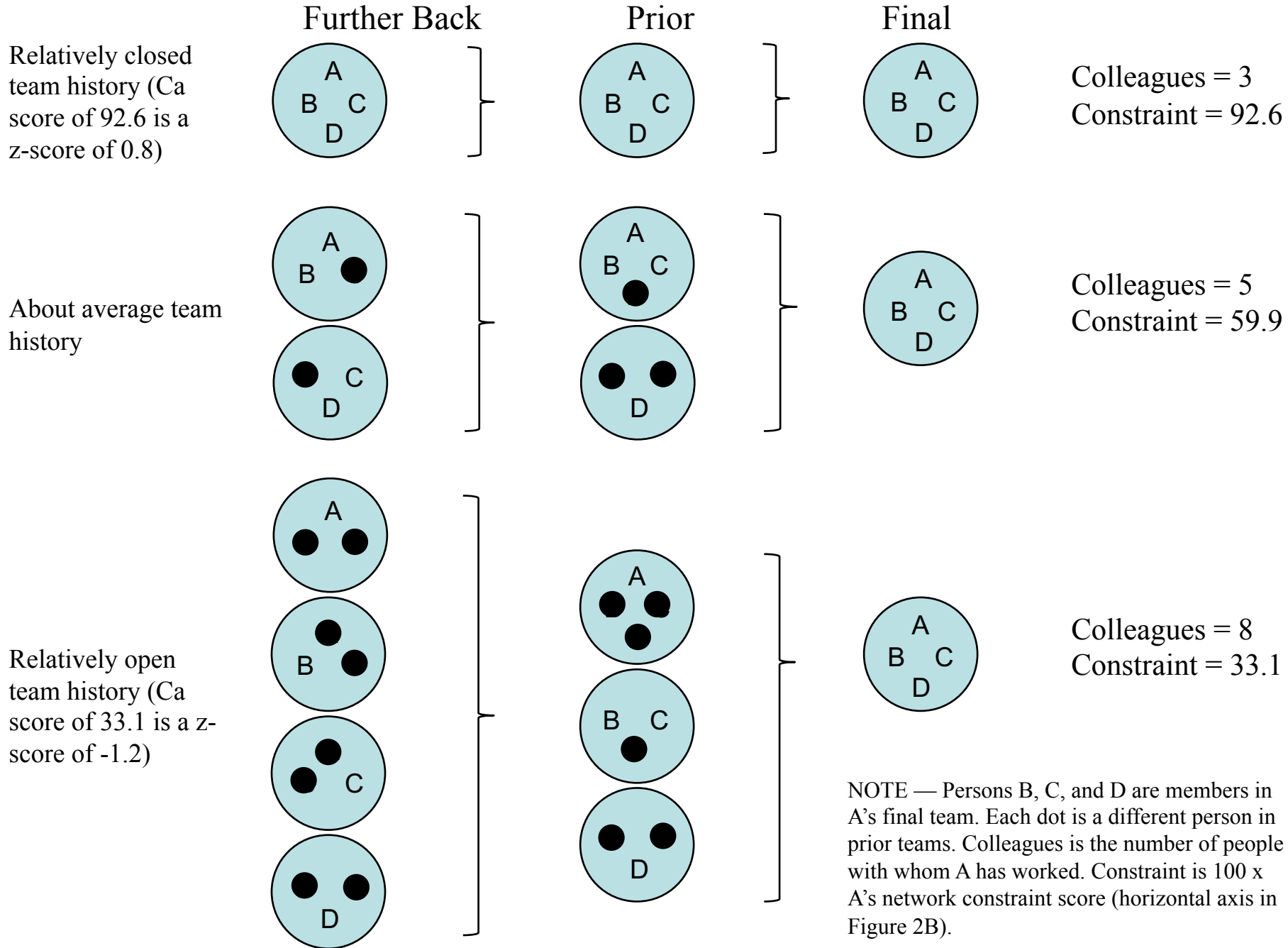


Figure 3. Person A in Three Team Histories

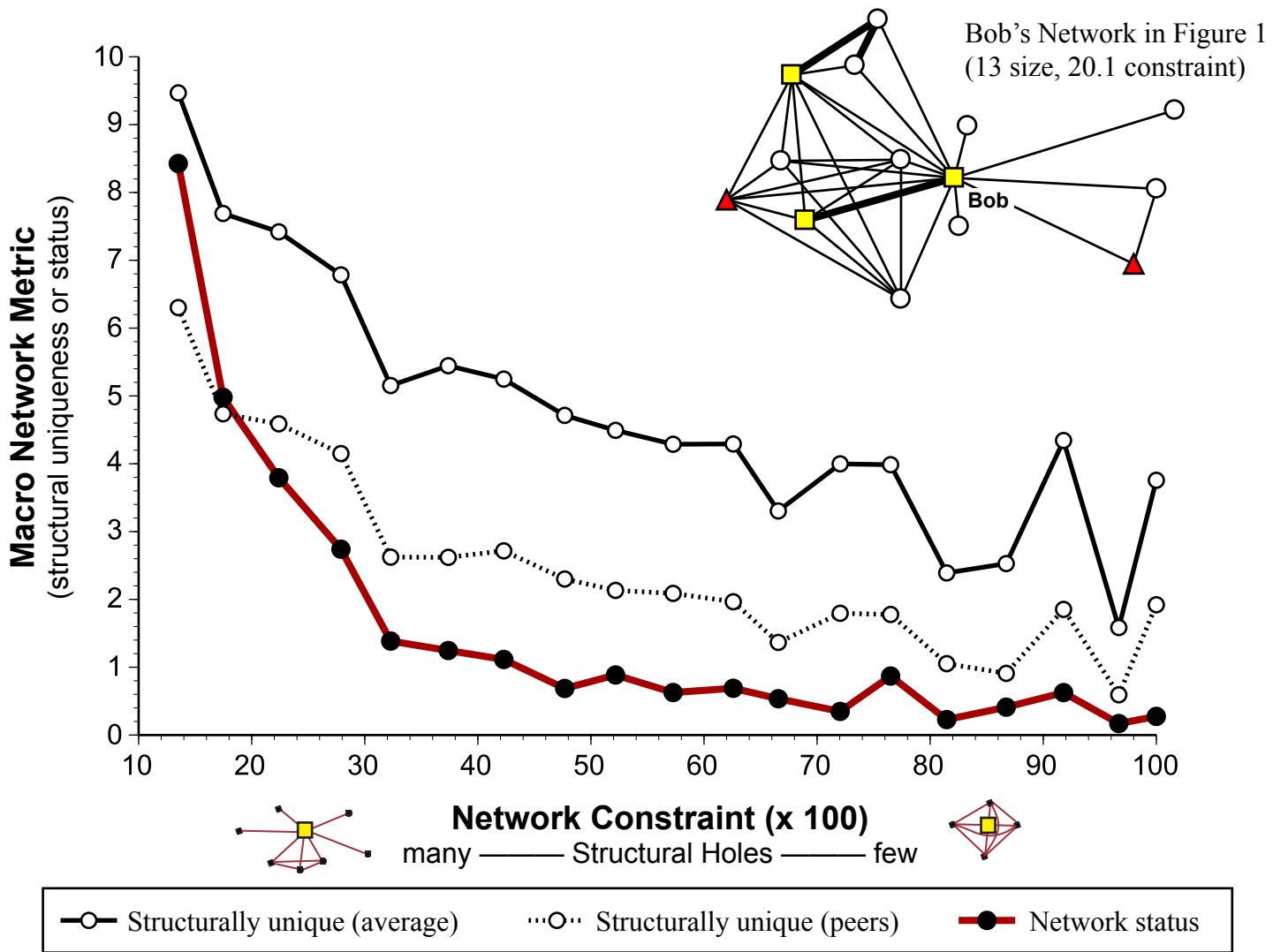


Figure 4. Micro Network Structure Is Correlated with Macro

NOTE — Plotted data are average scores within five-point intervals of network constraint for people in the Figure 2A management population. Status is an eigenvector expressed in multiples of average (solid dots). Structural uniqueness is Euclidean distance from networks of other managers in the population, on average (solid line through hollow dots) and relative to five most similar managers (dashed line through hollow dots).

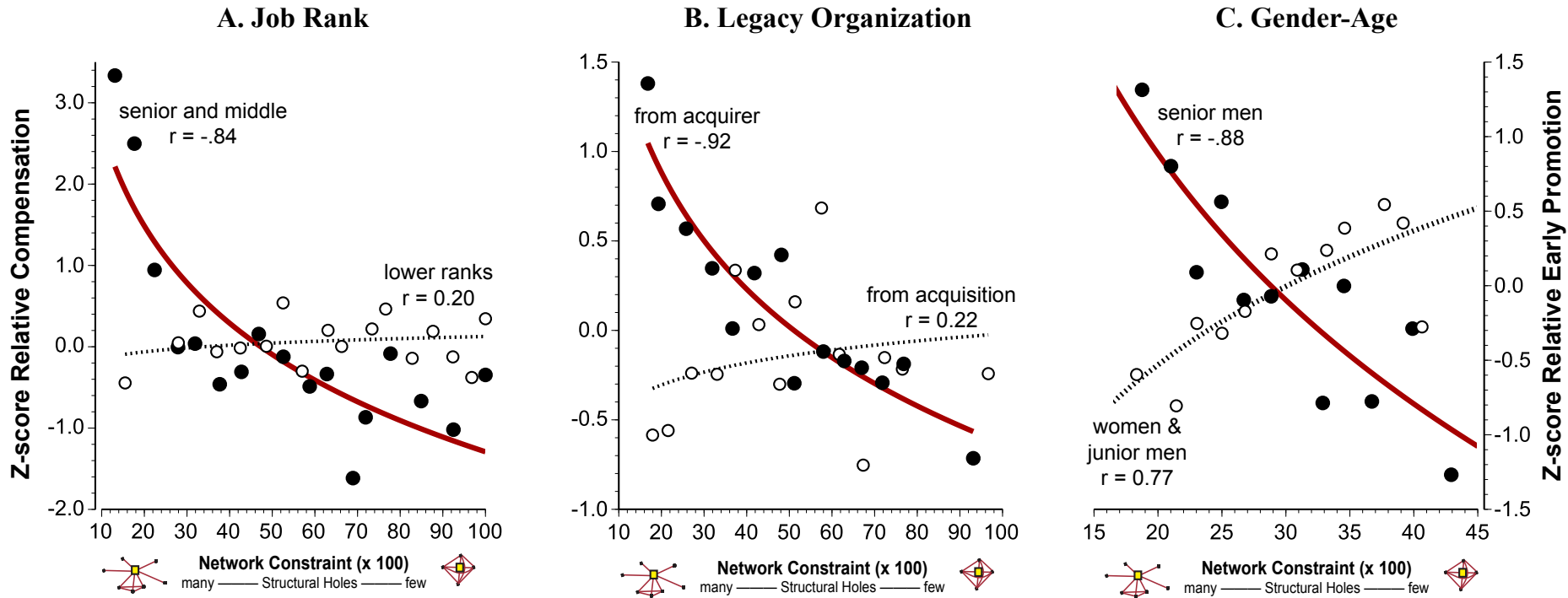


Figure 5. Detecting Network Brokers Deemed Illegitimate

NOTE — Plotted data are average scores within five-point intervals of network constraint within each study population (electronics company for job rank, computer company for M&A post integration, and another computer company for gender-age, see footnotes 5, 6, 7). Hollow dots are data on people deemed illegitimate to be network brokers in their organizations at the time. Correlations are computed from the plotted data using log network constraint.