

# Information and structural holes: comment on Reagans and Zuckerman

June, 2008 © RONALD S. BURT

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Reagans and Zuckerman (hereafter RZ) go behind the performance link with network brokerage to speculate on how information flow is responsible. The intuition is a perceived tension between brokers and contacts: If nonredundant sources of information provide the broker's competitive advantage, as is assumed in empirical research on the returns to brokerage, then the broker's contacts have a countervailing advantage as monopoly sources. Advantage versus countervailing advantage is the tension to be resolved.

The analysis is interesting in its own right, but it carries a broader significance in addressing a critical juncture for network models of advantage. Empirical success in predicting performance with network models has far outstripped our understanding of the way information flow in networks is responsible for network effects. A cluster of network concepts emerged in the 1970s on the idea that advantage results from connections with multiple, otherwise disconnected, groups and individuals. The hubs in a social network were argued to have advantaged access to information and control over its distribution. At the center of the concept cluster are Granovetter (1973, 1983) on weak ties as bridges between groups, Freeman (1977, 1979) on network centrality as a function of being the connection between otherwise disconnected people, Cook and Emerson (1978; Cook et al., 1983) on the advantage of having alternative

exchange partners, Burt (1980, 1982) on the advantage of disconnected contacts, later discussed as access to structural holes (Burt, 1992, 2005), and Lin et al. (1981) on the advantage of distant, prestigious contacts, later elaborated in terms of having contacts in statuses diverse and prominent (Lin, 2002). Empirical research has remained lively in predicting performance at the level of people, teams, organizations, and industries. However, the substance of advantage, information, is almost never observed. Rather, we rely on assumptions drawn from early diffusion research to treat network structure as a proxy for information flow, which makes it possible to ignore information, and get on with the task of explaining performance differences (not unlike the research focus on correlation between structure and performance in the structure-conduct-performance perspective on industrial organization).

Thus, the five and a half assumptions that define RZ's analysis warrant attention as a template for agent-based models of the information mechanism responsible for the broker's advantage. Table 1 lists RZ's five fixed assumptions as they number them, with RZ's variable assumption the uniform-homophily contrast in the third row of the table (Reagans and Zuckerman, 2008a:###-###; manuscript pages 7-12). The table also lists what I believe is a likely alternative version of each assumption, with implications for the performance advantage of brokers and the broker-contact tension that RZ use to motivate their analysis. I enter 'RZ' in an implications column where the variation is what RZ use in their analysis.

———— Table 1 About Here ————

A quick scan of the implications columns show that RZ's analysis is almost robust over the alternatives. I expect less broker-contact tension with the alternative capacity and channel assumptions — but the tension does not go away. In fact, the tension is more severe than RZ describe if information is distributed in the clustered way typically assumed in research on network brokerage. With likely alternative transmission or pricing assumptions, however, the broker-contact tension can be eliminated, to the broker's advantage.

### **Defining the social context: channel and distribution assumptions**

The setting for RZ's analysis is a fixed network of agents each endowed with a unique bit of information. The fixed network is RZ's 'links as fixed pipes' assumption (#3) in which network links are two-way channels through which bits can flow. This assumption is strong in the sense that we know it is typically not true. Some relations are exogenous, such as kinship or one's boss at work. Social foci limit opportunities to develop relations (Feld, 1981). Within limits, however, we select the people with whom we spend time and to whom we pay attention. Children can have a preferred parent. Managers do not always cite their boss as a key discussion contact (e.g., Burt, 2005:243, reports 69% not citing their boss). Brokers in particular can be expected to replace difficult contacts who exercise too much countervailing power; bridge relations between broker and contact certainly decay more quickly than relations embedded in mutual friends (Burt, 2005:196-208).

Although typically untrue, RZ's fixed-network assumption is not exceptional. It is implicit in empirical research on the performance correlates of network brokerage. The research is usually based on cross-sectional data so network structure is treated as fixed for the moment it was observed. More important, relaxing the fixed-network assumption does not eliminate the broker-contact tension that motivates RZ's analysis. If the assumption is relaxed so that connections are endogenous, the countervailing power of contacts against brokers is diminished since brokers are free to find alternative contacts when a current contact becomes difficult. I suspect that wealth would be more concentrated in advantaged people if redundant contacts could be used as substitutes (Burt, 1979), however, tension would remain since there are limits to individuals establishing or withdrawing from relationships (Reagans and Zuckerman, 2008a:## ##, ##-##; manuscript pages 8-9, 35-36). In fact, Ryall and Sorenson (2007:578) use a game-theoretic model of endogenous networks to conclude that the

tension limits brokers to a short-run advantage (see Buskens and van de Rijt, forthcoming, for broader analysis to the same end): "our results raise doubts as to whether brokers should ever emerge when performance-motivated actors choose their relations strategically, and, if they do, how long such positions can persist."

#### *Uniform distribution of information*

With respect to the distribution of information, RZ reason from a uniform distribution in which each agent has one unique and valuable bit. Specifically, the 'equal but unique endowment' assumption (#4) defines a distribution in which each person begins with one bit of information that (a) no one else possesses, (b) that neither complements nor substitutes for other bits, and (c) has the same value, subject to market conditions, in the sense that people are indifferent between two bits they do not already possess. It is difficult to imagine an organization or market in which information has this distribution. One could argue that the uniform distribution is a primal state from which a familiar distribution should evolve in the simulation, but it is not clear that people were ever equally endowed with a unique, valuable bit of information, and stories about information primal states involve more guess work than stories about the information distribution observed today as it affects advantage going into tomorrow.

A cluster distribution of information is reported in empirical research and typically assumed in theoretical discussions of network brokerage. Shifting from a uniform to a cluster distribution would increase accuracy without changing RZ's conclusion (though the simulation results on diffusion timing lose some of their thunder). Broker-contact tension increases because nonredundant contacts in a fixed network with a cluster distribution of information have a stronger monopoly on their cluster's information, so the broker's advantage would be eroded.

#### *Cluster distribution of information*

Models of network brokerage typically assume a distribution of information based on two facts taken from early diffusion research on communication and influence (e.g.,

Festinger, Schachter and Back, 1950; Coleman, Katz, and Menzel, 1957; Katz and Lazarsfeld, 1955): (1) People cluster into groups as a result of interaction opportunities defined by the places where people meet; the neighborhoods in which they live, the organizations with which they affiliate, the offices where they work, the projects in which they are involved. (2) Communication is more frequent and influential within than between groups such that people in the same group develop similar views of the history that led to today, similar views of proper opinion and behavior, similar views of how to move into the future. People tire of repeating arguments and stories explaining why they believe and behave the way they do. They make up short-hand phrases to reference whole paragraphs of text with which colleagues are familiar. Jargon flourishes. Not only jargon, but a system of phrasing, opinions, symbols and behaviors defining what it means to be a member of the group. What was once explicit knowledge interpretable by anyone becomes tacit knowledge meaningful only to insiders. With time, new combinations and nuances emerge. The tacit knowledge becomes more complex, making it more difficult to move to other groups. Explicit knowledge converted into local, tacit knowledge makes information sticky (von Hippel, 1994) such that 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 that inhibit information flow between people ("like an insulator in an electric circuit," Burt, 1992:18).

*Cluster distribution as foundation for advantage*

Structural holes distinguish two network sources of advantage: brokerage and closure. Argument and portions of available evidence are reviewed in Burt (2005). By way of quick introduction to prepare for comments below, closure is about staying on your own side of the hole. It is about the benefits of protection from variation in opinion and behavior, protection provided by focusing on connections with your own kind of people. Structural holes are boundary markers in the division of labor. By not having to attend to the interpretations of people beyond the boundary around my specialty, I

can focus on deepening my knowledge of what I already know pretty well. If structural holes were taken away, we would quickly re-create them to re-establish a sense of control over our lives. The advantage provided by closure is familiar in sociology from Granovetter's discussion of 'embedding' (1985) and Coleman's discussion of 'social capital' (1988). Reputation is the mechanism by which closure delivers its effect. As connections close the network around a manager, people are more informed about one another and calibrate with respect to one another. Reputations emerge to distinguish the peripheral from the best among us. To preserve reputation among colleagues well-informed about one another's behavior, people are careful to behave well (which lowers the risk of trust within the network) and people work to keep up with colleagues (which lowers cost within the network by increasing the quality and quantity of work and decreasing the need for a supervisor to monitor individual behavior). Closure's advantage is manifest as enhanced collaboration, productivity, and stability that speed a group down its learning curve.

Relatively homogeneous opinion and practice within closed networks is what makes brokerage across networks valuable. Network brokerage is about the advantage of exposure to variation in opinion and behavior provided by building connections across structural holes. In a closed network, where everyone you know knows everyone else, there are no structural holes to broker. Managers whose contacts are all in the same group know only their own group's opinion and practice. The more disconnected a manager's contacts, the more likely his network spans structural holes in the surrounding organization and market. People who connect across structural holes (call them network brokers, connectors, hubs, or entrepreneurs) are exposed to diverse opinion and behavior in the surrounding organization and market. Their connections are opportunities to coordinate people otherwise disconnected, and derive ideas or resources from exposure to contacts who differ in opinion or practice. Connecting across more holes means broader exposure. Broader exposure provides a vision advantage in selecting early between alternative

ways to go, synthesizing new ways to go, framing a proposal to be attractive to needed supporters, and detecting likely supporters/opponents to implementing a proposed way to go. The vision advantage is manifest across levels of analysis in routine performance metrics such as productivity, evaluations, and earnings higher than peers.

*Lack of direct research on distribution and advantage*

The cluster distribution of information is almost never observed in research on the returns to network brokerage. Discussion content is inferred from the structure of relations among the people with whom discussion occurs. The more that ego talks with people in separate groups, the more likely ego is discussing different topics. Using network structure as a proxy for information flow has facilitated research since structure can be measured more reliably and at lower cost than would be true of measuring information flows. Information flow can be documented in a limited way with ethnographic data (Obstfeld, 2005, on brokerage; Barker, 1993, on closure). The usual breadth-for-depth trade off can be made with survey questions asking respondents to remember their discussions with specific colleagues. For example, Rodan and Gallunic (2004) report that contacts perceived to know things different from a survey respondent are associated with higher respondent performance and disconnected contacts. Of course, topics deemed important by one manager can seem trivial to another (Bearman and Parigi, 2004), but specific information content matters less than content variation. Is discussion limited to a closed network of colleagues with similar views, or discussed with colleagues who have divergent views?

The breakthrough in testing information flow assumptions emerged a few years ago in algorithms for encoding electronic messages so the content of individual information exchanges can be compared while preserving sender and recipient confidentiality. For example, Aral and Van Alstyne (2007) analyze email traffic in a small headhunter company (73 recruiters in 14 offices in 2001) along with traditional survey network data and company data on recruiter backgrounds and performance.

Knowing the (encoded) content of email messages allows Aral and Van Alstyne to measure the information heterogeneity in which each recruiter is involved. They show that information heterogeneity is associated with bridging structural holes (people rich in information heterogeneity have many colleagues not closely connected with one another), and is associated with higher recruiter performance in terms of billable hours and bringing in contracts. Aral and Van Alstyne's analysis is a 'proof of concept' prototype for authoritative network analyses of information flow in large heterogeneous populations. Awaiting that authoritative research, formal models of information flow take on timely significance as a way to understand information mechanisms responsible for network advantage.

*Operationalizing the cluster distribution*

Here is a heuristic formula for  $s_{ij}$ , the extent to which two agents  $i$  and  $j$  in a network of symmetric connections (as in RZ's analysis) would be expected to have the same knowledge:  $s_{ij} = f(z_{ij}) - f(\sum_k (z_{ik} - z_{jk})^2)$ , where  $i \neq k \neq j$ , and  $z_{ij}$  measures the connection between  $i$  and  $j$ , so the two terms in the formula measure relational and structural equivalence factors. The likelihood of information moving between  $i$  and  $j$  increases with the strength of their connection ( $z_{ij}$ ) and the likelihood of them having similar knowledge increases with the extent to which they communicate with the same contacts ( $\sum_k (z_{ik} - z_{jk})^2$ ). Consistent with the diffusion-research image of opinion leaders, the relational factor is especially relevant to broker knowledge while structural equivalence describes shared knowledge in groups (Burt, 2005:78-86).

Replacing RZ's uniform distribution of information with a cluster distribution has two implications: First, the broker-contact tension is more severe than RZ describe. Brokerage is about access to variation. With a uniform distribution of information, there is abundant variation within and across groups. Clustered information means greater monopoly power for contacts within their respective clusters, which increases RZ's countervailing power of contacts against brokers.



The second implication is timing. The speed with which bits of information spread through a network depends in part on initial distribution. A cluster distribution of information means that people in closed networks, the people on the periphery of the illustrative networks in RZ's analysis, often fail to find exchanges for new information. In each round of the simulation, an agent draws one contact at random to determine whether there is information to exchange. Within a closed network, that random contact knows what ego knows so there is no exchange, and ego has to wait for the next round, slowing ego's access to new information — which corresponds to the network evidence on people searching for novel information (Lee, 1969; Korte and Milgram, 1970; Granovetter, 1973: 1371-1373). The time-to-new-information difference between a uniform and cluster distribution will be larger in populations that contain more people in closed networks. The hypothetical networks in RZ's analysis contain many positions with few occupants in each. The largest number of agents sharing a single position is three (the isolated triads in Figure 2). Networks in organizations typically have the opposite balance (many people inside groups, and fewer people brokering connections across groups), which means a larger timing difference between a uniform versus a cluster distribution.

### **Defining the agents: capacity assumption**

To more clearly study network effects, RZ hold constant individual differences in ability to exchange information. This is their 'limited bandwidth' assumption (#1) in which every agent "has the same limited capacity for transmitting or receiving resources at a given moment of time." RZ operationalize limited bandwidth as a quota on search. Each agent is given one opportunity in each round to find an acceptable exchange. When it is ego's turn, one of ego's contacts is drawn at random. An exchange calculation is made. If the exchange is not acceptable to ego, ego waits for the next round to search for an acceptable exchange.

Without this assumption, RZ believe that "structural effects will be swamped because actors with a very high bandwidth will end up with the greatest share of the knowledge in the network." (Reagans and Zuckerman, 2008a:##; manuscript page 7). This assumes that individual differences in capacity are a performance factor in their own right, exogenous to the network around an individual. Examples would be the personality differences that Mehra, Brass, and Kilduff (2001) report in which network brokers tend to score high on self-monitoring, or Schumpeter's opinion that 'good health' is the most important success factor for entrepreneurial activity. In empirical research on network effects, the limited bandwidth assumption is operationalized by holding constant measures of individual differences in capacity such as job rank, education, and experience.

Alternatively, capacity can be assumed to vary with opportunity such that network structure can be treated as an indicator of capacity, whereupon capacity need not be held constant as an independent variable (Burt, 1992:34-36; 2005:47-50). Under this assumption, network brokers have higher capacity for exchange because their larger networks provide more opportunities for exchange, or more obligations to exchange. The presumption is that people learn; they adapt to the network positions they occupy. The presumption is rarely tested, but there is evidence that even a little training can produce substantial improvements in learning new network structures as well as manager performance metrics such as evaluations, promotions, and retention (Janicik and Larrick, 2005; Burt and Ronchi, 2007). More generally, correlation between network brokerage and capacity can be attributed to a clear path to success (a person connected across structural holes is more likely to see exchange opportunities), or the personality of the person constructing the network (people with high capacity for exchange are more likely to make connections across structural holes), or environmental factors responsible for the structure of the network (persons forced by their jobs to manage connections across structural holes are more likely to develop exchange capacity).

As people learn to live with the higher exchange velocity of brokerage positions, they can adapt to the homogeneity of closed networks. People react to information and the search for information much as they react to the material consequences of information (Lowenstein, 2006). Within a closed network, people know similar things so they are unlikely in their day-to-day activities to encounter people with a valuable new bit of information. New bits crop up from time to time, but quickly circulate, returning everyone to the condition of having the same information. As people continuously encounter redundant information, they have less incentive to invest in search, they become less skilled in locating valuable new information, and on the occasion of finding novel information, less skilled in translating it to their personal interests. Decreased capacity for exchange contributes to insulation within the closed network, increasing the correlation between capacity and network structure.

Assume that capacity varies with opportunity. Then agents with more contacts in a network simulation have greater capacity to make exchanges. This would increase the broker's advantage since brokers have larger networks and so would have more opportunities to exchange. More exchange opportunities for brokers weakens the countervailing power of contacts, which decreases RZ's tension between broker and contact.

Applying the assumption to RZ's analysis would not change the results much because the analysis already allows capacity to increase with opportunity. RZ impose a quota on search, not transactions. Ego has one opportunity during a round to initiate exchange, but each other agent can initiate an exchange with ego. The more connections ego has, the more likely that ego will be selected at random by other agents initiating exchanges, so ego can end up sending and receiving multiple bits during a round (Reagans and Zuckerman, 2008b, take this one step further to explore inequality by allowing more powerful agents to receive multiple bits in each exchange). There is nothing wrong with the operationalization. It seems realistic to let people with more contacts have more opportunities for exchange. However, exchange capacity is

not being held constant. RZ's analysis is midway between the alternatives of capacity defined by quota versus opportunity. If capacity were completely defined by quota, agents would be equally limited in their opportunities for exchange (e.g., one exchange per round), which would decrease the advantage given in RZ's analysis to agents with more connections. If capacity were completely defined by opportunity, agents with more connections — who are the object of more searches in RZ's analysis — would be allowed to initiate more searches as well.

### **Defining the exchange: transmission and price assumptions**

RZ assume that information is exchanged like a material resource that moves through network connections without distortion at a price defined by availability elsewhere.

#### *Global and local processes*

Transmission is defined by RZ's 'resources as codified information' assumption (#2) in which the resources to be exchanged are: "'bits' of 'information' that are 'nonrival' in that they are always retained even after they have been transmitted; and they are always transmitted without distortion or ambiguity." In other words, the information exchanged is what Centola and Macy (2007) describe as 'simple' contagions, as RZ point out, or what Von Hippel (1994) describes as information that is not 'sticky,' or what is commonly discussed as 'explicit' rather than 'tacit' knowledge. RZ introduce an element of 'complex' contagion, or 'sticky' information, when they allow agents to prefer information from local sources. This is RZ's variable assumption in which information has uniform or homophilic value. Information assumed to have uniform value moves equally well through direct connections or long chains of indirect connections (Reagans and Zuckerman, 2008a:###-###, manuscript pages 11-12). Information assumed to have homophilic value is more likely to move between structurally equivalent people. Specifically, homophilic value increases in RZ's Eq. (4) with the extent to which buyer and seller have many mutual contacts, which means

that buyer and seller are structurally equivalent occupants of the same position as discussed above in the heuristic formula for  $s_{ij}$  measuring the extent to which agents  $i$  and  $j$  are expected from network structure to have similar knowledge. Mutual acquaintances provide a 'wide' bridge for information transmission (Centola and Macy, 2007). RZ discuss uniform versus homophilic value in terms of buyer preferences, but their distinction is equally well described as a distinction between global and local information, which corresponds to the uniform versus cluster distribution of information discussed above, or a neoclassical versus Austrian market metaphor. Either way, the distinction is about how information moves through network connections, respectively free from, versus subject to, decay in more distant connections.

*Personal processes*

Another way to think about transmission is to ask how relevant distant information is to the competitive advantage associated with brokerage. For example, Friedkin (1983) shows that even if information moves through long connections, its influence as a contagion disappears after one intermediary. At the other extreme, even if information decays through indirect relations, what little gets through could provide competitive advantage (Ryall and Sorenson, 2007:572; van Liere, Koppius, and Vervest, 2008).

The issue boils down to an empirical question. If access to information through global or local processes is the key to brokerage advantage, there should be spillover between adjacent networks in the sense that ego derives advantage from affiliation with advantaged contacts. As Rowley and Baum (2004:122) quote an investment banker: "information and access to it are king . . . being close to the source is the name of the game. . . . I don't have time to know everyone, but I need to be close to those that have the best contacts." Global processes imply substantial spillover as in Metcalf's Law since information can move meaningfully across long distances (Spence, 2002:453). Local processes imply some amount of spillover because most friends of friends are still local contacts but longer chains quickly lead to contacts in

other groups. Either way, if information flow defines advantage by global or local processes, there should be spillover between adjacent networks.

In fact, there seems to be no spillover at all. Table 2 contains illustrative results discussed in detail elsewhere (Burt, 2007a, 2008b). The key points here are the diversity of the study populations, and the relative effects of access to structural holes among direct versus indirect contacts. The populations in Table 2 vary from a population of Asia-Pacific employees clustered by country who are launching a new software product, to well-integrated global networks of investment bankers and analysts. In each population, the first column in Table 2 shows a strong performance association with structural holes among an employee's direct contacts. This is the jumping-off point for RZ's analysis. Network brokers have an advantage manifest in more-positive job evaluations and higher compensation than peers. The second column in Table 2 shows consistently negligible association with performance. There is no advantage to affiliation with brokers after ego's own network and job are held constant.

———— Table 2 About Here ————

My inference from the lack of advantage spillover between adjacent networks, is that the active ingredient in the broker's advantage is not access to information, it is the cognitive and emotional skills that develop as a by-product of living with divergent information. The bridge relations that connect network brokers across groups, expose the brokers to divergent opinion and practice. To communicate across the divergent opinion and practice, brokers develop cognitive skills of analogy and synthesis, and emotional skills for reading, engaging, and motivating people struggling to understand novel information. Whatever the specific skills involved, brokerage is not valuable for the information it provides so much as it is valuable as a forcing function for the cognitive and emotional skills required to communicate across divergent views. It is the cognitive and emotional skills produced as a by-product of bridging structural holes that are the proximate source of competitive advantage.

The implication for formal models and simulations is that learning is critical to the reality of the model/simulation. Learning is not an optional feature of network brokerage models. It is a central feature. This highlights the importance of formal models such as Rauch and Watson's (2007) in which managers who learn brokerage skills have a better odds of later success as entrepreneurs (see Sorensen and Philips, 2005, for corroborating empirical evidence), brings to mind early research on boundary-spanning scientists in R&D labs showing that the scientists more active in communicating across organizational boundaries were also more active in keeping up with professional journals (e.g., Allen and Cohen, 1969:17), and takes us back to Coleman's (1988) original network formulation of social capital as a forcing function for human capital.

This is not to say that RZ's model is wrong so much as it is incomplete in an important way. It is missing the learning component that seems to be essential to the competitive advantage of brokerage. For example, RZ introduce their intuition about broker-contact tension by contrasting the 'R-Strategy' and 'NR-Strategy' networks in their Figure 1. However, the networks only differ in indirect contacts, which by the evidence in Table 2 are irrelevant to the performance association with network brokerage. With respect to structural holes in the immediate network of direct contacts, which are the holes associated with performance, RZ's 'R-Strategy' and 'NR-Strategy' networks in Figure 1 are identical. Both contain four disconnected contacts.

Switching from an assumption of global or local processes to an assumption of personal processes eliminates the broker-contact tension that motivates RZ's analysis. The tension is resolved because brokers are not purchasing information from contacts. Brokers are simply exposed to contradictory information in discussions with their disconnected contacts, which has a by-product of enhancing performance-relevant cognitive and emotional skills. Without the countervailing power of contacts, brokers are free to develop their advantage to the limit of their personal abilities, so 'greater advantage' is entered in the fourth row of Table 1.

I hasten to add that the irrelevance of indirect contacts is limited to brokerage in social networks. It is not true for the stability advantages of closure, which do spillover between adjacent networks (Burt, 2007b), and it is not true for the performance advantage of brokerage at the level of industry networks where information can be codified into routines, which can be transmitted with impact across indirect connections (Burt, 2008a).

*Price*

In his influential discussion of information markets, Stigler (1961) infers the value of information from variance in prices. The more prices vary between sellers, the more incentive buyers have to search for a good price. Closer to RZ's analysis, Garmaise and Moskowitz (2003) estimate the value of real estate brokerage by comparing the average price at which commercial properties sell with a broker to the average price when comparable properties sell without a broker. There are no such price data for information in social networks. The concept of price applied to information in social networks is a heuristic analogy. Pricing models are not right or wrong so much as they are more or less reasonable and interesting. There is precedent for models in which price is more determined by people with more exchange options (Cook and Emerson, 1978; Taylor and Coleman, 1979; Marsden, 1983; Cook et al. 1983), so it is eminently reasonable for RZ to make their 'priced transmission' assumption (#5) in which the price for a bit of information decreases with the number of alternative sources (Eq. 5).

My only comment here is to raise the possibility of an equally reasonable pricing assumption under which RZ's broker-contact tension is resolved. RZ model network brokerage as a dyadic exchange in which the broker purchases information from a source. This is apt if the broker consumes the information.

However, brokerage is a triadic exchange in which the broker is a middleman who obtains information from a source and ships it to a target. There are three ways the broker can create value: (search) find a target unfamiliar to the source who will pay a premium for the information, (conversion) translate the information into a new



version in which the information is more obviously valuable to a target, or (synthesis) combine the information with other bits to create a new version for which the target will pay a premium. Getting information is not the primary cost. Information is abundant to network brokers. The primary production cost to a broker is phrasing the information so its value is apparent to a target. Value is not created when you get information. Value is created when you get someone else to take it. The value of information resides in its destination, not its source.

Academic work provides familiar illustration. Consider the exciting body of knowledge known as behavioral economics (if you prefer your illustrations with the protagonist named, see the academic brokerage story in Hsiung, 2007). Imagine an economist and a psychologist trying to explain to economists the value of research on a psychology mechanism. Whatever the psychologist's advantage from knowing the mechanism, the economist has an advantage in knowing the economic vernacular so he is more likely to know an attractive way to frame and communicate the mechanism to the target audience. This is a set-up for network brokerage. An economist broker looking to make his mark in the discipline locates a finding in psychology that has interesting implications when integrated with an economic model, creates the integrated behavioral-economics model, and sells it to fellow economists. If the broker has developed a model posing interesting questions that can be solved with familiar methods, colleagues are drawn to work on the model. The psychologist is rewarded by a larger, more diverse, audience making use of his work. The primary cost is integrating the psychological finding into an economic model so it is interesting to other economists. That cost is borne by the economist broker. The psychologist is happy to share his work anticipating the expanded audience; indeed the psychologist has an incentive to facilitate the broker's work because attention from many economists is a larger pay-off than whatever could be extracted from the individual broker. Academic work is its own phenomenon, but there are analogous examples in business, politics,

and culture that involve brokers translating source information so its value is more apparent to a target audience.

The shift from dyad to triad alleviates the broker-contact tension that RZ use to motivate their analysis. The shift is not a mirror image of RZ's analysis, with the countervailing power of targets replacing the countervailing power of sources. The shift is a realignment of cost and benefit. In dyadic pricing, the broker's benefit is in tension with the cost imposed by a monopolist source. In triadic pricing, cost and benefit are balanced within the broker. Free from the countervailing power of sources, brokers can develop their advantage to the limit of their personal abilities, so 'greater advantage' is entered in the bottom row of Table 1.

## **Conclusion**

RZ have initiated a productive line of work. With respect to their channel, distribution, and capacity assumptions, my likely alternatives in Table 1 do not eliminate RZ's perceived broker-contact tension, and in fact can increase the tension. However, the broker-contact tension can be eliminated with likely alternatives to RZ's pricing or transmission assumptions. It is to be expected that the analysis would be most sensitive to critical comment on those assumptions since pricing and transmission are where we have the least authoritative empirical research. I find the analysis exciting as a template for future work with formal models and network simulations. More, it is a stimulus for empirical research where research is most needed for this kind of work, namely, on the information pricing and transmission mechanisms responsible for the competitive advantage of network brokerage.

## References

- Allen, Thomas J. and Stephen I. Cohen (1969), 'Information flow in research and development laboratories,' Administrative Science Quarterly 14, 12-19.
- Aral, Sinan and Marshall Van Alstyne (2007), 'Network structure and information advantage: structural determinants of access to novel information and their performance implications,' Paper presented at the annual meetings of the Academy of Management, Philadelphia.
- Barker, James R. (1993), 'Tightening the iron cage: concertive control in self-managing teams,' Administrative Science Quarterly, 38, 408-437.
- Bearman, Peter and Paolo Parigi (2004), 'Cloning headless frogs and other important matters: conversation topics and network structure,' Social Forces, 83, 535-557.
- Burt, Ronald S. (1979), 'Relational equilibrium in a social topology,' Journal of Mathematical Sociology, 6, 211-252.
- Burt, Ronald S. (1980), 'Autonomy in a Social Topology,' American Journal of Sociology, 85, 892-925.
- Burt, Ronald S. (1982), Toward a Structural Theory of Action. Academic Press: New York.
- Burt, Ronald S. (1992), Structural Holes. Harvard University Press: Boston.
- Burt, Ronald S. (2005), Brokerage and Closure. Oxford University Press: Oxford.
- Burt, Ronald S. (2007a), 'Secondhand brokerage: evidence on the importance of local structure for managers, bankers, and analysts,' Academy of Management Journal, 50, 119-148.
- Burt, Ronald S. (2007b) 'Closure and stability: persistent reputation and enduring relations among bankers and analysts.' In James E. Rauch (ed.), The Missing Links: Formation and Decay of Economic Networks, (pp. 100-143). Russell Sage Foundation: New York.
- Burt, Ronald S. (2008a) 'Industry performance and indirect access to structural holes.' In Joel A. C. Baum and Timothy J. Rowley (eds.), Advances in Strategic Management, 25 (pp. 315-360). JAI/Elsevier: Oxford.
- Burt, Ronald S. (2008b) Your Neighbor's Network. Unpublished manuscript, University of Chicago Graduate School of Business.
- Burt, Ronald S. and Don Ronchi (2007), 'Teaching executives to see social capital: results from a field experiment,' Social Science Research, 36, 1156-1183.
- Buskens, Vincent and Arnout van de Rijt (forthcoming), 'Dynamics of networks if everyone strives for structural holes,' American Journal of Sociology, 114, In Press.
- Centola, Damon and Michael Macy (2007), 'Complex contagions and the weakness of long ties,' American Journal of Sociology, 113, 702-734.

- Coleman, James S. (1988), 'Social capital in the creation of human capital.' American Journal of Sociology, 94, S95-S120.
- Coleman, James S., Elihu Katz, and Herbert Menzel (1957), 'The diffusion of an innovation among physicians,' Sociometry, 20, 253-270.
- Cook, Karen S. and Richard M. Emerson (1978), 'Power, equity and commitment in exchange networks,' American Sociological Review, 43, 712-739.
- Cook, Karen S., Richard M. Emerson, Mary R. Gillmore, and Toshio Yamagishi (1983), 'The distribution of power in exchange networks: theory and experimental results,' American Journal of Sociology, 89, 275-305.
- Feld, Scott L. (1981), 'The focused organization of social ties,' American Journal of Sociology, 86, 1015-1035.
- Festinger, Leon, Stanley Schachter, and Kurt W. Back (1950), Social Pressures in Informal Groups. Stanford University Press: Stanford.
- Freeman, Linton C. (1977), 'A set of measures of centrality based on betweenness,' Sociometry, 40, 35-40.
- Freeman, Linton C. (1979), 'Centrality in social networks: conceptual clarification,' Social Networks, 1, 215-239.
- Friedkin, Noah E. (1983), 'Horizons of observability and limits of informal control in organizations,' Social Forces, 62, 54-77.
- Garmaise, Mark J. and Tobias J. Moskowitz (2003), 'Informal financial networks: theory and evidence,' Review of Financial Studies, 16, 1007-1040.
- Granovetter, Mark S. (1973), 'The strength of weak ties,' American Journal of Sociology, 78, 1360-1380.
- Granovetter, Mark S. (1983), 'The strength of weak ties: a network theory revisited,' Sociological Theory, 1, 201-233.
- Granovetter, Mark S. (1985), 'Economic action, social structure, and embeddedness,' American Journal of Sociology, 91, 481-510.
- Hsiung, Bingyuan (2007), 'Ronald Coase's Englishness and Steven Cheung's Chineseness,' Pacific Economic Review, 12, 171-187.
- Janicik, Gregory A. and Richard P. Larrick (2005), 'Social network schemas and the learning of incomplete networks,' Journal of Personality and Social Psychology, 88, 348-364.
- Katz, Elihu and Paul F. Lazarsfeld (1955), Personal Influence. Free Press: New York.
- Korte, Charles and Stanley Milgram (1970), 'Acquaintance networks between racial groups: application of the small world method,' Journal of Personality and Social Psychology, 15, 101-108.
- Lee, Nancy Howell (1969), The Search for an Abortifacient. University of Chicago Press: Chicago.
- Lin, Nan (2002), Social Capital. Cambridge University Press: New York.

- Lin, Nan, Walter Ensel, and John Vaughn (1981), 'Social resources and strength of ties: structural factors in occupational status attainment,' American Sociological Review, 46, 393-405.
- Loewenstein, George (2006), 'The pleasures and pains of information,' Science, 312, 704-706.
- Marsden, Peter V. (1983), 'Restricted access in networks and models of power,' American Journal of Sociology, 88, 686-717.
- Mehra, Ajay, Martin Kilduff and Daniel J. Brass (2001), 'The social networks of high and low-self monitors: Implications for workplace performance,' Administrative Science Quarterly, 46, 121-146.
- Obstfeld, David (2005), 'Social networks, the tertius iungens orientation, and involvement in innovation,' Administrative Science Quarterly, 50, 100-130.
- Rauch, James E. and Joel Watson (2007), 'Clusters and bridges in networks of entrepreneurs.' In James E. Rauch (ed.), The Missing Links: Formation and Decay of Economic Networks, (pp. 210-235). Russell Sage Foundation: New York.
- Reagans, Ray E. and Ezra W. Zuckerman (2008a), 'Why knowledge does not equal power: the network redundancy trade-off.' Industrial and Corporate Change, 17, ##-##.
- Reagans, Ray E. and Ezra W. Zuckerman (2008b), 'The short cut to inequality: the small but stratified world.' Unpublished manuscript, Carnegie Mellon University.
- Rodan, Simon and Charles Gallunic (2004). 'More than network structure: how knowledge heterogeneity influences managerial performance and innovativeness,' Strategic Management Journal, 25, 541-562.
- Rowley, Timothy J. and Joel A. C. Baum (2004), 'Sophistication of Interfirm Network Strategies in the Canadian Investment Banking Industry,' Scandinavian Journal of Management, 20, 103-124.
- Ryall, Michael D. and Olav Sorenson (2007), 'Brokers and competitive advantage,' Management Science, 53, 566-583.
- Sorensen, Jesper and Damon Philips (2005), 'So small firms produce better entrepreneurs?' Paper presented at the annual meetings of the American Sociological Association, Philadelphia.
- Spence, Michael (2002), 'Signaling in retrospect and the informational structure of markets,' American Economic Review, 92, 434-459.
- Stigler, George J. (1961) 'The economics of information,' Journal of Political Economy, 69, 213-225.
- Taylor, D. Garth and James S. Coleman (1979), 'Equilibrating processes in social networks: a model for conceptualization and analysis,' In Paul W. Holland and

Samuel Leinhardt (eds.), Perspectives on Social Network Research, (pp. 257-300). Academic Press: New York.

van Liere, Diederik W., Otto R. Koppius, and Peter H. M. Vervest (2008), 'Network horizon: an information-based view on the dynamics of bridging positions. In Joel A. C. Baum and Timothy J. Rowley (eds.), Advances in Strategic Management, 25 (pp. 597-642). JAI/Elsevier: Oxford.

von Hippel, Eric (1994), 'Sticky information and the locus of problem solving: implications for innovation,' Management Science, 40, 429-439.

**Table 1: RZ assumptions and alternatives**

<b>Assumptions</b>	<b>Alternatives</b>	<b>Broker Advantage Implications</b>	<b>Broker-Contact Tension Implications</b>
1. Capacity	Quota	RZ	RZ
	Opportunity	Greater advantage	Less tension
2. Transmission	Global-local process	RZ, uniform-homophily	RZ, uniform-homophily
	Personal process	Greater advantage	Tension alleviated
3. Channel	Exogenous network	RZ	RZ
	Endogenous network	Greater advantage	Less tension
4. Distribution	Uniform	RZ	RZ
	Clustered	Less advantage	More tension
5. Pricing	Dyadic	RZ	RZ
	Triadic	Greater advantage	Tension alleviated

**Table 2: Advantage associated with structural holes among direct versus indirect contacts\***

<b>Study Population</b>	<b>Direct Contacts</b>	<b>Indirect Contacts</b>
Asia-Pacific product launch	2.70	1.00
Supply-chain managers	4.17	0.92
HR employees	4.29	0.23
Investment bankers	3.78	1.33
Investment analysts	3.38	0.24

\*Cells contain t-tests predicting employee performance in the row population from structural holes in the employee's immediate network of direct contacts, structural holes in the networks around the employee's direct contacts, and various controls for job rank, function, location, and experience. Observations vary from 258 to 469.