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Explaining Clustering in Social Networks: Towards an Evolutionary Theory of Cascading Benefits

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Individual and organizational actors enter into a large number of relationships that include benefiting others without ensuring the equality of reciprocal benefits. We suggest that actors have evolved mechanisms that guide them in the choice of exchange partners, even without conscious calculation or bookkeeping of gain and loss. One such mechanism directs actors to membership in clusters, which are homogenous groups of actors densely connected among themselves and only loosely connected to other groups. We suggest that clusters offer network externalities, which are not possible in sparse networks, thus conferring cascading benefits on the actors contained in those clusters. Using this logic, one can understand the omnipresence of clustering in social networks of individuals and firms. We review the benefits and challenges associated with clustering and use the logic of cascading benefits to derive empirical predictions. Copyright © 2006 John Wiley & Sons, Ltd.

INTRODUCTION

The evolution of cooperation in humans has been the focus of enormous research effort over the last two decades. Called 'ultrasocial' (Richerson and Boyd, 1998), humans cooperate extensively with others. An array of tools have been brought to bear on this issue, including game theoretical and agent-based modeling (Boyd and Richerson, 1985; Gintis, 2000; Whitmeyer and Yeingst, in press), experimental laboratory work (Cosmides and Tooby, 1992; Fehr *et al.*, 2002), and cross-cultural field research (Prietula *et al.*, 1998; Slonim and Roth, 1998; Cameron, 1999; Henrich *et al.*, 2005). Because of its centrality to human existence, cooperation has also attracted the attention of economists (Dawes and Thaler, 1988), sociologists (Granovetter, 2002), psychologists (Kramer and Brewer, 1984), and political scientists (Axelrod, 1984; Ostrom, 1998). Nonetheless, fundamental aspects of human social behavior remain opaque. Boyd and Richerson (2005) and Silk (2003) recently penned chapters with titles that refer, respectively, to the 'puzzle of human cooperation' and 'the puzzle of friendship.' Apparently, many pieces have yet to be fit together to complete our picture of human cooperation.

Here we focus on one aspect of cooperation that has important consequences for organizations and those in them—the omnipresent tendency to choose partners that are connected to each other, thus creating a clustered structure of relationships

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(Moreno, 1951; Simmel, 1955 [1908]; Kadushin, 1968; Feld, 1981). We explain this tendency by suggesting that humans have evolved cognitive mechanisms designed to capture benefits associated with multiple network externalities (defined below). It is particularly relevant in the organizational context, where clustering among managers and directors (Useem, 1984; Kadushin, 1995; Davis and Greve, 1997; Burt, 2004) as well as among organizations themselves (Gulati and Gargiulo, 1999; Sorenson and Audia, 2000), can have both positive and negative effects on performance (Uzzi, 1996; 1997).

We proceed by presenting a set of ideas drawn from evolutionary theory that shed light on the choice of exchange partners and propose several evolved cognitive mechanisms that can explain the origins of clustering. Then, we review the literature on clustering in social networks to contrast the ubiquity of clustering with the paucity of theoretical explanations regarding it. We offer specific propositions regarding the choice of exchange partners in networks and conclude by suggesting some implications of the theory in economic and organizational contexts.

NON-MARKET RELATIONSHIPS AND THE CHOICE OF PARTNERS

Human sociality takes many forms, including social exchange (Blau, 1964; Emerson, 1981), coalitions (Boissevain, 1974; Stevenson and Greenberg, 2000; Kurzban *et al*., 2001), friendship (Lazarsfeld and Merton, 1954; Kadushin, 1995; Ingram and Roberts, 2000; Silk, 2003), kin relationships (Daly *et al*., 1997) and mating relationships (Buss, 1994). Each of these social domains can be construed as having produced a set of adaptive problems associated with them, such as joining cooperative groups (Kurzban and Leary, 2001), directing investment in others (Trivers, 1971), attracting a good mate (Miller, 2000) and so on.

Our focus is on the fact that actors enter into a large number of relationships that include benefiting others *without* keeping close track of and ensuring the equality of reciprocal benefits. That is, actors have exchange relationships that are not based on the strict reciprocal and immediate exchange so dominant in neo-classical economic thought (cf. Clark and Mills, 1979; Fiske, 1992). Here we concentrate exclusively on non-market relationships. Such relationships have been receiving increasing attention in recent years because they seem to underlie many economic and organizational phenomena (Williamson, 1989; Granovetter, 1992; Portes and Sensenberger, 1993; Uzzi, 1997; Baker *et al*., 1998; DiMaggio and Louch, 1998). Despite the absence of strict record keeping regarding gains and losses, these relationships are likely to be the result of adaptations designed to generate mutual benefits to the actors involved. That is, we presume that the evolution of exchange partner choice derives from the fact that these relationships yielded net benefits in some form, even if actors do not keep conscious track of this information. The evolutionary logic is not foreign, of course, to economic and organizational thought. A large body of literature has applied evolutionary theory in various forms to organizations and those within them (e.g. Hannan and Freeman, 1977; Levinthal and March, 1981; Nelson and Winter, 1982), and in this spirit we assume that such choices are made similarly by individual and organizational actors.

Here we avoid many issues surrounding the evolution of adaptations designed to form relationships, merely assuming this as one aspect of human sociality that has a reasonably long evolutionary history (Silk, 2003). Instead, we focus on a set of selection pressures that derive from the fact that actors form these relationships, recently discussed in some length by Tooby and Cosmides (1996).[1] Because of the gains associated with sociality, actors can be expected to have evolved mechanisms designed to extract benefits from the social world. In the sociological and economic sense, benefits include a wide variety of favorable outcomes, spanning material gain, lucrative information, social obligations that can be called upon, material and emotional support, and so forth. Intense sociality implies that there would have been strong selection pressures for extracting social benefits from others, avoiding social costs, and, crucially, making oneself valuable as a social partner. In short, sociality generates a market for social actors.

However, there are a limited number of social relationships that one can maintain simply because one's time is necessarily finite (Hallinan, 1979; Guimerà *et al*., 2003). Tooby and Cosmides (1996) refer to 'friendship niches' to capture the notion

that everyone has only a limited number of social slots that can be filled. This, combined with the fact that other actors represent very different potential fitness costs and benefits, implies that actors can be expected to have adaptations designed to make good decisions regarding whom to enter into a relationship with. In the same way that humans can be expected to have finely sculpted adaptations for preferences in mating choices (Buss, 1994), the same should apply to preferences regarding relationship partners. Next we turn to the question of some of the features of these preferences.

YOU CAN PICK YOUR FRIENDS (AND PARTNERS)

The work of Tooby and Cosmides (1996) directs attention to the potential importance of *externalities* in social relationships.[2] Assume that in the environment of a focal actor, *ego*, there are some other actors who have goals that, for whatever reason, align with the goals of ego. If another actor, agent A, has goals that are similar to ego's, then ego derives benefits by the continued well-being of agent A. It is important to note that these benefits are *not* due to reciprocity, but are simply a by-product of Agent A's pursuit of goals that align with ego's. Crucially for the model, this sets up a dynamic in which Agent A, because of ego's interest in her well-being, has a reciprocal interest in ego's well-being. This 'deep engagement' model implies that one feature of the cognitive architecture associated with partner preferences should include mechanisms designed to come to value those actors who, for whatever reason, value us.

We propose to take the logic of externalities one step further. In particular, beyond externalities that derive from convergence in goals, the intense sociality of humans sets up the possibility of dynamics that resemble the notion of network externalities in microeconomics. In a network externality, a third party experiences a gain (or a loss) as a function of the number of users of a given product (Katz and Shapiro, 1985). For instance, the more subscribers use the telephone system or a Macintosh computer, the more people one can call and the more software is available for one's computer. Those benefits are external to the dyadic relationship between a subscriber and the telephone company and are dependent on the network.

The logic of network externalities can be applied to the choices associated with partner selection. In particular, if actors derive benefits when particular others benefit, then *a benefit to an actor benefits those that are tied to the focal actor*. For instance, imagine a cluster where each actor has an interest in the others' well-being. When ego benefits alter, this delivers a secondary benefit—as an externality—to all of alter's exchange partners. Because alter's partners—A, B, and C—all have a stake in alter's well-being, benefiting alter also benefits A, B, and C indirectly. This means, in turn, that to the extent that A, B, and C believe that ego is likely to benefit alter, they have a stake in the continued well-being of ego. Thus, the benefit is likely to return to ego through the shared ties, as a *tertiary* benefit. As social networks increase in the number of connections, the possibility for benefit cascades increases.

This argument is about the nature of selection pressures on human cognition, but emphatically not about the conscious calculations made by actors (cf. Sen, 1977; Granovetter, 1992; Tooby and Cosmides, 1992). That is, this argument suggests that cognitive mechanisms that included computations that in turn drove behavior to reap these cascading benefits would have been selected over evolutionary time. There is no need to posit that these calculations are explicit when actors, individuals or organizations, select their exchange partners. In the same way, people have taste for foods because of the fitness advantages conferred by these preferences; no conscious computation of the nutritive value is required (e.g. Symons, 1992). In general, when an individual delivers a benefit to someone with whom she shares overlapping mutual relationships, i.e. when the tie is embedded in a dense network, the effect of this benefit is increased as a function of the number of ties that connect her to the beneficiary indirectly. The more ties ego and alter share, the more of ego's contribution will return to the her as a tertiary benefit. Thus, when the benefactor and the beneficiary are embedded in a network of dense ties, the net cost of delivering benefits returns to the benefactor through their mutual ties.[3]

This argument is similar to, but distinct from, reciprocal altruism (Trivers, 1971) and more recent arguments surrounding indirect reciprocity (Panchanathan and Boyd, 2003, 2004). The cascading

benefits logic is driven by externalities and in this sense is closer to the logic of by-product mutualism, in which benefits are derived as a side effect of actions taken by actors (Dugatkin, 1997). The ingredient we add to these arguments is driven by the extreme sociality of humans, which sets up the possibility for benefit cascades in a way that would not be possible in less social species. Similarly, our argument is driven by a selection pressure that leads to benefits that are not driven by altruism on the part of other actors, but rather by their positive externalities. It is our hope that this logic will be helpful in understanding relationships that seem to emerge in which careful records of costs endured and benefits delivered are not kept.

CLUSTERING IN SOCIAL NETWORKS

Now we put the notion of cascading benefits to work by using it to explain phenomena associated with social networks. In particular, we show that social networks, including those associated with organizations such as firms, have a clustered structure. Clustering is omnipresent in individual and organizational networks alike and has important consequences for actors. Clustering in social networks requires explanation, not least because this structure deviates from what would be expected from existing theoretical perspectives. We argue that this feature of social networks is comprehensible from the perspective of adaptations designed to capture network externalities, as described above.

Social network theory has risen to prominence in recent years. Putting forward propositions about the behavior of actors in a network, the body of theory employs terms broad enough to apply to a variety of structures and entities interacting in them. Armed with the mathematical tools of graph theory, social network theory has been shown to explain a wide range of phenomena, ranging from the individual, to the firm, interfirm, and even the national and international levels. Networks, it is thought, play an important role in job search (Granovetter, 1973), innovations (Tushman, 1977; von Hippel, 1987), determination of prices and cost of capital (Uzzi, 1999; Uzzi and Lancaster, 2004), business alliances (Gulati, 1995, 1998), industrial clusters (Saxenian, 1996; Castilla *et al*., 2000), national systems (Locke, 1995; Biggart and Guillén, 1999), and the spread of forms and standards across organizations and national borders (Westphal and Zajac, 1997; Guler *et al*., 2002).

THE CLUSTERING OF EXCHANGE PARTNERS

The recent interest in networks has sometimes masked an inherent duality: networks provide connectivity but are often structured in clusters of actors. On the one hand, they allow flows—of ideas, practices, people, knowledge, and so on—as has been widely documented in studies in organizational science, sociology, economics, and physics (for recent reviews see Borgatti and Foster, 2003; Watts, 2004). On the other hand, such dissemination is constrained by the tendency of actors to cluster in homogenous groups that are only loosely connected to other groups (Moreno, 1951; Simmel, 1955 [1908]; Kadushin, 1968; Feld, 1981; Ravasz and Barabási, 2003). The tendency to cluster has been found in a variety of empirical settings and levels of analysis. It has been demonstrated among individuals, e.g. in friendship ties (Hallinan, 1974) and social circles (Kadushin, 1966). Because of its implications, it has won special attention in the organizational and economic arena, where it has been observed among managers (Ingram and Roberts, 2000; Burt, 2004), company directors (Mizruchi, 1996; Davis and Greve, 1997), and throughout the socio-economic elite (Useem, 1984; Kadushin, 1995). Clustering is not confined to individuals, but is also prevalent in choices made by organizations. For instance, it has been empirically shown that flows happen more within clusters than between clusters in a longitudinal analysis of the US footwear industry (Sorenson and Audia, 2000). Similarly, new ties established by biotechnology startup firms tended to reproduce the existing network structure rather than bridge disparate clusters (Walker *et al*., 1997). Clustering has been shown to prevail in such distinct arenas as Canadian investment syndicates (Baum *et al*., 2003), corporate ownership in Germany (Kogut and Walker, 2001), and business groups in east and south Asia and Latin America (Guillén, 2000). A longitudinal analysis of choices of alliance partners (Gulati and Gargiulo, 1999) has revealed a tendency to contract with those indirectly tied to a focal firm, i.e. creating new alliances with those that are already allied with

one's existing partners, thus further increasing clustering.

Clustering is the backdrop for several influential ideas about networks, such as the *Strength of Weak Ties*, *Structural Holes*, and *Small World*. The *Strength of Weak Ties* refers to the informational advantages that one gains by connecting to others who are in positions that are different from the self. In a seminal study of job seekers, Granovetter (1973) showed that weak social ties—acquaintances and distant friends—played an important informational role, providing leads and references that were not available from close friends or family members. The counter-intuitive finding—that it was acquaintances, not close friends, who led one to find a new job—led Granovetter to conclude that weak ties were more suitable than strong ones in gathering information and following opportunities.

Weak ties are likely to exist in a sparse network while strong ones are likely to be clustered (Granovetter, 1982). Because strong ties are clustered, the knowledge of each actor is likely to resemble the knowledge of others in the cluster. This is the reason that strong ties are not very useful in getting unique information.

Similarly, in Burt's influential work on *Structural Holes* (1992, 2002, 2005), gaps in a network derive from their clustered structure, where there is little communication between distinct clusters. In such an environment, brokers can connect otherwise disconnected clusters and reap substantial gains for themselves.

The *Small World* phenomenon (Milgram, 1967; Travers and Milgram, 1969) turns on the fact that a small number of individuals connect the distinct clusters that make up society. The small world is possible not because we live in one dense collective where everybody is connected to everybody else; quite the opposite: few ties that connect distinct clusters allow messages to travel.

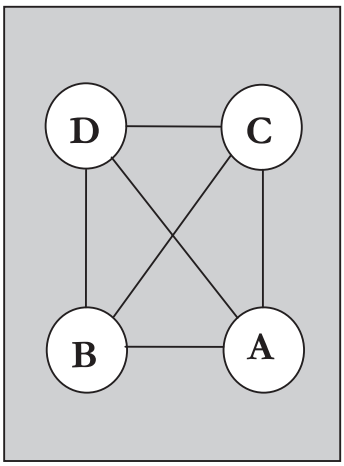

Figure 1. High-density network; $\Delta = 1$.

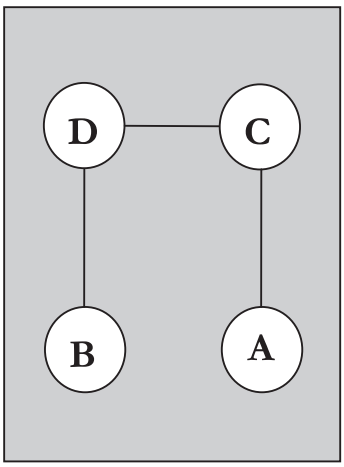

Figure 2. Low-density network; $\Delta = 0.5$.

DENSITY

Inside clusters, social networks are dense. Intuitively, this means that many of the actors interact with each other, as in a village community or an industrial cluster. In Figure 1, all of the potential relationships in the group are realized, making it a very high-density network. In Figure 2, only some of the potential relationships are realized. For instance, A and B could have been connected by a relationship, but are not. Therefore, it is a lower density network.[4]

Much scholarly attention has been given to the consequences of the dense network structure associated with clusters, although less attention has been given to its causes. In the next two sections, we review some of the evidence to highlight the important consequences of density and sparsity.

THE BENEFITS OF CLUSTERING

Clusters, and particularly the dense network structures within them, have been associated with

several benefits. Granovetter argued that at the societal level the dense networks found in clusters can support moral behavior (1992, pp. 38–48). According to him, while it is overly deterministic to claim that actors will act morally no matter what the incentives are, the alternative view—that moral behavior is the result of clever institutional arrangements—underestimates the role of sociality (cf. Wilson, 1993). Contracts alone, elaborate as they may be, cannot substitute trust (Rose-Ackerman, 1978; Okun, 1981), because people are boundedly rational (Simon, 1955) and contracts are necessarily incomplete (Williamson, 1975). Moral behavior may be assisted by institutional arrangements, but is also dependent on the clustering of relationships in dense networks, where there is greater pressure against cheating. Thus, a denser network is related to better performance through trust, an outcome of neither culture nor contracts alone, but of effective monitoring.

Echoing this idea, Takahashi (2000, 2004) postulated that higher density may lead to a higher level of generalized exchange by enabling faster, more complete flow of information about past behaviors of beneficiaries, allowing for better sanctioning (cf. Panchanathan and Boyd, 2003, 2004). Generalized exchange is said to exist when an actor benefits another but does not expect the beneficiary to reciprocate. Rather, the benefactor expects reciprocation by any other actors implicated in the system (Ekeh, 1974).

Biggart and Guillén (1999) took an institutional approach to explaining the economic development of countries, attributing some variation in development to the effect of network density. For instance, they described the success of Taiwan in becoming a large exporter of auto parts and credited the dense cluster of family firms. Such network arrangements, they suggested, are especially suitable for capital-light and knowledge-intensive products. A dense industrial network can respond quickly to changes in technology and taste. Firms became highly specialized, producing only part of the final product, and sourcing the rest from others. To do so, however, they 'rely on personal relations, which are powerful in family networks, to assure quality control' (p. 735). The assumption, then, is that a dense network serves as a coordination mechanism, facilitating knowledge transfer. At the same time—and in a manner similar to the previous arguments—a dense network provides for effective monitoring, which promotes quality assurance.

This conclusion is found also in one of the few studies tying density to firm-level outcomes: Ahuja (2000) underlined the negative effects of *sparsity* (i.e. the opposite of density) in interfirm networks. The results, based on a longitudinal study of firms in the international chemical industry, indicated that direct and indirect ties had positive effects. In contrast, gaps in the interfirm collaboration network had a negative effect on innovation. Similarly, network density and individual action to increase this density were recently found to be good predictors of the tendency to innovate within organizations (Obstfeld, 2005).

Within organizations, dense networks have been associated with better transfer of complex knowledge (Hansen, 1999). Weak ties, which are more likely in sparse networks, were indeed found to facilitate the discovery of useful knowledge. However, such ties were also found to impede the transfer of complex knowledge, which tends to require a strong tie between the two parties for a successful transfer. In short, network sparsity was useful for discovery of knowledge elsewhere, but impeded the acquisition of complex knowledge. Density may serve to reduce competition and increase motivation to transfer. Some have suggested that social cohesion, defined as 'dense third party ties around the relationship' (Reagans and McEvily, 2003, p. 242) can support knowledge transfer within organizations because it decreases the competitive and motivational impediments that result from the costliness of the transfer to the benefactor.

CLUSTERING AS A CHALLENGE

While network density supports trust, cooperation, and communication, it can also cut external ties, create isolation, and eventually degrade performance. Dubbing such cases 'over-embeddedness,' Uzzi (1997) has shown that trading exclusively within a cluster has been associated with worse chances of firm survival. The positive relationship between higher density and increased organizational performance reverses at high levels of density because of isolation and loss of market discipline (Talmud and Mesch, 1997; Uzzi, 1997).

Similarly, individual or team-level clustering will slow the flow of knowledge within the

organization. McDonald and Westphal (2003) showed that poor performance made CEOs more likely to seek advice within the cluster of friends and associates, reducing their exposure to new knowledge and eventually worsening their woes.

Clustering may be even more stubborn inside organizations than between organizations. People have a tendency to cluster even when formal structure is absent, as in naturally occurring groups (Mayhew *et al*., 1995). When the bureaucratic arrangement of offices, departments, and units, subordinates and superiors, is combined with the natural tendency to cluster, we should not be surprised to find organizational cliques and silos, separated from each other by restricted communication and a lack of social ties (e.g. Dalton, 1959; Mintzberg, 1979). Thus, organizations, which are supposed to serve as caches of readily deployable knowledge, may have serious difficulties moving that knowledge around due to the combined effects of formal structure and the natural tendency to cluster.

The tendency to congregate in homogenous clusters poses a special challenge to entities that thrive on transfer, such as knowledge-intensive firms and industrial clusters. Here the *raison d'être* of the organization is to produce knowledge and to disseminate it quickly and effectively (Teece, 1998; Winter and Szulanski, 2001). However, while knowledge travels well within clusters, it travels less well between them, especially when it is complex (Hansen, 1999; Sorenson *et al*., 2002). Thus, clustering within knowledge-intensive firms can interfere with the transfer of knowledge between units and undermine organizational performance (cf. Levine, 2005).

Looking at the positive and negative consequences of density, several studies have concluded that individuals and organizations need to simultaneously maintain areas of high and low density. For instance, employees may benefit from a sparse network, which is more valuable in gathering information, while maintaining a dense network, which is useful in conveying expectations and deciding among conflicting demands. For organizations, ties outside the cluster can bring in unique ideas and knowledge, while ties within the cluster allow the transfer of complex knowledge that is necessary to turn unique knowledge into innovations. Thus, the optimal configuration for an actor's success is likely to be a combination of first, membership in a cluster, which provides dense, strong ties, and, second, sparse ties outside the cluster (Podolny and Baron, 1997; Mizruchi and Stearns, 2001; Oh *et al*., 2004; Burt, 2005). The exact ratio of density and sparsity depends on the task. However, such combinations necessitate a trade-off because an increase in one will lead to a decrease in another (Reagans *et al*., 2004) simply because one has only finite capacity to maintain relationships, whether within or outside one's cluster.

THE CAUSES OF CLUSTERING

It is surprising that despite the great attention to the consequences of clustering and its omnipresence in networks of individuals and organizations, there is no conclusive theoretical explanation for this pronounced tendency. Here we review the two main theories on partner choice to show that clustering is not predicted by them. We also note the empirical tendency for transitivity, i.e., befriending the friends of one's friends.

Similar to the perspective of neo-classical economics, social exchange theory (Homans, 1958; Blau, 1964) explains the selection of exchange partners as based on calculations regarding anticipated gains from exchange. Put simply, actors are attracted mostly to those who carry the most desirable goods for exchange. Exchange theoreticians argue that human behavior is a series of exchanges, involving either spot (simultaneous) or deferred, unspecified commitments, but always between a pair of individuals. While the dyadic perspective is surely fitting sometimes, it excludes instances of social action that involve more than a dyad (cf. Emirbayer and Goodwin, 1994).

The homophily principle explains selection of partners as based on similarity—actors choose to interact with those that are similar to them (Lazarsfeld and Merton, 1954; Coleman, 1961; McPherson *et al*., 2001). Empirical research has shown that homophily explains choice in a variety of settings, including exchange, work, advice, support, and information, as well as marriage, friendship, and membership. It also has important organizational implications (Ibarra, 1992). Strong predictors for homophily have been found to be race, ethnicity, religion, education, occupation, and gender. The homophily principle explains

not only attraction, but also rejection: ties between dissimilar individuals dissolve at a higher rate.

While Exchange Theory and homophily may explain some patterns of interaction at the interpersonal, dyadic level, they are less suitable in explaining the observed tendency of individuals to congregate into dense clusters. As Feld (1981) pointed out, within the framework of social exchange theory, there is no particular reason to expect that exchange partners will all be tied to each other. Quite the contrary—it can be expected that one's optimal exchange partners will be distributed randomly through the population, and actors in the same cluster would not be each other's optimal exchange partners. Thus, under this assumption, a prototypical network could be visualized roughly as having a star pattern, where the focal individual transacts with others that are unrelated to each.

Similarly, in the homophily view, individuals should relate to each other in varying degrees of closeness as determined by the similarity between them. Because people are always similar to each other *to some extent*, one could envision a continuum of closeness, ranging from those most similar to ego to those most dissimilar. If the homophily view were a good descriptor of society (or industry), it would have resembled a fabric made of ties with varying degrees of strength. This is not the observed pattern, where individuals are clustered into dense and isolated groups (Feld, 1981).

Rather than a theoretical explanation, *transitivity* is an empirical tendency to befriend the friends of one's friends: 'if P chooses O and O chooses X, then P is likely to choose X' (Davis *et al*., 1971, p. 309). Based on the work of Homans (1950), it has been shown in friendship data that transitive triplets are common, while intransitive triplets are relatively rare (Holland and Leinhardt, 1971; Davis and Leinhardt, 1972). Despite plenty of descriptive work, the theoretical sources of transitivity, as well as the processes that lead to it, remain unclear. Davis (1979), one of the original formulators of the transitivity hypothesis, noted frankly that 'after a decade of matrix grinding, I have no more idea of why triads are transitive than I did when I began' (p. 60). It has often been assumed that transitivity is an outcome of individuals' desire to maintain cognitive balance (Heider, 1958; Hallinan, 1974). However, it has been shown convincingly that transitivity can be explained in other ways, for instance as an artifact of differing popularity among people (Feld and Elmore, 1982a, b). However, there is little evidence regarding the processes that underlie transitivity. While Hallinan (1982) called for more laboratory studies to investigate the processes underlying it, most of the evidence remains descriptive, based on patterns in large-sample data. The model of cascading benefits is one way to explain the observed tendency towards transitivity.

THE LOGIC OF CASCADING BENEFITS APPLIED

The evolutionary logic of cascading benefits described above can be used to generate predications about network structure. Very generally, following the logic of cascading benefits, we propose that increased density implies greater returns through direct and indirect rewards from the succession of network externalities. Hence, we expect that actors will prefer dense networks to sparse ones. We suggest the following propositions regarding to the tendency of individuals to choose dense networks over sparse networks, and thus creating clusters.

Proposition 1:
Actors will prefer a join a network of higher density to a network of lower density.

Once an actor is member of a dense network (i.e. cluster), we suggest that the actor will prefer members of the cluster, will view them as more trustworthy, and will assess them as closer to self.

Proposition 2:
Actors will prefer exchange partners that are located in the same cluster as themselves.

The design of the motivational system behind this preference will include feelings of trust and closeness directed toward actors embedded in a denser network.

We suggest the following proposition as to the mode of exchange in dense networks:

Proposition 3:
The denser the network that surrounds a relationship, the more likely it is that the relationship will

be based on social and generalized exchange, and *not* resemble a market exchange.

Proposition 4:
Generalized exchange is more likely to be the principle for transactions in a dense network as opposed to a sparse one.

Furthermore, we expect that actors will be sensitive to the *perception* of a network as dense or sparse. Research has shown that networks can be perceived quite differently from their objective reality, but it is perception that determines action. For example, perception of having a prominent friend matters more than actually having such a friend (Kilduff and Krackhardt, 1994), social distance affects evaluations of balance in others' relations (Krackhardt and Kilduff, 1999), and positive affect has an impact on people's ability to perceive correctly the structure of the network (Casciaro *et al*., 1999).

Accordingly, a tie that is perceived as embedded in a network of high density would be evaluated more favorably than a similar tie that is perceived as embedded in network of low density. Thus, it would seem natural that strong ties are embedded in dense networks while weak ties are embedded in sparse networks.

In contrast, we do not expect that the presence or absence of such benefits would cause a change in ego's perception of alter's characteristics, such as traits. It will make a tie more or less strong, we anticipate, but not carry over to a very general revision of alter's assessment in a positive or negative direction. We predict that the effects of network density will be limited to the tie itself, rather than to alter.

Taken together, these propositions imply that people tend to choose interaction partners with those who have mutual ties, creating dense social networks. However, while choosing interaction partners in this fashion might have made (adaptive) sense in the environment in which humans evolved, it is plausible that these adaptations have detrimental effects in modern environments (cf. Burnham and Phelan, 2000). If this is the case, then it should be the case that existing network structures, such as those within- and between-firms, are optimal neither for individuals nor for the organization. Hence the need to understand the causes of clustering and manage this tendency.

CASCADING BENEFITS IN ORGANIZATIONAL CONTEXT

The logic of cascading benefits has several organizational and economic implications. First, we outline the differences between cascading benefits and other benefits that are associated with being in a unique position.

Several scholars have pointed out gains that occur when actors, whether individuals or firms, occupy unique niches that are difficult to replicate. The argument has a long history in industrial organization economics and business strategy (e.g. Barney, 1991), in which firms are advised to develop those resources that are unique and difficult to imitate. The notion of uniqueness in positional advantage has been discussed widely in social network theory, both for individual actors and firms (e.g. Burt, 1982, 1992; Walker *et al*., 1997), where location outside clusters is deemed favorable because of the possibility to broker new ties.

The cascading benefits argument, however, does not involve profits gained through reciprocal gains, monopoly rents, returns on brokering, control of information, or other power tactics. To reiterate the logic described above, the benefits here arrive through multiple network externalities: by making ego valuable to alter, ego subsequently becomes valuable to those who care about alter's well-being. Now, those who benefit from alter's well-being also benefit from ego's welfare because that welfare affects alter's well-being. Thus, if ego delivers a *primary* benefit to alter, ego also benefits those who benefit from alter's well-being as a *secondary* effect. Those, in turn, are interested in ego's welfare, and this leads to *tertiary* benefits that are directed back towards ego.

The logic of cascading benefits helps in understanding why clustering abounds, and inter-cluster ties are few, even when there are substantial rewards for brokerage. There is evidence that clustering is a steady state, rather than a temporary disequilibrium waiting for entrepreneurs to bridge the clusters and profit from arbitrage across them. In a recent account, Burt (2004) analyzed the source of good ideas of managers in a large electronics manufacturer. He showed convincingly that managers whose networks spanned structural holes were more likely to originate good ideas, discuss them with colleagues, have them

considered by senior management, and have them judged valuable. Yet, despite the obvious returns to network entrepreneurs, longitudinal observation suggested that the organization remained rife with structural holes. Even worse, few of the top ideas were eventually implemented. Examining the conversation partners of the managers, Burt found that mangers were overwhelmingly more likely to consult with those with whom they has the most mutual friends, i.e. they turned to ties that were embedded in their dense network. This effectively blocked the implementation of good ideas. This tendency is exactly what the logic of cascading benefits would predict.

Clusters are ubiquitous because they confer benefits. Clustering is not a transient state. Hence, the cascading benefits argument is sympathetic to the notion of *sustainable* gains from brokerage: a position that bridges or spans structural holes can be a source of unique value over time (Schumpeter, 1934 [1912]; Burt, 1992). Because actors desire to congregate in clusters, entrepreneurs will always be able to reap repeated benefits from connecting those clusters.

Understanding the logic of cascading benefits may allow a broker to increase her returns. A broker would not derive maximum benefits merely by connecting two dense network clusters. Ideally, she will be a member of a least one of them. In the case of merely connecting clusters, she can collect a one-time benefit from mediating the tie, but afterwards her role becomes superfluous and benefits cease. Greater benefits can be found if the entrepreneur herself is a member of a dense network cluster. When this is the case, her rewards for connecting two actors are multiplied as a function of benefiting those who are in turn connected to those actors. Thus, an optimal setting for private gains would be to connect two dense clusters that are disconnected from each other, as long as the entrepreneur is densely embedded in one of these clusters.

Moreover, because density is associated with trust, brokers may be looked upon suspiciously. When she span clusters, even if the broker creates objective value, she risks being conceived as unworthy of trust, because as an outsider to the cluster her interests may not be aligned with those of the cluster members (Goffman, 1963; Wellman, 1983). As such, a broker's position encourages others to find ways to neutralize or nullify her unique position, for instance, by extending performative ties, *ad hoc* social ties between strangers (Levine, 2005).

CONCLUSION

We began by discussing the ultrasociality of humans and noting that actors enter into a large number of relationships that include benefiting others without keeping close track of and ensuring the equality of reciprocal benefits. We suggested that actors have evolved mechanisms that guide them in the choice of exchange partners even without conscious calculation or bookkeeping of gain and loss. One such mechanism directs actors to membership in clusters, homogenous groups of dense relationships, which are only loosely connected to other groups. We explained that clusters feature network externalities, which are not possible in sparse networks, thus conferring cascading benefits on the actors contained in those clusters. We highlighted the omnipresence of clustering in social networks, its benefits and challenges, and used the logic of cascading benefits to derive empirical propositions.

Our propositions here constitute a small step towards a more general theory, one that addresses fundamental questions of the social sciences. It is well established that humans are social creatures, constantly engaging in interaction with others. This interaction however is not random. A person tends to interact repeatedly with a relatively small set of individuals, such as close friends (Dunbar, 1996). Similarly, firms tend to interact repeatedly with the same partners (Uzzi, 1997), or the partners' partners (Gulati and Gargiulo, 1999; Guillén, 2000). A network diagram of social contacts typically reveals islands of dense relationships. Those islands are separated by spaces that are bridged only by an occasional tie or a network entrepreneur. In longitudinal studies of networks, interpersonal and interfirm alike, such islands tended to form early and remain robust over time (Burt, 2004; Kogut and Walker, 2001; Uzzi and Spiro, 2005), giving rise to the Small World phenomenon (cf. Conyon and Muldoon, in press).

Clustering—the tendency of humans to congregate into relatively small, tight, and bounded groups—is a fundamental feature of human society. It is well known, documented, but not well understood. The model of cascading benefits provides a two-fold advantage: at the micro-level,

it helps to explain why actors prefer to interact with others that are tied to each other. Unlike the homophily argument, we specify the ultimate explanation and the proximate mechanism that leads to the observed behavior: dense networks are more conducive to secondary and tertiary benefits, while sparse networks are not, leading to an evolved psychology designed to prefer the former.

At the macro-level, when multiplying individual-level behaviors to form a social pattern, our model predicts congregation of actors in dense clusters that are sparsely connected to each other, be those groups of friends, firm alliances, or industrial clusters. Unlike the social exchange argument, the cascading benefits model explicitly predicts and explains clustering as opposed to association with well-endowed individuals at random network locations. Moreover, unlike both alternative explanations, ours does not require an additional level of theory to explain the pattern. The cascading benefits argument is intrinsic to the network structure and does not require information about the actor's endowment or characteristics. Rather, it is a direct outcome of the micro-mechanisms, those specified at the individual level. Thus, we present a theoretical framework that is parsimonious, provides testable hypotheses, and suggests a micro–macro link that is missing in competing explanations. Moreover, it suggests that structure begets structure, an idea very much in agreement with recent work on network evolution.

If the search for cascading benefits is indeed the mechanism behind the clustering of exchange partners, it may explain the ubiquity of this phenomenon. Organizationally, understanding the causes can assist in managing the tendency for clustering and reaping its positive benefits, such as increased trust and cooperation, with less of the negative outcomes, such as isolationism and cliquism.

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NOTES

1. Although the theory was originally applied to choices in friendship, we see nothing in it that prevents the more general extension that we present here.
2. An externality is said to exist when a transaction brings consequences to third party, which is not directly involved in it (Pigou, 1932).
3. Notice that we leave out the discussion of direct reciprocity (or reciprocal altruism) from alter to ego because is it immaterial for our argument. The argument we present here holds even when direct reciprocity is absent. If such reciprocity is expected, ego's benefits would be compounded: direct reciprocity from alter in addition to tertiary benefits from ties shared with alter. Otherwise, the density of the network may promote a form of generalized exchange (Yamagishi *et al.*, 1999).
4. Formally, network density is measured as the ratio between the number of existing relationships in a group and the sum of total potential relationships in the same group. It is expressed as $\Delta = 2R/I(I-1)$, where R is the number of existing relationships, and I is the number of individuals in the group. The network density value is always in the range [0,1] on a continuum between no relationships in the group and the case in which each member has a direct tie to every other member.

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