Beyond Markets and Communities: 
A Comparative Approach to Knowledge Exchange in Organizations

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While knowledge transfer has been shown to affect organizational performance, little is known about the processes of knowledge exchange between organizational agents. We propose that combination of various modes of exchange and degree of tie strength produce at least five different configurations: neo-classical exchange, local search, embeddedness, community exchange, and performative ties. Using an agent-based simulation of problem solving in an organizational setting that involves knowledge exchange, we find that embeddedness and community exchange provide results that are superior to neo-classical exchange. Performative ties, however, outperform both, even if just a minority of the organizational agents is able to extend such ties. In addition, we find that the marginal returns on performative ties are greatest when such ties are relatively rare, suggesting that the cost associated with encouraging them can be minimized with little in adverse effects. We conclude by discussing managerial implications for team setup and facilitation of knowledge transfer.

Keywords: Knowledge, Social Network, Exchange, Reciprocity, Performance
Knowledge has grown to occupy a major role in the discussion on firm performance and survival (Winter, 1987). In the management literature, it has been recognized as a valuable resource (Kogut and Zander, 1995), a source of lasting competitive advantage (Teece, Pisano and Shuen, 1997), and even the very foundation for the existence of the firm (Grant, 1996). However, unlike other economic resources, such as capital or land, knowledge is a social entity. In the last two decades, much ink has been spilled to argue and show that organizational knowledge, the kind that is necessary to create a competitive advantage, does not reside in manuals or training books, but in individuals and the regularities by which they cooperate, i.e. tacit knowledge and routines (Cohen & Bacdayan, 1994; Foss, 2003; Kogut & Zander, 1992; Nelson & Winter, 1982). Consequently, the organizational literature has been devoting much attention to the transfer of knowledge between agents, either within (intra-) or between (inter-) organizations. Much has been achieved: we now have better understanding of the flows of knowledge between agents and the consequences for various phenomena of managerial interest, such as organizational structure (e.g. Reagans & McEvily, 2003; Sorenson, 2003), innovation (e.g. Hargadon & Sutton, 1997; Obstfeld, 2005), and performance (e.g. Hansen, 1999).

We seek to make two interconnected theoretical contributions to the knowledge literature. First, we model how individual agents, rather than organizational units or firms, search and exchange knowledge. Sociology has a long tradition of discussing interpersonal transfer of resources as an exchange whether tangible goods to social goods, such as prestige and power. Homans (1958) drew on micro-economics to expand the notion of exchange to non-market settings, and Blau (1964) added by stressing the interaction between the transactions and the eventual social structure, which, in turn, constrains the transactions. In both treatments, individuals attain their personal or group goals by exchanging with others. In the managerial literature, however, the notion of exchange in knowledge transfer has largely been overlooked (cf. Szulanski, 2000). Somehow, it was implied, organizations take care of the internal exchange process. Some exceptions exist, but they mostly describe either aggregate knowledge transfers between teams and divisions (Hansen & Løvås, 2004; Hansen, Mors, & Løvås, 2005; Hansen, Podolny, & Pfeffer, 2001; Tsai, 2002) or densely connected individuals in small organizations (Lazega, 2001). Few have modeled or examined the
common case of individual exchange in a large organization, as we do here (cf. Argote & Ingram, 2000).

Second, we aim to provide a comprehensive taxonomy of organizational configurations of knowledge exchange. In the taxonomy, we categorize exchange configurations that have received much scholarly attention, such as neo-classical exchange (Wilson, 1987), as well as more recent ones, such as embeddedness (Portes & Sensenberger, 1993; Uzzi, 1996) and performative ties (Levine, 2004b). Translating the taxonomy into an agent-based model allows us to examine the effects of various individual, task, and organizational characteristics on organizational performance. It enables us to compare performance of organizations that are identical, except for the knowledge exchange configuration they employ. Further, it also us to specify hybrid modes, in which some of the individuals in an organization apply different configuration towards a selected group of others, as sometimes happen with people who share alma mater affiliation, for instance (cf. Yamagishi, Jin, & Kiyonari, 1999).

This paper combines qualitative data and agent-based modeling through computer simulations as mechanisms to investigate organizational and social phenomena (Carley, 2002; Macy & Willer, 2002; Prietula, Carley, & Gasser, 1998). Qualitative data is rich and offers high external validity, but it is hardly parsimonious. We synthesize the qualitative data to generate taxonomy of knowledge exchange configurations and subsequently build a nuanced agent-based model. Specifically, we are interested in linking individual choices to organizational performance (cf. Gibbons, 1999). When performing their professional tasks, agents decide who to turn to their search for knowledge and how to negotiate the transfer. These micro-choices – mode of exchange and the characteristics of the exchange partner – can eventually affect organizational performance, a macro variable (Felin & Foss, 2005). In our model, we examine a range of configurations: modes of exchange and the nature of relationships between the agents. Our model allows agents to interact purely in one mode of exchange, or – more realistically – in a combination of them, dependent on the characteristics of the exchange partner.
Exchange Configurations: Partners and Modes

Tie Strength

Individuals often need to obtain knowledge that is necessary to perform their professional tasks, whether they are service technicians (Orr, 1990, 1996), high-technology engineers (Bechky, 2003), or white-shoe professionals (e.g. Hansen, 1999, 2002; Hansen et al., 2005; Hansen et al., 2001).

In a study of a global professional service firm, Levine (2004a) found some use of codified sources, such as textbooks and internal publications. Those sources were typically used when an employee was completely unfamiliar with the industry or the problem at hand, and was interested in an introductory overview. More commonly, professionals in the firm turned to their social network for knowledge. They approached strong ties: office mates, close friends, and family members making a variety of requests from asking quick questions about statistical functions in Microsoft Excel to spending several hours sourcing an insider view on an industry. Individuals also called on weak ties: acquaintances in their office and in other offices when seeking references and advice. However, however, Levine suggests that strong and weak ties were not the only sources for knowledge.

Employees also sought knowledge from strangers – others they neither had met nor been referred to by a mutual contact. A performative tie is said to exist when it is extended directly between (unacquainted) individuals to facilitate a generalized exchange transaction. Because performative ties are direct (as opposed to indirect, brokered ties) they allow a wide search for the most likely carriers of the knowledge sought. Because performative ties are based on generalized exchange, the transfer is coordinated and the knowledge (or other good) is customized to the needs of beneficiary, even without expectations for direct reciprocity. Table 1 summarizes the various sources of knowledge and provides examples and theoretical and empirical referents.

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Insert table 1 about here
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A knowledge transaction involved several steps: identification of the potential knowledge carrier, initiation of contact with that individual and negotiation of terms, and transfer of content (Szulanski, 2003). An important feature is the choice of mode of exchange, which determines the expectations of both partners for immediate, future, or generalized (indirect) reciprocity.

**Partner Identification: Local and Global Search**

A common way to identify an exchange partner is to scan neighboring individuals. Empirically, we know that people (and organizations) are more likely to choose as exchange partners those that belong to the same cluster (Levine & Kurzban, forthcoming). The search criteria can be geographic propinquity (Marsden & Campbell, 1984; Newcomb, 1961, 1966), characteristics such as ethnicity or age (Ibarra, 1992; Marsden, 1988; McPherson, Smith-Lovin, & Cook, 2001), or membership in a focal group (Burt, 2004; Feld, 1981). In a great number of search situations, individuals (and organizations) exercise local search, turning to a neighbor or an acquaintance and neglect searching potential but distant exchange partners (Denrell, 2003; Hansen & Lovás, 2004; Levinthal & March, 1993).

**Global Search**

Normative approaches for search call for a comprehensive search before deciding on an exchange partner, thus achieving optimality. This approach is the hallmark neo-classical economics (Wilson, 1987) and the early decision-making literature (cf. Simon, 1957).

While an optimal search may not be possible, organizations have created organizational indexes, which list members and their experience, to be used when searching for knowledge. Students of knowledge transfer in organizations have documented Knowledge Management Systems (KMS), organizational databases that sought to complement (or replace) humans by archiving accumulated experience (Hansen, 1999). In the case described by Levine (2004a), the KMS emphatically was not set to capture much knowledge, but contained short descriptions of many of the projects performed in the firm worldwide. In addition to a sketch of the problem and the solution, it also contained contact information for all of the project team members, even if no longer

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1 Recent managerial critique (Donahue, 2001; McDermott, 1999) contends that such mechanisms have been expensive and largely ineffective, as proponents of the knowledge-based view could have probably predict.
employed at the firm, allowing direct contact. Rather than a library of codified knowledge, KMS
served more as a collection of pointers, an organizational index, which identified individuals who
possibly possessed relevant knowledge. Knowledge seekers used the information contained in the
KMS to scan the list of potential knowledge carriers and decide which ones to contact.

If KMS did not provide a lead, employees sometimes sent out a mass electronic mail
message to the entire office, geographic region, or all of the employees worldwide. The message
detailed the knowledge need and asked for assistance. A similar pattern of sending out mass
electronic message, with considerable success, was documented among sales personnel in a large
computer hardware manufacturer (Constant, Sproull, & Kiesler, 1996).

Whether through the use of a central KMS or by sending a mass message to colleagues,
knowledge seekers attempted to perform as search as close to a global search as possible to locate
prospective exchange partners.

**Typology of Exchange Modes and Tie Strengths**

Once a prospective exchange partner is identified, the seeker makes contact, either directly
or through a broker, a third party who can introduce both to each other (on the role of brokers see
Burt, 1992, 2005; Hargadon & Sutton, 1997). Then, the sides must agree on the terms of the
exchange. As detailed below, the transfer can be arranged as a spot exchange (neo-classical
exchange), as a favor that must be returned in the future (social exchange), or as a non-reciprocated
donation (generalized exchange). These modes of exchange have different meaning when used on
ties of varying strength, leading to five configurations of exchange, which we model here.

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*Insert table 2 about here*

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The table categorizes configurations of exchange according to two criteria:

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2 We do not discuss pure altruism as a mode of exchange because there is no substantial empirical evidence that it serves
as a sustainable mode of exchange within organizations. Reciprocal altruism (Trivers, 1971) is similar to social exchange.
Tie strength

As commonly used, it denotes "the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie" (Granovetter, 1973:1361; cf. Marsden & Campbell, 1984). Tie strength is a continuum here, running from strong ties, as in between close friends or family, to "no prior ties" which indicates interaction between people who are completely unacquainted, neither directly nor indirectly. ³

Spot, Social, and Generalized exchange

Mode of Exchange refers to the principle underlying the transaction — what is transferred from each exchange partner to its counterpart. The categories along the Mode of Exchange axis begin with a spot market exchange, where — in a neo-classical sense — autonomous economic agents repeatedly search for the best price-quality combination and exchange is price-based and simultaneous, as both sides agree on a price and proceed to give and receive at the same time.

Social exchange can be used for tangible goods, as well as for some desirable social goods that are not easily tradable in neo-classical markets due to their nature — prestige and friendship are two examples. It could be, for instance, due to difficulty in evaluating them or their unavailability for simultaneous transaction (Blau, 1964; Bourdieu, 1997; Homans, 1958). An important distinction of social exchange is that the transactions are repeated, or expected to be repeated, and thus the need for simultaneity is reduced. For instance, relations of power and dependency are created between two actors when one repeatedly needs a resource that the other controls but has no way of paying back. Thus the needy one “must subordinate himself to the other and comply with his wishes, thereby rewarding the other with power over himself as an inducement for furnishing the needed help” (Blau, 1964:21). Naturally, subordination is not a behavior that lends itself to an instantaneous market transaction, but delivered to the recipient through repeated interaction.

An important commonality of neo-classical and social exchange is that both are cases of direct exchange. In the either case, exchange is a transaction between two actors, where both give and receive from each other, either identical or different goods, either immediately or sequentially.

³ The label “weak tie” is added for convenience, as to show the drop in tie strength, but its location along the continuum is arbitrary.
Generally, direct exchange “includes any system which effectively or functionally divides the group into a certain number of pairs of exchange units so that, for any one pair X-Y there is a reciprocal relationship” (Lévi-Strauss, 1969 [1949]:146).

Generalized exchange, in contrast, occurs when a beneficiary is not obliged to reciprocate directly to her benefactor, but to any other agent: “An individual feels obliged to reciprocate another’s action, not by directly rewarding his benefactor, but by benefiting another agent implicated in a social exchange situation with his benefactor and himself” (Ekeh, 1974:48). Generalized exchange is quite different from direct exchange: it neither requires immediate reciprocity nor creates a direct obligation to a specific benefactor. Several subcategories of generalized exchange have been identified (Bearman, 1997; Ekeh, 1974; Lévi-Strauss, 1963; Malinowski, 1920; Sahlins, 1965), and they differ from each other in the way the goods exchanged are transferred (for a recent review, see Takahashi, 2005).

While generalized exchange often takes place in communities, where the agents eligible to participate are well known and clear boundaries are drawn, generalized exchange can also guide transactions among strangers (Befu, 1977, 1980; Emerson, 1981; Molm & Cook, 1995). Helping a stranded driver on a remote mountain road, for example, is such an instance because the benefactor does not expect the specific beneficiary to return the favor in the future, although the benefactor probably expects to be helped similarly if she is ever stranded.

Generalized exchange is a term that describes a mode of exchange. It is neutral, however, as to the underlying motivation leading to the adoption of this mode. Recent work has suggested that generalized exchange can develop as a result of norms (Yamagishi et al., 1999) or merely application of individually-held notions of fairness (Takahashi, 2000), even if the actors themselves are not aware of underlying logic of exchange (Bearman, 1997; Gouldner, 1960).

Cell 1: Neo-Classical Market

The interaction of the axes produces several configurations of exchange, some of which are more familiar than others. One very familiar case is cell 1, which combines spot exchange absent of

4 The sociological literature uses “generalized exchange” (Takahashi, 2000) side by side with “generalized reciprocity” (Mauss, 1954). Economists sometimes speak about “impure altruism” (e.g. Abel & Bernheim, 1991). After a close reading, it seems that the terms refer to the same phenomenon. For consistency, we will use “generalized exchange” throughout this paper.
social ties, which is essentially the case of neo-classical markets, where autonomous economic agents repeatedly search for the best price-quality combination and then engage in a transaction with whoever happens to offer that combination (Wilson, 1987). The strength of a neo-classical market is that it vastly expands the choice of exchange partners. The search is wide and the gains are potentially greater. Drawbacks lie in the arms-length nature of the transaction, which hinders customization, increases risk, and increases costs in haggling and negotiations. It also requires that the goods are available for simultaneous exchange; that is, both actors must have something desirable for the counterpart for the transaction to take place.

Cell 2: Local Search

In cell 2, the search is narrower, as one searches only along her direct and immediate indirect ties, that is among her acquaintances and her acquaintances’ acquaintances. Such a local search is a common deviation from the ideal, and it can occur due to the cost of search, unavailability of information, or cognitive limitations (Levinthal & March, 1993). Local search is inefficient, for it settles on the local maximum (best combination of quality and price), which is not likely to also be the global maximum (Levinthal, 1997). Despite its drawbacks, people often go to acquainted rather than capable others when seeking knowledge (Ghoshal, Korine, & Szulanski, 1994; Hansen & Løvås, 2004).

Cell 3: Embeddedness

Embedded exchange takes place when social and economic relations are intertwined (Granovetter, 1992; Portes & Sensenberger, 1993; Zukin & DiMaggio, 1990). It is a combination of repeated exchange partner and social exchange logic, which allows for non-price-based transactions under less specified terms, in comparison to the contract-based transactions in markets. Some of the transfers may be done as favors. Others do not carry a specific price tag but have to be repaid. Others may be market-like transactions, but are performed in a more trusting environment and under less formal conditions. In embedded exchange, the need for simultaneity in exchange is

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5 Due to rapid attrition, search is unlikely to succeed beyond direct and immediately indirect ties. We incorporate in the model recent findings that show completion rate that is less than 12% even for a second-degree tie. Beyond that, more than 95% of attempts to extend a tie fail (Watts, Dodds, & Newman, 2002).
reduced. These conditions allow the exchange partners to reap benefits that are not possible in a market exchange (Baker, Faulkner, & Fisher, 1998; Granovetter, 1985; Gulati & Gargiulo, 1999; Uzzi, 1999; Uzzi & Gillespie, 2002). In one of the first empirical accounts, Uzzi (1997) described some of the benefits: fine-grained information transfer, joint problem solving arrangements, economies of time, integrative agreements, and greater willingness to invest and take associated risks. In a separate article (1996), he provided evidence on the financial benefits of embedded exchange vis-à-vis market-based exchange. Embeddedness, however, can result in several risks, primarily because the search for exchange partners is “deep rather than wide” (51): actors repeatedly turned to the same exchange partners, rather than search widely for the best price-quality combination (see also Sorenson & Waguespack, 2003). Access to non-embedded actors may be limited, and an unforeseeable exit of a major network partner can be disastrous, as it may be difficult to replace. By interfering with the propagation of information from diverse sources, embeddedness can also disguise changes in the environment (Sorenson, Rivkin, & Fleming, 2002).

**Cell 4: Community/Clan**

Many, if not most, of the documented cases of generalized exchange take place among specific exchange partners who are connected through direct and indirect ties (Bearman, 1997; Lazega, 2001). A typical case of generalized exchange along direct ties is described by Uehara (1990). It is a small network of low-income black women, who support each other as they go through job loss. Here support flows to the needy, the ones that are unemployed, from their circle of supporting friends and relatives. The goods offered do not necessitate direct reciprocity, so the need for simultaneity is gone. Rather, members are expected to contribute and consume according to their needs.

A community that establishes generalized exchange as its mode of exchange benefits from the reduced need for simultaneity and direct reciprocity. It enjoys many of the benefits of embeddedness, in addition to the added ability to transact with agents who have little to offer in the short run, as calculations for direct reciprocity are eliminated. Research on communities as sources of support has expanded in the last decade, examining their role in providing economic, social, and psychological benefits, which are difficult to contract in a neo-classical economic market. For
instance, informal ethnic associations fulfill an important mediating function between new immigrants, their societies of origin, and their new homeland. Their expected support plays a role in the decision to immigrate, and recent immigrants help new immigrants to find their way in a new country once they arrive, as exemplified in work on immigrants from Hong Kong to North America (Fong, Salaff and Siu-lun, 1995; Salaff, Fong and Wong, 1999). Community institutions provide revolving credit arrangements and allow immigrants to start their own businesses, even when their commercial credit worthiness is low (Portes, 1995).

Some have described organizations as (or suggested that should become) communities (Kogut & Zander, 1996), usually to imply that generalized exchange should become a prevalent mode of exchange, helping to overcome opportunistic behavior and elicit cooperation among employees. Similarly, Ouchi (1980) proposed that Japanese firms are based on a clan logic, which is different from bureaucracies (and certainly markets), and called for American managers to follow in changing their organizations to be more clan-like.

**Cell 5: Performative Ties**

Performative ties combine the wide search of neo-classical exchange with the low transaction costs of generalized exchange. When resources are heterogeneous, such as knowledge in the cases presented here, a wide search becomes uniquely more efficient in facilitating transaction. Compared to embeddedness or community, performative ties allow much wider search, wider than what can be achieved through direct and indirect ties alone. Even if indirect ties are used to extend the search beyond immediate locality, extension of such ties requires mediation of at least one other individual. As Burt (1992; 2005) showed, mediators of network ties gain from their control over transactions in the network. While this can be beneficial for an individual, it may interfere with organizational tasks. Even if only benevolent individuals are involved, the message can still become jumbled as it passes from one to another (Szulanski, 2003; Winter & Szulanski, 2001). Indirect ties are also likely to consume more time and resources because they require a seeker to contact not only the carrier but also everyone in between them. Moreover, indirect ties suffer from a rapidly decreasing completion rate, due to attrition levels that lead to roughly 60% failure rate (Watts et al., 2002). Finally, indirect ties are still limited in reach – one can only reach other individuals with
whom she has indirect ties, but not others who are not tied to one’s ties. Thus, performative ties greatly extend the scope of a search and decrease its cost, compared to the alternative of indirect ties.

Performative ties feature the search benefits of a market transaction but add to them, because wide search is insufficient to assure transaction. In a market transaction, once a potential carrier is found, the terms have to be negotiated. The mode of generalized exchange provides benefits that are comparable to embeddedness and community, absent from markets, and especially beneficial in a knowledge-intensive organizational setting. Because direct reciprocity is not expected, even those that are low on resources or prestige, who are often the most needy cases, can partake in exchange with well-endowed agents.

The Model

We investigate the effect of exchange configurations – combinations of exchange mode and tie strength – on the efficacy of organizational problem solving. In addition, we investigate the robustness of a hybrid mode, combining performative ties with community modes, and examine the returns on firm-level investment in nurturing performative ties.

The model simulates agents that are embedded in local groups of direct ties, such as project teams, and work to solve a group-level problem. A problem is decomposed into assignable tasks for the agents. Each agent has a set of skills suitable for a set of tasks, which may or may not be the tasks assigned to it. For each of those skills, the agent has an attained competence level. Tasks are completed through the application of these task-relevant skills by the agent. Knowledge (as skill development) is attained either through self-learning, acquisition through exchange with another agent, or both. Acquisition from other agents is driven by the nature of the network exchange environment within which the agent resides and the ties it can exploit. By simulating various exchange configurations – types and parameters of network exchange environments and ties – we explore their impact on the dynamics of knowledge creation and propagation.
Agent Behavior

At the beginning of the simulation, each agent is randomly assigned tasks for solution. When an agent receives a task, it first checks to see whether it has any knowledge of the task. If so, it applies the knowledge. If the knowledge is insufficient to solve the task, the agent will endeavor to acquire the remaining knowledge through self-learning. However, if the agent possesses absolutely no knowledge about the task, it must acquire that knowledge through a process of search among the other agents present. The nature of that search process and the mechanisms of acquisition are largely determined by the pattern or patterns of exchange set by the simulation operator.

For the model, we represent the horizontal line of Table 2 – Mode of Exchange – in the following way:

1. **Spot Exchange.** Agents will search to maximize the knowledge gained through the exchange. For knowledge acquisition to ensue, it is necessary that both agents agree and exchange knowledge under a strict requirement of simultaneity and direct reciprocity without incurring debt. As all exchanges are immediate (either agreed or declined), no social memory of agents or events is required.

2. **Social Exchange.** Agents will engage in a knowledge exchange, but one agent can endure a debt of exchange to another agent if it is in good standing i.e., without current debt to that agent. Therefore, agents possess a social memory capable of distinguishing individual agents and their obligations. Again, direct reciprocity is expected, but social debt is permitted and thus simultaneity in exchange is not required.

3. **Generalized Exchange.** Agents will engage in a knowledge exchange and, as in social exchange, one agent can endure a debt. However, the debt is one of indirect reciprocity, where the debt is obligated to a group and not to a specific individual.

The second axis of the typology – Interaction History – specifies the extent to which there is an existing social link, as a degree of familiarity, between the transaction partners. Because we seek
to make our assumptions socially realistic, we designate that the agents always begin with acquaintance others and – if those fail to provide a solution – move to indirect ties. As noted earlier, we incorporate certain level of attrition in direct (0.2) and indirect ties (0.6 for each indirect tie), based on empirical evidence (Dodds, Muhamad, & Watts, 2003). Those agents that search globally will perform that if both direct and indirect ties do not provide a solution. Specifically, we represent the two search rules in the following ways:

1. **Searching Existing Social Ties.** Extant social ties exist between transaction partners who have an existing (direct tie) relationship as defined by the group structure, or have referred to by a one-off common acquaintance (indirect tie). The following three configurations are based on existing social ties, which are defined as direct ties as members of the immediate group, or indirect ties as agents who have direct ties with the immediate group. In local search, agents search only their local ties and their indirect ties for knowledge. Knowledge will be acquired by any given agent only if the two agents can agree on an exchange; that is, if one agent has task-knowledge that is immediately useful for the other agent’s task. Agents will attempt to maximize the exchange, but it is restricted to the local/group “market-like” environment. In embeddedness, agents search only their local ties (and their indirect ties) in an attempt to maximize the acquisition, but unlike pure local search, this configuration sets the agent within a relatively stable social group where toleration for debt exists. Thus, opportunities for exchange revealed by this local group search are expanded by the acceptance of obligation as determined by its individual members. Here agents do not seek the optimal, but satsifice by engaging in the first acceptable exchange condition. In community, although agents are again restricted in their search to local group ties (and indirect ties), the nature of the social environment now transcends direct reciprocity requirements for individual transactions and affords opportunities for asymmetric exchanges without direct debt to specific individuals. Rather, agents are in the debt of the group and that obligation
can be managed using a variety of social mechanisms, such as R-scores, standing, and image scores (Nowak & Sigmund, 1998), and altruism.

2. **Searching Unacquainted Others.** The agents in the transaction have no direct or indirect social ties, nor have a prior history of transactions. Neo-classical exchange and performative ties are based on such search. The search is facilitated by KMS, which links task descriptions, solution descriptions, and contact information for all of the agents. In the neo-classical configuration, an exchange requires simultaneous direct reciprocity without debt. An agent needs to have knowledge of value to the other agent. In the performative tie configuration, a tie is enabled by finding agents in the KMS who may have knowledge of potential value and have agreed to engage in performative ties.

**Agent, Group, Organizational and Problem Structures**

The agent structure includes the size of its skill memory, the decay rate of skill loss, learning rate parameters, and its strategy for skill replacement, where newly acquired skills must replace existing memory slots. The group structure is simple. The model allows variation in team size and number, the organizational turnover rate, the knowledge distribution of agents (including newly joined ones), and the attrition rate for direct and indirect ties. The organizational structure is a hierarchy with dispersed teams. The organizational problem structure, $P$, is represented as a vector of integers. Each element $P_i$ is an assignable task to an agent, and the value of the element indicates the task difficulty in terms of required competence level. The problem can vary in terms of four properties: size, (task) difficulty, complexity and redundancy. Size refers to the number of tasks in the problem. Difficulty refers to the level of skill (an integer) required to complete each task. Complexity refers to the need for coordinated implementation of completed tasks in a strictly ascending order for the problem. Redundancy is the percentage of tasks common to subsequently assigned problems.
Results and Discussion

Performance and Neo-classical exchange, embeddedness, and community/clan

We begin by comparing the efficacy of the modes of exchange against each other. To obtain variance, we let the agents handle problems of difficult nature, which contain a large number of sub-tasks.

The first experiment shows that neo-classical exchange performs poorly in comparison to either embeddedness or community/clan configurations. The difference are statistically significant between the first and the latter two, but not between embeddedness and community/clan. This finding matches empirical findings, such as that embeddedness provides fine-grained information transfer, joint problem solving arrangements, economies of time, integrative agreements, and greater willingness to invest and take associated risks, all related to increased performance (Uzzi, 1996, 1997; Uzzi & Gillespie, 2002). It also fits the arguments on the virtues of community and clan organizations. As discussed earlier, the community/clan configuration differs from embeddedness in that it employs generalized exchange as the mode of exchange rather than social exchange.

The Robustness of Performative Ties

Levine (2004a) argued that performative ties are superior to other modes of exchange, because such ties combine the wide-search of neo-classical exchange with the low transaction costs of community exchange. Performative ties also allow resource-poor agents to remain productive, because dyadic reciprocity is not required. Preliminary runs of the simulation have resembled this argument – the performance of organizations composed of performative ties agent were vastly superior to any combination.
However, it may not be realistic to assume that an organization would be entirely composed of agents that are always willing to benefit strangers. Students of cooperation have shown that a substantial chunk of the general population consistently behave in an opportunistic manner, if the opportunity exists (Kurzban & Houser, 2001, 2005). In real-life organizations, employees may be absent, busy, uncooperative or straight out “free riders”. Hence, it is valuable to explore whether performative ties can still affect organizational performance. To that end, we created an organization that employed two exchange configurations simultaneously. The majority the agents followed the community mode (i.e., within-group generalized exchange). A certain percentage of the agents were hybrid: when seeking a piece of knowledge, they began by a local search, following the logic of the community mode. However, the knowledge was not available locally, the agents employed performative ties: they turned to the KMS, and searched for another hybrid agent that would be willing to exchange knowledge. It is important to note that hybrid agents could extend a performative tie only to other hybrid agents, and not to the majority, which used community as the sole configuration.

As evident in the results above, the organizations that include hybrid agents performed significantly better than those that were based on the community configuration alone. In addition, an increase in the percentage of agents that were able to extend performative ties led to significantly better performance. The relationship remained unchanged when we included 10% and 30% of hybrid agents or above 50%, however, the marginal increases varied, as discussed in the following section.

These results provide a potentially important theoretical proposition: the benefits from performative ties are significant even if the majority of the agent population adheres to another mode, in this case – community. Managerially, the results suggests that organizations will begin to see benefits from
performative ties even with low levels of individuals that are able to extend and willing to receive such ties.

**Marginal Returns from Performative Ties**

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While performative ties can boost organizational performance above other modes of exchange, the organizational setting that is necessary to enable them may be prohibitively expensive. In this experiment, we investigate the returns, in organizational performance improvement, as affected by increase in agents who practice performative ties and at various problem structures.

Performative ties are thought to be associated with a variety of organizational practices, some of which are costly to implement. Most elementary, the creation and maintenance of a KMS is necessary for wide-search. A practice that may contribute to the appearance of performative ties is embeddedness of workers in multiple networks, so that the network appears dense (cf. Levine & Kurzban, forthcoming). This can be achieved, for instance, by employing teams that are transient and composed of non-specialized employees, as to increase the perceived chances that each one of them could eventually be in the same team with any other member of the firm. Mentoring of junior employees by senior ones and cross-hierarchical teams may increase the chance of ties across levels, and multiple simultaneous team assignments immediately increase one’s organizational social network.

Spatial arrangements can also increase interaction and perception of dense network: rotation of employees allocated space and generous provision of public spaces may be two ways to achieve that, but both require expenditure of capital on extra moving and space. Also associated with performative ties are cross-site occasions, where employees from multiple offices meet together for training or retreat, or move to another office for a while. As Levine (2004a) notes, flying even junior employees across continent to attend a routine training session may allow them to meet more peers, but it can be borne only by wealthy firms.
Our results show that firms see the great return on their investment in such practices early one, because the marginal returns from performative ties tend to be higher at lower levels, with the steepest improvement occurring in the range 10%-30%. The marginal returns taper off as the percentage of hybrid agents increases, although they always remain significantly higher than zero. Similar behavior was observed along problem structures of increasing difficulty.

**Conclusion**

With the understanding that knowledge is crucial for organizational performance, comes the desire to facilitate processes of knowledge exchange. We began by explicating the approaches to knowledge exchange, and show how they interact with agent characteristics. While the first study replicated prior empirical findings and theoretical propositions, the second study showed that performative ties provide superior returns, even when those who practice them are a small minority in the organization. We noted that this finding suggests that management will see benefits from performative ties even if only a small number adopted them.

The ability of performative ties to generate significantly higher organizational performance even at low levels may suggest that they contribute to the appearance of an organizational Small World (Milgram, 1967; Travers & Milgram, 1969). Recent research on small-worlds networks has generated interest and interpretations of how global and local structural properties interact in dynamical systems. For example, it has been demonstrated that connecting disparate, clustered worlds by shifting a local edge in cluster to link to a distant node has little impact on the clustering (a local property), but a distinctly nonlinear effect on the characteristic path length, a global property (Watts & Strogatz, 1998). Because individuals are likely to communicate easily with their immediate neighbors, it is sufficient if just one of these neighbors is able to extend performative ties to enable to entire team (local cluster) to enjoy the benefit of performative ties.

Furthermore, it has interesting application concerning organizational diversity. It has been long argued that diversity, such as in gender and race, can increase organizational performance because it allows the organization to choose from a greater variety of approaches to a given problem. However, it has been recently questioned whether creating truly diverse teams is likely or
even possible in organizations (Reagans, Zuckerman, & McEvily, 2004). At the same time, we know
that individuals have social networks that are largely homogenous – composed of people that are
similar to self (McPherson et al., 2001). Our results lead us to think that creating diverse teams may
not be entirely necessary. It is sufficient to have a small number of agents who can extend and
receive performative ties. These may be individuals who belong to a distinct group, such as alumni
of the same university. As noted earlier, their ability to extend performative ties will cascade to their
neighbors. Thus, creating teams that are homogenous, but include at least one agent with
performative ties capability may be a sufficient substitute for the holy grail of full diversity in teams.

While knowledge transfer has been hailed as a means for improved organizational
performance, the question of cost of transfer has rarely been addressed (Haas & Hansen, 2005). This
is not a moot question by any mean, as with any other organizational resource, the benefit from
knowledge transfer should exceed the cost of facilitating these processes. Our last experiment, which
examines the marginal returns to performative ties, suggests that marginal returns are higher when
performative ties are scarcer. If one bears in mind the cost of facilitating performative ties, and add
to that the fact that they show immediate a greater jump in performance early on, management may
choose to keep performative ties at levels that are lower than maximum, thus economizing on costs
without sacrificing a great deal of organizational performance. Future research is likely to dwell
longer on the question of benefits and cost associated with knowledge.
References


<table>
<thead>
<tr>
<th>Contribution</th>
<th>Example</th>
<th>Theoretical and Empirical Referents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codified Sources</td>
<td>Overview of industry, typical problems and relevant frameworks</td>
<td>(Arrow, 1969; Kogut &amp; Zander, 1995; Teece, 1977)</td>
</tr>
<tr>
<td>Strong Ties</td>
<td>Varies: from help in using computer software to getting insider view on industry</td>
<td>(Bian, 1997; Coleman, 1988; Nelson, 1989; Wellman &amp; Wortley, 1990)</td>
</tr>
<tr>
<td>Weak Ties</td>
<td>Account of previous projects in same industry or similar</td>
<td>(Granovetter, 1973; Hansen, 1999; Levin &amp; Cross, 2004)</td>
</tr>
<tr>
<td>Performative Ties</td>
<td>Recalled specific similar cases, suggested ways to approach about issues, provided proprietary data</td>
<td>(Constant, Sproull, &amp; Kiesler, 1996; Hansen et al., 2001; Lakhani &amp; Hippel, 2003)</td>
</tr>
</tbody>
</table>

**Table 1:** Knowledge sources, examples, and theoretical referents
<table>
<thead>
<tr>
<th>Mode of Exchange</th>
<th>Spot Exchange</th>
<th>Social Exchange</th>
<th>Generalized Exchange</th>
</tr>
</thead>
</table>

**Tie Strength**

| Strong tie | Frequent, close and intensive |
| Weak tie | Infrequent, not close or intensive |

**No prior tie**

No history of dyadic interaction

| 1. Neo-classical market | Limited scope of search and need for simultaneous availability of exchange items mean that transactions are executed at a suboptimal level. |
| 2. Local Search | Allows access to benefits not available in the marketplace, but limited scope of search can lead to suboptimal results. Requires pre-existing personal trust in the exchange partner. |
| 3. Embeddedness | Allows access to benefits not available in the marketplace, and allows resource-poor agents to participate. But relationships tend to be primary and oriented for the long term, and the breadth search is limited. |
| 4. Community/Clan | Allow wide search of potential exchange partners. Generalized exchange allows for transactions that are unbalanced in the dyadic level, and does not require simultaneity. |

**Table 2: Typology of exchange**

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6 Social exchange requires repeated exchange with stable partners, and unlikely to take place with strangers. Closest to social exchange with strangers would be generalized exchange (or pure altruism, where reciprocity is not expected at all).
<table>
<thead>
<tr>
<th>Performance Configuration</th>
<th>Average</th>
<th>Median</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neo-classical exchange</td>
<td>3.29***</td>
<td>2.90</td>
<td>1.61</td>
</tr>
<tr>
<td>Embeddedness</td>
<td>11.00</td>
<td>10.90</td>
<td>1.49</td>
</tr>
<tr>
<td>Community/Clan</td>
<td>10.46</td>
<td>10.00</td>
<td>1.58</td>
</tr>
</tbody>
</table>

**Table 3:** Performance effect of Neo-classical exchange, Embeddedness, and Community/Clan Modes

† $p \leq 0.1$, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$, in a two tailed paired t-test, n=20

<table>
<thead>
<tr>
<th>Performance Configuration</th>
<th>Average</th>
<th>Median</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community + 15% hybrid agents</td>
<td>13.27**</td>
<td>13.30</td>
<td>1.84</td>
</tr>
<tr>
<td>Community + 20% hybrid agents</td>
<td>15.39***</td>
<td>15.60</td>
<td>1.54</td>
</tr>
<tr>
<td>Community + 40% hybrid agents</td>
<td>27.55***</td>
<td>27.50</td>
<td>1.59</td>
</tr>
</tbody>
</table>

**Table 4:** Performance Effect of Community Hybrid Mode (prior tests included for comparison)

† $p \leq 0.1$, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$, in a two tailed paired t-test, n=20
Figure 1: Performance effect of Neo-classical exchange, Embeddedness, and Community/Clan Configurations
Figure 2: Performance Effect of Community Hybrid Mode
**Figure 3**: Effect of Performative Ties on Performance under different Problem Structures