APPENDIX 5: WHO BUYS WHOM: INFORMATION ENVIRONMENTS AND ORGANIZATIONAL BOUNDARY SPANNING THROUGH ACQUISITIONS\(^6\)

Who buys whom: information environments and organizational boundary spanning through acquisitions

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Abstract
Companies extend their boundaries through acquisitions to new industries, product lines, technologies, markets and geographic locations. Diversification research has focused predominantly on boundary extensions across industries. Using data on 167 intra-industry acquisitions in the pharmaceuticals industry between 1991 and 1996, we study boundary extension in an industry, integrating existing arguments to examine how proximity in intra-industry networks, geographic location, and technological domain influences the likelihood of acquisition. As expected, the proximity of two firms in these search contexts increases the likelihood that one will acquire the other, but the contexts are partial substitutes, proximity in one search context overcoming distance in other contexts. Thus, we find that while pharmaceutical companies are more likely to acquire technologically similar foreign companies, they are more likely to acquire technologically dissimilar alliance partners. Our results contribute to an improved understanding of who buys whom and in doing so, organizational boundary spanning through acquisitions.

Keywords • acquisition • alliance • boundary spanning • local search

In this article we study how firms use acquisitions to extend their boundaries. Boundary extension involves the extension of a firm's scope to new geographical areas, technological domains, or networks. Acquisitions have in principle the potential to create path-breaking change (Karim and Mitchell, 2000). In practice, however, many organizational and environmental path-dependencies tend to limit the emergence of radically new resource combinations, even through acquisitions (Nelson and Winter, 1982; Cyert and March, 1992). In addition to specialized resources (Capron et al., 1998; Williamson, 1999), information environments are likely to limit a firm's choices. Uncertainties of distant acquisition
targets increase the perceived risks of acquisitions (Dierickx and Koza, 1991; Shen and Reuer, 2005), leading firms to mainly acquire other firms they are either close to, similar to or otherwise familiar with.

Although the importance of information environments in investment decision-making is widely acknowledged (Cyert and March, 1992; March and Simon, 1993), their relative importance has not been studied in the context of acquisition patterns. Our basic argument in this article is that a firm’s information environments play a significant role in acquisition decision-making. Acquirers identify and evaluate acquisition targets on the basis of their existing knowledge and the information they gain through different information search contexts (Daft and Weick, 1984; Cyert and March, 1992; Baum et al., 2000; Rosenkopf and Almeida, 2003). As firms extend their boundaries, their information contexts also become more diverse, and they engage in increasingly diverse acquisitions. Supporting our reasoning, Mitchell and Shaver (2003) found that firms that differ in their integration capabilities have different propensities for performing acquisitions. Extending Amburgey and Miner’s (1992) ideas, they found that the greater the scope of medical firms’ product lines were, the more likely they were to become acquirers and purchase product lines similar to those they already had.

Our article complements the existing research on strategic, managerial and economic efficiency explanations for acquisitions. Just as motivational and economic factors have been shown to predict the firm-level tendency to acquire, a theory based on information environments will help us to go one step farther in capturing the likely acquisition patterns in an industry. We extend Mitchell and Shaver’s (2003) analysis of intra-industry acquisitions in two main ways. First, we apply a dyadic research setting that enables us to move from the analysis of target characteristics to the ways in which the match of different relational characteristics affect the choice of acquisition targets. We shift from an analysis of what kind of firms acquire or are acquired to an analysis of which factors make two specific firms more likely to merge; that is, who acquires whom. Second, complementing Mitchell and Shaver (2003), who focus their analysis on the product line scope, we examine information search contexts (Rosenkopf and Almeida, 2003) external to the firm.

Firms obtain information on acquisition targets from at least three external contexts: prior alliance partners, technological domain and country location. Building on information substitutability arguments (Haunschild and Beckman, 1998), we hypothesize that the effects of the three external contexts substitute for each other. To examine the effect of different search contexts, we modeled the effects of the evolving alliance and patent networks on who acquired whom in the pharmaceutical sector from 1991 to 1996. By creating a dyadic case-control research setting in which altogether 167 actual acquisition events in the pharmaceuticals industry are represented, we show that acquisition behavior is localized in all the three search contexts. Mutual substitutability of the search contexts implies that companies can selectively span their boundaries by
expanding to new areas through familiar information contexts, for example through alliance ties in technologically unfamiliar contexts or technological ties in a geographically unfamiliar location.

Explanations for acquisitions

Strategy and organizational researchers frequently treat acquisitions as the results of rational choice. Although some researchers have probed deeply into the actual decision-making processes (Pablo et al., 1996), the current literature continues to emphasize different rational, economizing motives for these decisions (Miller, 2004; Villalonga and McGahan, 2005). However, a range of alternative approaches exists, and some recent studies on psychological, social, and institutional influences on acquisition behavior complement the rational explanations.

Acquisition motives

A considerable literature has examined firm- and management-level motivations underlying acquisition decisions (Hayward and Hambrick, 1997). The most common motivations at the firm level include growth and related scale advantages (Walter and Barney, 1990), financial synergies (Slusky and Caves, 1991), improved bargaining power, the elimination of overlaps and the utilization of complementary assets (Trautwein, 1990). The failure of such firm-level value creation motives to explain acquisition behavior in numerous empirical studies (Slusky and Caves, 1991; Hayward and Hambrick, 1997) has led the acquisition literature to turn to potentially self-serving managerial motives as the driver of acquisitions. It has been argued, for example, that acquisitions may be the result of managerial empire-building or job-security concerns (Amit and Lev, 1981). Managements’ incentive compensation schemes have also been invoked (Sanders, 2001).

In contrast to these approaches, others have emphasized managerial bounded rationality (Cyert and March, 1992), suggesting that the acquisition process may create escalating commitment and managerial overconfidence (Roll, 1986; Haspeslagh and Jemison, 1991; Haunschild, 1994). Organizational power and political compromises (Cyert and March, 1992), as well as information search and processing limitations (Simon, 1957), may also serve to bound the rationality of the acquisition process.

Although such motivations and processes may influence the likelihood that a firm engages in acquisitions, they are unlikely to have systematic effects on the choice of acquisition targets, that is, on who acquires whom. Irrespective of their motives and decision-making processes, management can acquire only those companies of which it is aware. The literature on information asymmetry and market failures (Akerlof, 1970; Dierickx and Koza, 1991; Shen and Reuer,
underscores this point: acquirers’ lack of accurate information regarding the target inhibits transactions; markets for companies exist only when information asymmetry can be managed. To reduce uncertainty and identify potential synergies, an organization must be able to gather and process the needed information on potential target firms (Dierickx and Koza, 1991). Information environments, in contrast, are more likely to exert a systemic effect on the developmental paths that organizations take by engaging in acquisitions. The evolving literature on local search provides a framework for investigating the role of information environments in firms’ decisions to acquire, whereas acquisition decision-making provides an ideal context for applying the concept of local search.

Local search

The concept of local search emerged from a research program in the 1950s and 1960s whose goal was to describe decision-making more realistically than the hypertational models prevalent at the time were capable of (Cyert and March, 1992; March and Simon, 1993). Local search is the tendency of decision-makers to utilize prior models of the world up to a point where the models are no longer acceptable (Cyert and March, 1992: 126). When existing solutions fail, organizations start a search for new solutions in the neighborhood of the problem symptom and of the current solution alternative (Cyert and March, 1992: 170).

Evolutionary economists shifted the focus from decision-making and decision-makers to aggregate organizational behavior (Nelson and Winter, 1982), according to whom (p. 18), a firm’s search behavior is conditioned by its existing routines. Local search has also been used, for example, to conceptualize technological paradigms and trajectories (Dosi, 1988) and the geographic expansion of multiunit chains through acquisitions (Baum et al., 2000). Recent empirical studies have found that firms tend to ‘initiate new R&D projects that share technological content with the outcomes of their prior searches’ (Stuart and Podolny, 1996: 21), and demonstrated different performance implications from local and boundary-spanning searches (Rosenkopf and Nerkar, 2001; Katila, 2002).

Whereas early theory was concentrated on the characteristics of solutions (Cyert and March, 1992), recent studies have extended the concept to cover also probable sources of solutions (Rosenkopf and Nerkar, 2001; Rosenkopf and Almeida, 2003). Studies suggest that technological solutions tend to be adopted from geographically proximate sources (Jaffe et al., 1993), alliance partners (Mowery et al., 1996; Stuart and Podolny, 1996) and industry peers (Cohen and Levinthal, 1989).

Following Rosenkopf and Almeida (2003), we refer to the structures that moderate information and solution familiarity as search contexts. Rosenkopf and Almeida (2003) suggest that search contexts are structured by the accumulation of prior organizational choices (Giddens, 1984), since the perceived familiarity
of future strategies is contingent on experience. For us this definition is somewhat restrictive, given the scope of the current local search literature, in which macro-level structures such as technological paradigms (Dosi, 1988) and industrial boundaries (Rosenkopf and Nerkar, 2001; Katila, 2002) are examined. Extending the notion to correspond to the broader literature, we consider as search contexts all environmental structures that affect firms’ behavior by shaping their information environments. Our specific hypotheses focus on three such contexts: alliance networks, rational context and technological domain.

Hypotheses

Local search behavior, as it is understood in the contemporary literature, results from two conceptually distinct but empirically interrelated factors: the availability of information regarding possible solutions and the perceived familiarity of these solutions. Thus, one of the fundamental questions in local search research focuses on the identification and analysis of the structures and contexts moderating these factors. To understand the role of different search contexts in acquisition choice, we put forward two sets of hypotheses. In the first set, we examine the effect of proximity in three search contexts to the choice of acquisition targets in order to confirm our basic assumption regarding the local nature of acquisitions. Our second set of hypotheses focuses on our main arguments regarding the mutual substitutability and relative importance of the different search contexts as determinants of acquisition choice.

Alliance networks

Alliance networks represent an important search context that provides a variety of information and learning benefits to companies (Powell et al., 1996) and promotes trust among alliance participants (Gulati, 1995a). A firm’s network of collaborative relationships represents an environmental surface that provides both opportunities and constraints for the firm (Granovetter, 1973; Gulati, 1998). An alliance network structure can affect acquisition behavior in at least three ways. First, the information benefits of alliances suggest that an alliance network may be a useful resource in providing private information relating to acquisition opportunities (Haunschild, 1993; Gulati, 1999) and allowing managers to identify current and potential strategic interdependencies between companies (Gulati, 1995b; Dyer and Singh, 1998). Second, the fine-grained information gained through an alliance network can help companies evaluate potential acquisition targets and reduce perceived risk and uncertainty, thereby increasing the likelihood of acquisition (Pablo et al., 1996; Coff, 2002). Third, social interaction among network partners creates trust that can decrease the potential moral hazard related to acquisitions, thus enhancing the evaluation of prospects (Dierickx and Koza, 1991). Accordingly, alliances represent an
important information context for a firm. Building on these three arguments, we hypothesize that mutual alliance ties increase the likelihood of an acquisition between two firms.

**Hypothesis 1A** Mutual alliance ties increase the likelihood of an acquisition.

**Technological domain**

Technological domain represents an important search context in technology-intensive sectors, such as pharmaceuticals. Firms are likely to identify other firms possessing technological capabilities similar to their own by the virtue of their industry position (Podolny et al., 1996). Recognizing the potential synergies from acquisitions of relatively similar targets is easier than for dissimilar ones (Lane and Lubatkin, 1998). Firms are also better able to understand and evaluate the capabilities of a potential target because of their technological similarity. Technological similarity lowers the perceived uncertainty and increases the likelihood of an acquisition. Furthermore, the actual post-acquisition synergies may depend on the relatedness of the technological capabilities of the acquirer and the target. Research on interorganizational knowledge transfer suggests that the more similar new knowledge is to a firm's existing knowledge base, the better the firm is able to absorb it (Mowery et al., 1996; Lane and Lubatkin, 1998). Ahuja and Katila (2001) found, for example, that the relatedness of technological resources had a positive impact on the post-acquisition innovativeness of acquiring firms. Finally, earlier research has also found that technological similarity affects the propensity to form strategic alliances (Stuart, 1998), suggesting that acquisitions might follow the same logic.

Taken together, the technological relatedness of two firms can be expected to increase the likelihood of an acquisition occurring between the firms through first, an awareness of the existence of the other firm; second, an improved ability to understand and evaluate the technological capabilities of the other firm; and third, the potential for greater or less risky post-acquisition benefits accruing from the combination of related technology areas.

**Hypothesis 1B** Technological similarity increases the likelihood of an acquisition.

**Country co-location**

Both geographic context and country co-location represent search contexts that provide valuable information on potential acquisition targets. Geography has been shown to moderate the diffusion of technological inventions (Jaffe et al., 1993; Thompson and Fox-Kean, 2005), venture capital investments (Sorensen and Stuart, 2001) and the spatial expansion of multiunit chain organizations (Baum et al., 2000). Although Baum et al. base their main argument on experiential and
vicarious learning, their research suggests that geographic proximity moderates the availability of information and thus influences the direction of chain expansion.

Country co-location represents a socially determined search context that is independent of geographic co-location, although the two are highly correlated. The domestic context represents an important search context likely to affect both the identification and the evaluation of targets. Country borders often represent changes in language, newspapers, and TV channels, as well as accounting practices and governmental regulations. Moreover, cultural (Hofstede, 1980) as well as psychic (Johanson and Vahlne, 1977; O'Grady and Lane, 1996) distances between countries may be considerable. Although some countries and regions are more similar than others, there is a major difference between going abroad and operating in one's home country. Even in the European Union, acquisitions in seemingly related countries have thrown up considerable cultural hurdles (Vaara, 2002). Taken together, co-location in the same country implies a higher likelihood of acquisitions, given the greater availability of relevant information.

**HYPOTHESIS 1C** Companies are more likely to acquire targets residing in the same country.

**Information substitutability**

The availability of information increases the likelihood of a particular choice by making the company aware of an alternative and by reducing perceived uncertainties (Gyert and March, 1992; March and Simon, 1993). Search contexts contribute to the likelihood of acquisition by providing information enabling the identification and evaluation of target firms. The availability of multiple search contexts raises two questions: whether these contexts reinforce or substitute for one another (Rosenkopf and Almeida, 2003), and whether there is some priority order among them (Haunschild and Beckman, 1998).

Search contexts can provide redundant information, diminishing the value of different information sources when other mechanisms for learning or information flow are present (Burt, 1997; Haunschild and Beckman, 1998). If the information received from multiple search contexts is redundant, their joint impact should be less than the sum of their individual effects. Thus, the benefits of a given search context should increase when the information it affords is not available from other contexts. In line with this reasoning, research has found, for example, that alliance networks may be valuable in crossborder operations by helping to overcome cultural barriers (Barkema et al., 1996).

Consequently, if the information benefits of different search contexts are at least partially redundant, then we would expect that proximity in one search context would weaken the effects of other search contexts on acquisition behavior. The alternative would be that the different contexts provide complementary information for the firm. In that case, proximity in one search context would strengthen the effect of signals received from another search context.
The three search contexts we examine—prior alliance partners, technological domain and geographic location—are likely to differ in their influence on the identification and evaluation of potential acquisition targets. Alliances are the most direct among the information sources, and so provide the richest breadth and depth of information. Prior cooperation helps an acquirer evaluate a target firm’s different organizational characteristics, such as technological resources, organizational culture and managerial capabilities, thereby decreasing uncertainty. Technological similarity provides a narrower benefit for the identification and evaluation of firms. Similar technologies may help an acquirer evaluate the risks and synergies in the target’s research and development capabilities. Because technologically related firms are likely to serve the same markets (Podolny et al., 1996), technological knowledge may also be beneficial for estimating market-related synergies and risks. Finally, country co-location provides the most generic information on the broadest variety of issues, increasing the mutual awareness of firms in general. Domestic companies are more likely to resemble each other in their business practices than do companies operating in different institutional environments. Thus, we expect prior alliances to reduce the information benefits of both country co-location and technological similarity. Similarly, in the presence of technological similarity the information benefits of country co-location should matter less.

Technological similarity and country co-location

Technological similarity and country co-location are distinct, but complementary sources of information in the identification and evaluation of potential acquisition candidates. Country co-location provides acquirers with a generic knowledge of target firms and their operating context; technological similarity, in contrast, enables an evaluation of the internal capabilities. In this respect, technological similarity is likely to provide more specific information on potential target firms than country co-location.

When acquiring technologically familiar targets, even uncertainties common in the international context can be overcome. The more distant acquisition targets are likely to require a more systematic search for a match with the acquirer and its technology domain. In contrast, when a firm engages in acquisitions driven by identification of idiosyncratic opportunities, for example, as a result of the initiative of the target itself (Graebner and Eisenhardt, 2004), the domestic context will play a more significant role. Acquirers may obtain information about a broad variety of local acquisition possibilities. They also possess insider knowledge and local contact networks that help to evaluate a target irrespective of whether they possess knowledge of the target firm’s technology or not. Thus, we argue that when firms acquire targets in their proximate technology domain, country co-location is of less importance; when they acquire local firms technological domain plays a lesser role.

**Hypothesis 2A** Technological similarity and country co-location weaken each other’s effects.
Technological similarity and alliance partners
A mutual alliance enables an acquirer to evaluate a potential acquisition candidate in depth over time. Given the depth of information provided by alliance ties, even technological similarity is likely to provide little additional information from the perspective of acquisition decision-making. If a firm already knows its potential target firm’s technological capabilities in depth, however, then an alliance tie may not provide as much additional information than if the target were technologically unrelated. Indeed, when a company identifies a technologically unrelated firm as a potential acquisition target, it might first establish an alliance with it to learn more about its technologies (Kogut, 1991).

HYPOTHESIS 2B Technological similarity and alliance ties weaken each other’s effects.

Alliance partners and country co-location
Given the depth of information available through alliances, it is unlikely that country co-location would provide significant benefits in the pre-acquisition evaluation when the acquirer and potential target already are alliance partners. However, in the absence of alliances, country co-location enables the identification of potential targets the company would not otherwise be aware of. For example, the local business press tends to focus mostly on domestic firms. Firms operating in different countries also tend to have fewer common stakeholders and social contacts with each other. Thus, the role of alliances can be expected be more significant in identification of international than domestic acquisition targets.

Earlier research has also suggested that alliances can overcome cultural boundaries and information asymmetry in acquisitions (Barkema et al., 1996; Portini, 2004). When a firm engages in an international expansion strategy, its network of alliance ties can alleviate information asymmetries and other information-related uncertainties of operating in an unfamiliar market. In contrast, when a firm is considering an acquisition in its domestic market, alliance ties may be unnecessary for uncertainty reduction reasons, because the acquirer is familiar with the operating environment and can gather additional information about the target firm relatively easily. Thus, on the basis of these identification and information asymmetry arguments, we expect that the effects of mutual alliance ties and country co-location to substitute for each other.

HYPOTHESIS 2C Alliance ties and country co-location weaken each other’s effects.

Methodology and data
As in previous research on alliance formation, we test our hypotheses on a set of company dyads (Gulati, 1995b; Sorenson and Stuart, 2001). Our study differs, however, from previous studies of alliance formation (Gulati, 1995b; Gulati,
1995a; Gulati, 1999) in that acquisitions are treated as directed relations. To test our hypotheses, we formed a case-control setting in which we could compare the properties of dyads that did and did not conduct acquisitions. We initially selected company dyads in which one company had acquired another (representing positive events), in the years 1991–6. We then formed control (non-event) dyads by yearly pairing all the actual acquirers with the actual targets bought by other companies. To remove unrealistic acquisition, we excluded the company dyads in which the size of the target company was more than 75 percent of the acquirer's. The results are not dependent on this selection criterion. We thus created 4283 company dyads at risk of conducting an acquisition, of which 167 company–dyads actually did conduct an acquisition.

Such a low percentage of positive events creates biased results for normal probit or logit regression models. To counter this bias, we utilized the Rare Events Logistic Regression (relogit) procedure developed for STATA by Tomz et al. (2002). The same procedure has been used in other recent dyadic settings (Sorenson and Smrut, 2001; Hansen and Lövás, 2004). The relogit model is similar to a standard logit model, except in cases of rare events data, for which the standard logit model provides biased mean square errors on coefficients, probabilities and other quantities of interest (Tomz et al., 2002). Robust variance estimates in the relogit procedure are used to counter heteroscedasticity.

Moreover, the use of interaction terms in logistic regression models assumes equal residual variation across groups (Allison, 1999), a condition that is not always met. After initial analysis, our data appeared likely to produce potentially unreliable results for interactions. We remedied such threats by confirming our regression models with Allison’s (1999) method to account for unequal residual variance (see also Hoetker, 2003) and obtained similar significant results.

Empirical data

Our sample covers data on longitudinal alliances, patents and acquisitions in the global pharmaceuticals industry. We used Compustat’s definition of the pharmaceuticals industry and included companies with the following primary Standard Industry Codes (SIC): 2833 (Medical chemicals), 2834 (Pharmaceutical preparations), 2835 (In vitro, in vivo diagnostics), and 2836 (Biological products, excluding diagnostics). We collected data on alliances by using a moving four-year window preceding the year in which acquisitions were conducted. We also collected information on the patents granted to the acquirers or targets in the three years preceding the acquisition. Alliance and acquisition data were extracted from Thomson’s SDC Platinum database.

To capture the technological similarity of acquirers and of firms acquired, we collected data on all patents that the firms had filed in the US patent and trademark office. Some of the firms were wholly owned subsidiaries. In many corporations, subsidiaries tend to file patents in the name of the parent corporation; therefore, when the acquiring or acquired company was an independent
subsidary of a larger corporation and the subsidiary had filed no patents, we used the patents of the parent corporation instead. Similar results were obtained when we used corporate-level patent portfolios for independent subsidiaries. The patent data were retrieved from the NBER (National Bureau of Economic Research) patent database (Hall et al., 2001).

**Variables**

Our dependent variable is the occurrence of an acquisition between two firms in the given year. *Acquisition* is a binary variable, with value 1 for dyads in which acquisition took place, and 0 for control dyads (no acquisitions). If acquisition was announced in one year but carried out in a different year, we attributed the event to the year of announcement.

The binary variable *Alliance* indicates whether companies in a dyad had formed a direct mutual alliance in the previous five years. Direct alliance ties represent a significant source of information and trust between companies. The variable was coded 1 if companies had formed a mutual alliance during the four years preceding the acquisition, 0 if they had not. Binary ties have been widely applied in the literature, although some authors (Koka and Prescott, 2002) have also utilized repeat and multiplex ties between firms to estimate the depth of collaboration.

*Technological similarity* is a measure of the overlap in companies’ technological domains (Podolny and Stuart, 1995). We determined similarity as the number of patents cited by both companies divided by the number of patents filed by the company with fewer patents. Common citations imply that the companies are building on the same prior innovations (for further discussion, see Podolny and Stuart, 1995; Stuart and Podolny, 1996). The mathematical formula is adapted from Stuart and Podolny (1996). In the formula, the number of prior patents cited by both companies during the preceding three years is divided by the number of total patents cited by the company with the fewer patent citations. The lower boundary of the measure is 0, which denotes cases with no common citations to prior patents. The upper boundary is 1, indicating that the technological base of the company with fewer patents is a subset of the technological base of the company with the larger number of patents.

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\text{CitationOverlap}_{ab} = \frac{\text{CommonCited Patents}_{ab}}{\text{Min}(\text{Patents}_a, \text{Patents}_b)}
\]

Our formula differs from those used in earlier research in that we use the minimum of citation counts instead of the total number of cited patents. This measure ensures a representative overlap even when companies have substantially different sizes. It provides high similarity scores when the knowledge base of a smaller company resembles a subset of a larger company’s knowledge base. We consider patents-based measures to be justified, although they have been subject to criticism (Destechers, 1998). Patents have commonly been used as
proxies for technological knowledge bases (Mowery et al., 1996; Stuart and Podolny, 1996; Ahuja and Katila, 2001; Rosenkopf and Nerkar, 2001), and their relationship to knowledge flows has been empirically validated (Jaffe et al., 1993). Furthermore, patent protection in the pharmaceuticals industry is regarded as one of the strongest, in comparison with protections in other industries (Levin et al., 1987).^3

**Control variables**

Firms were included in our sample if they had participated in one or more acquisitions during the period studied. We did not inspect whether the firms engaged in acquisitions or whether they were acquired, and thus we do not analyze firm-specific variables affecting the acquisition likelihood. Because the control dyads and actual dyads are formed from the same sets of firms, any firm-specific values, such as revenue or employee counts, appear approximately as often in both positive and negative outcomes yearly. Thus, there is no need to control firm-specific differences.

To control for the higher propensity of acquisitions between companies in the same subsector, we created the control variable, *Same subindustry*, which received the value 1 if the firms shared the same primary industry class. We used year dummies to account for the fact that the ratio of control dyads to acquisitions varies depending on the yearly volume of acquisitions. Because the acquirers are commonly much larger than the targets they have acquired, we constructed a measure, *Relative size*, to capture the relative size of the target as a percentage of the acquirer’s size. Some of the firms included in the sample were privately held and their sales data commonly were missing. Consequently, we based this measure on the number of patents filed during the three years before the acquisition. Similarly, since private and public target firms may differ according to information asymmetry characteristics (Shen and Reuer, 2005), we included a dummy variable, *Private target*, to control for potential differences.

Finally, there were large differences in the number of potential targets in each country. Thus, firms operating in countries with a high number of potential targets are likely to be more inclined to purchase firms domestically. But if the likelihood of foreign purchase were be equal in all countries, the higher number of control dyads for domestic acquisitions in large countries could result in an opposite bias on purely statistical grounds. To minimize the total effect of firms included from each country, we controlled for the total number of actual targets acquired in acquirers’ country of origin during the study period.

**Results**

Table 1 presents the correlations and descriptive statistics. As expected, the control variable for country size correlates strongly with the number of potential
domestic acquisition targets. Otherwise, the correlations among the independent variables are relatively low.

Table 2 gives the regression results for the likelihood of acquisition events among the company dyads. Model 1 shows the effects of independent and control variables on the occurrence of an acquisition without interaction terms. Models 2–4 show the individual effects of search contexts, and model 5 depicts the effects together. Models 6 and 7 depict individual effects of interactions for technological similarity. Finally, model 8 presents the complete model, including all independent effects and interactions. We interpret the results based on the full model.

H1A, H1B and H1C predict that two companies’ mutual alliance ties, similarity of technologies and co-location in the same country would increase the likelihood of acquisition between them. Although we find consistent and strong support for H1A (mutual alliances) and H1C (country co-location), the support for H1B is only partial. Technological similarity does not appear to increase acquisition likelihood when alliances and co-location in the same country are taken into account. Model 8 reveals a more complex relationship for the effects of technological similarity: it is a significant predictor of acquisitions if companies have no mutual alliance and/or reside in different countries.

Table 2 provides support for our hypotheses that country co-location and technological similarity (H2A) and alliances and technological similarity (H2B) are substitutes for each other. However, we fail to find support for the interaction of country co-location and alliances (H2C). Table 3 provides further descriptive statistics to reinforce our intuition on the roles of the different search contexts in acquisition decision-making.

The top section of the table shows that, although technological similarity appears to be more prevalent in acquisitions in general, it seems to be particularly important in international acquisitions. This supports our intuition that when firms are engaging in acquisitions locally, they are acquiring with a more

<table>
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<tr>
<th>Variables</th>
<th>Mean</th>
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<td>1. Acquisition</td>
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<td>2. Alliance</td>
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<td>3. Technological similarity</td>
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<td>4. Domestic</td>
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<td>5. Same subindustry</td>
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<td>6. Private target</td>
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<td>7. Relative size of target</td>
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<td>8. Country size</td>
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Notes
N=4283. All correlations larger than .03 or smaller than -.03 are statistically significant at p<.05 (in bold).
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<th>(1) Base model</th>
<th>(2) Alliance</th>
<th>(3) Overlap</th>
<th>(4) Domestic</th>
<th>(5) Main effects</th>
<th>(6) Alliance overlap</th>
<th>(7) Domestic overlap</th>
<th>(8) Full model</th>
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<td><strong>Hypothesis 1</strong></td>
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**Notes**

N=4283; standard errors are in parentheses; one-tailed tests were used for independent variables.

*** p<.001,

** p<.01,

* p<.05,

+p<.10.
Table 3  Descriptive statistics for acquisition and non-acquisition dyads

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<th>t-test</th>
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<th>t-test</th>
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<td>t-test</td>
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Notes
- T-test statistics are for non-zero difference in means.
- **p < .01.
- ***p < .001.

broad technological scope than when they are carrying out international acquisitions (H2A). This effect does not, however, appear to be driven by the lack of technologically-related firms locally.

The middle section of the table shows that alliances are in general the most common among firms with mutually overlapping technology areas. Yet, the contribution of alliances to the likelihood of acquisition appears to be statistically more important when there are no technological overlaps between the alliance partners, as one would expect based on the substitution effects of technological similarity and alliance ties (H2B).

Finally, the section at the bottom of Table 3 shows that although mutual alliance ties contribute to acquisition likelihood, they do not differentiate between international and domestic acquisitions. Thus, it seems that country co-location cannot substitute for the information gained through alliance relationships and consequently these two contexts do not appear to substitute for each other, thereby failing to provide support for our last hypothesis (Hypothesis 2c).4

To examine the reliability of our findings, we performed several robustness tests. We used Allison’s (1999) methodology to test for unequal variance in our models. Although the indicator of unequal variance across domestic and international dyads had almost significant p-values, our robustness checks using Allison’s logit provided significant results similar to those of our relogit models.
Also, as advocated by Hoerker (2003), we complemented this analysis with various comparisons of means tests (with relogit models) and obtained similar statistically significant results as those reported here.

The exclusion of firms that did not make acquisitions limits the scope of our analysis and the questions we can address. Whether a company was acquired or became an acquirer in the first place was ignored (Gulati, 1995b). This limitation circumvents potential problems with unobserved endogenous selection processes acting to distinguish acquirers from non-acquirers and targets from non-targets. We investigated all pharmaceutical firms in Compustat to infer whether such endogenous choices would invalidate the generalizability of our results. In line with earlier findings (Hoang, 1997), we found that firms with more alliances were more likely to become both acquirers and targets. Similarly, we found that the average technological similarity increased the likelihood of becoming acquired. Thus, we can infer that our effects for mutual alliances and technological similarity would be stronger if we included a broader set of firms. Unfortunately, we were unable to compare interaction effects with country co-location on such a broader dataset because Compustat data are limited to public US firms only.

Conclusion

We examined the effects of three external search contexts – prior alliance partners, technological domain and country location – on intra-industry acquisition behavior. Our main interest was the ways in which these different contexts interact to influence acquisition behaviors. In support of our hypotheses we found that, in each of these search contexts, proximity was associated with a higher likelihood of acquisitions. Multiple search contexts were not entirely independent, however, with some effectively substituting for the effects of others. Turning this result the other way round, our research suggests that a firm’s presence in one search context may enable it to mitigate the information uncertainties inherent in other, more distant search contexts (Sorenson and Stuart, 2001; Rosenkopf and Almeida, 2003). Thus, a firm could, for example, engage in local search in a regional context and become diversified technologically.

Although acquisitions may be used to break away from existing evolutionary trajectories and create radical change (Karim and Mitchell, 2000), the local search inherent in acquisition behavior may also limit the emergence of radically new resource combinations (Baum et al., 2000). Previous studies on formation of alliance ties show results similar to those obtained by us. Technological and social relatedness tends to increase the likelihood of alliance formation between two firms (Gulati, 1995b; Stuart, 1998), which seems to suggest that the same search contexts affect both acquisitions and alliances. Our results underline the possibility of avoiding individual local search constraints through other contexts.
where they are local. Studies focusing only on behavioral search in individual contexts can easily overlook the possibility that companies may, in fact, have the means to systematically overcome their limitations.

On the basis of our analysis of the applicability of the local search explanation for acquisitions in the pharmaceuticals industry, we believe that the three search contexts specified in this study can be applied to explain acquisition behavior in a broad range of technologically-intensive industries. The search context framework may also be applied outside technology-intensive industries when appropriate industry-specific search contexts are identified. For example, in manufacturing industries, shared customers and suppliers or even participation in industry associations can foster information exchange and increase the perceived familiarity between companies. Building on a similar kind of reasoning as ours, these relational effects should also lead to a greater likelihood of acquisitions.

This article contributes to several different streams of research. First, we demonstrate the applicability of the basic premises of behavioral search to the study of acquisition patterns and, as a result, contribute to an improved understanding of macro-level acquisition patterns in one industry. Second, we contribute to the understanding of which behaviors affect firms’ abilities to span boundaries by demonstrating that different local search contexts interact with each other negatively. Third, we contribute to the study of acquisitions by demonstrating how a multidimensional dyadic setting can be used to examine hypotheses regarding the acquisition behavior of firms. Recognizing the importance of the question, ‘Who buys what?,’ we stretch it further to ‘Who buys whom?’. This question has not been addressed in acquisition research already because of the methodological limitations of non-dyadic settings. Finally, our study provides some initial insight into the dynamics through which acquisitions affect industry evolution (Stuart and Sorensen, 2003). For example, assuming that findings are generalizable across industries, those industries having a higher number of alliances should exhibit more radical acquisitions and create more new unique resource combinations.

We propose several potential directions for future research. A dyadic research setting similar to the one used in this study makes it possible to examine hypotheses on acquisition motivation with an even more comprehensive research setting. A holistic approach to the modeling of acquisition likelihood would incorporate factors that have an effect on whether companies become acquired or acquire others, and how a specific target is chosen. Research could also apply the ideas of local search and selective boundary spanning to diversifying acquisitions. Existing empirical evidence on inter-industry acquisitions can be interpreted as a tendency to diversify into familiar industries (Pfeffer, 1972; Finkelstein, 1997). However, further research will be needed to distinguish among alternative explanations.

Since both acquirers and targets conduct their own individual search processes simultaneously, it might be also that target firms’ behaviors play a role
(Graebner and Eisenhardt, 2004). In addition to proposing the acquisition, companies seeking to become acquired could, for example, have a tendency to form alliances in order to be noticed by potential acquirers (Stuart et al., 1999). Following this line of reasoning, post-acquisition performance might in fact display systematic differences depending on whether the acquirer or the target initially searched for the deal. Comparing acquisitions motivated by perceived synergistic opportunities with those used to address emerging issues should be useful. Future studies could also examine how different local search contexts and acquisition motives interact.

Firms are embedded in a number of search contexts that can subtly but systematically affect even their most deliberate strategic choices, such as the decision to acquire. Although acquisitions and other strategic initiatives can create organizational change, these strategic decisions themselves are subject to various forms of inertia or momentum, some internal (Amburgey and Miner, 1992) and some external. In particular, our research on acquisitions highlights the importance of multiple external local search contexts that influence organizational choices. An integrated understanding of internal and external sources of strategic momentum and path-dependence will further illuminate the evolutionary paths of organizations. This is an interesting future challenge for organization theorists.

Acknowledgements

We acknowledge the financial support of the Research Programme for Advanced Technology Policy (ProACT) of the Finnish Ministry of Trade and Industry and the National Technology Agency, Tekes, Finland. We are indebted to Joel A. C. Baum and the three anonymous reviewers of Strategic Organization for their review comments. We are also grateful to Allen C. Amazon, Riitta Karila and Markku Maula for their suggestions on earlier versions of this article.

Notes

1 We are grateful to an anonymous reviewer for pointing out this connection.
2 It has been suggested that alliances may be formed with potential targets to ‘create options to acquire’ (Kogut, 1991). Such reverse causality may also be present in some acquisitions included in our sample. However, the cause of association is the same: information.
3 The NBER database used in this study covers only patents filed in the US. As such, this could create bias in a study of international companies. However, the US is the single most important market in pharmaceuticals, and firms outside the US commonly patent their innovations there as well as in their home countries. It is possible that our use of US patent citations may result in US firms having a larger number of patents representing, on average, less important innovations. This is unlikely to create bias, however, because our measure is based on the relative similarity of patents, independent of their absolute number.
4 Our reasoning of mutual substitutability suggests that the triple interaction between country co-location, alliances and technological similarity should be negative. We tested this relationship and found a significant negative interaction. However, the number of
technologically similar crossborder alliance partners in our sample is too small to treat these results as robust.

References


Pfeffer, J. (1972) 'Merger as a Response to Organizational Interdependence', Administrative Science Quarterly 17: 382–94.


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