Myopia in Partnership Formations between Established and Startup Firms:
The Role of R&D Successes and Failures

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Abstract: Research in organization theory and strategy has documented the tendency of organizations to be myopic, that is, to favor predictable routines and familiar knowledge paths in their technological searches. At the same time, researchers have documented that established firms increasingly cross organizational boundaries and partner with smaller startup firms to gain access to emerging and novel technological solutions. In this paper, we demonstrate ongoing myopia despite firms’ increasing orientation toward solutions outside of the organization. Further, we reveal that prior failures and successes in solving R&D problems may affect myopia in partnership formations in different ways. This is because successes and failures differ in the extent to which they challenge firms’ conventional ways of solving problems and in the degree to which they allow firms to balance long- and short-term organizational demands. We test our predictions with a sample of large, established bio-pharmaceutical firms exposed to partnering opportunities from nascent biotechnology startups and find broad support for myopia in partnership formations. We further find that myopia in partnership formation can be both attenuated and magnified by prior failures and successes in R&D. The study argues for the value of integrating perspectives on myopia with studies examining failures and successes in the context of technological search.

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Introduction
Research in organization theory and strategy has documented the tendency of organizations to be myopic, that is, to favor predictable routines and familiar knowledge paths in technological search (Benner & Tushman, 2002; Levinthal & March, 1993; Levitt & March, 1988; Sørensen & Stuart, 2000). At the same time, researchers have also observed that established firms increasingly cross organizational boundaries and partner with smaller startup firms to gain access to emerging and novel technological solutions (e.g., Anand, Oriani, & Vassolo, 2010; Laursen & Salter, 2006). In this paper, we demonstrate ongoing myopia despite this increasing orientation toward solutions outside of the organization, and we also reveal specific conditions under which established firms pursue more novel and/or nascent partnering opportunities.

Myopic behavior is characterized by a firm’s preferences for solutions “local” to prior experiences and near term payoffs, so that even when firms choose to span organizational boundaries, they may overlook partnering opportunities with novel elements of knowledge (spatial myopia) and opportunities temporally distant from monetary payoffs\(^1\) (temporal myopia) (Levinthal & March, 1993; Miller, 2002). While prior studies on partnership formations have acknowledged a general tendency of established firms to search locally (e.g., Monteiro, 2015; Rothenberg & Boeker, 2008; Stuart, 1998), they have rarely recognized that myopia may take multiple forms and, in particular, have not explicitly considered the temporal dimension of expected payoffs in partnership formations.

In addition, we know little about the types of organizational experiences that ultimately shape myopic behavior in partnering. Recently, researchers have emphasized that failures and successes profoundly influence organizational outcomes (Audia, Locke, & Smith, 2000; Baum & Dahlin, 2007; Greve, 2011; Haunschild & Sullivan, 2002; Kim, Kim, & Miner, 2009; Madsen & Desai, 2010).

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\(^1\) Novelty itself can have many dimensions (Rosenkopf & McGrath, 2011). In this paper, it refers to the technological means by which firms attempt to solve organizational problems. A technological solution with greater novelty uses more previously unutilized elements of knowledge to solve a particular problem. The distance from monetary payoffs relates to the payoff horizon, which is the time until the expected returns of an investment will exceed its costs (Souder & Shaver, 2010).
Remaining unclear, however, is how failures and successes shape myopic organizational behavior in the formation of partnerships of established firms with startup firms.

In this paper, we model the formation of partnerships\(^2\) as the result of a search process for emerging partnering opportunities. We develop a theoretical framework that explicitly considers established firms’ spatial and temporal myopia as well as failures and successes in solving R&D problems. We use this framework to clarify how established firms search for and select from among emerging partnering opportunities generated by startups.\(^3\) We first investigate the myopia perspective to understand whether established firms demonstrate local search tendencies in partnering. We then examine how prior successes and failures in solving R&D problems may influence whether those firms pursue partnering opportunities that offer novel elements of knowledge and opportunities that promise payoffs only in the distant future.

We argue that prior failures and successes differ in the extent to which they (a) challenge established firms’ conventional ways of solving problems and (b) allow firms to balance long- and short-term organizational demands. Accordingly, we suggest that prior failures and successes affect spatial and temporal myopia very differently and may both attenuate and magnify myopic behavior in partnership formations.

The context for the study is the global pharmaceutical industry between 1997 and 2006. We examine 852 unique emerging biotechnology startup (henceforth, startups) partnering opportunities and the partnership formations that ultimately resulted. We find that established firms tend to search locally in partnering, as they overlook distant “places” (novel technological solutions) and distant “times” (technological solutions with distant payoff horizons) (Levinthal & March, 1993:95). However, taking into account the firms’ prior successes and prior failures reveals important contingencies. Namely, prior failures increase firms’ likelihood to pursue novel solutions, and prior successes make firms more likely

\(^2\) We consider partnerships to comprise all voluntarily initiated agreements between firms involving exchange, sharing, or co-development of products, technologies, or services (e.g., Gulati, 1998).

\(^3\) In this paper, established firms in an industry have an existing product portfolio on the market. Conversely, startups attempt to enter the industry by offering alternative products and services.
to tap into solutions with a more distant monetary payoff. We also find partial evidence that prior failures may magnify temporal myopia, as firms are more likely pursue partnerships with technological solutions that promise more immediate payoffs. These results account for unobserved differences across firms over time, and are robust to a number of alternative econometric specifications and operationalization of key variables.

By systematically considering forces of myopia as well as experiences of successes and failures, this study extends the understanding of how firms search for and make choices in partnering (e.g., Rothaermel & Boeker, 2008; Stuart, 1998). At the same time, we explicate the role of prior failures and successes to clarify when firms are more likely to pursue “non-local” partnering opportunities (Cyert & March, 1963; Greve, 2011) and whether prior failures matter more than prior successes in organizational search and learning (Baum & Dahlin, 2007; Kim et al., 2009; Madsen & Desai, 2010; Sitkin & Pablo, 1992). We further elaborate on these implications in the discussion section.

**Theory and Hypotheses**

**Spatial and Temporal Myopia in Partnership Formations**

Startups—young firms unencumbered by aging and embedded competencies—have taken an important role in the generation of new ideas and are believed to substantially push technological change forward (Foster, 1986). Established firms increasingly partner with startups to access new and potentially disruptive technological solutions (Hagedoorn, 1993, 2002; Rothaermel, 2001).

A helpful approach is to model established firms as interpretive systems that search for and make decisions about emerging technological opportunities generated by startups (Lane, Koka, & Pathak, 2006; Todorova & Durisin, 2007). Searching for and making decisions about emerging technological opportunities may be subject to myopia as firms and decision makers alike are boundedly rational, which limits the range of technological alternatives considered feasible (March & Simon, 1958). Levinthal and March (1993:101,102) observe that myopia can be both spatial and temporal as firms restrict themselves to the neighborhood of prior actions and tend to prefer near (or short-term) over distant (or long-term)
payoff horizons (Miller, 2002; Souder & Shaver, 2010). We apply these ideas to the formation of partnerships and examine how both spatial and temporal myopia are reflected by firms’ tendencies to (a) overlook distant places—partnering opportunities that contain novel elements of knowledge—and (b) overlook distant times—partnering opportunities that are nascent and, hence, have expected payoffs only in the distant future.

**Spatial myopia and partnership formations:** Over time, organizations gather distinct competencies in problem solving that shape their fundamental cause-and-effect representations of how problems and solutions are interrelated (Itami & Roehl, 1991; Lei, Hitt, & Bettis, 1996). Emerging partnering opportunities, which attempt to solve problems in ways previously not considered may not be recognized as feasible since they do not conform to conventional ways of problem solving (Levitt & March, 1988).

Following the idea of bounded rationality, researchers have argued that when searching for new knowledge and technologies, firms limit their search to alternatives that are close to prior problem solving attempts (Nelson & Winter, 1982; Rosenkopf & Nerkar, 2001). This approach suggests that prior problem-solving attempts shape an established firm’s subsequent technological search preferences in partnering (Dijksterhuis, Van den Bosch, & Volberda, 1999). An important reason is that firms use their own knowledge as a reference point, which limits the subset of alternatives in the external environment by ruling out technological solutions that depart from the agreed-on subset of possible alternatives (Jansen, Van Den Bosch, & Volberda, 2005; Monteiro, 2011; Monteiro, 2015).

Another cause stems from decision makers’ interest in retaining control and power (Cyert & March, 1963; David, Hitt, & Gimeno, 2001), which may lead firms to not consider partnering opportunities that do not reinforce previous internal R&D attempts (Jansen et al., 2005; Todorova & Durisin, 2007). In the extreme case, organizations may actively resist highly novel partnering opportunities, especially those perceived as rendering internal competencies obsolete or as violating current industry conventions for solving specific problems (Hill & Rothaermel, 2003). Supporting this
idea, Rothaermel and Boeker (2008) found some evidence that technological similarities drive partnership formation between established and startup firms.

We follow these arguments and expect spatial myopia to be salient in the formation of partnerships, which suggests that established firms tend to overlook partnering opportunities with novel elements of knowledge.

**HYPOTHESIS 1 (H1) (spatial myopia): The likelihood of an established firm forming a partnership with a startup decreases with the novelty of the startup’s technological solutions to the established firm.**

**Temporal myopia and partnership formations:** Researchers suggest that firms generally prefer short-term over future gains (Levinthal & March, 1993; March, 1991). In partnership formation, such myopic behavior is apparent when established firms prefer opportunities with near-term payoff horizons while overlooking opportunities that are expected to create value only in the distant future.

Organizational learning has demonstrated that aging and larger firms gradually shift their emphasis from future gains (exploration) to short-term gains (exploitation) (March, 1991; Sørensen & Stuart, 2000). Prior research also suggests that while firms may prefer near- or short-term gains for economic reasons, managers must simultaneously balance long- and short-term demands (Laverty, 1996; Marginson & McAulay, 2008). Patterns of temporal myopia are also prevalent in partnership formation as, for example, within a given industry partnerships with more immediate payoffs become more prevalent over time while the relative importance of partnerships with longer term payoffs declines (Koza & Lewin, 1998). An important explanation is that, over time, established firms invest substantially in complementary assets and build routines to develop and commercialize new products (Nelson & Winter, 1982; Rothaermel & Boeker, 2008). When evaluating partnering alternatives, firms may, hence, assess partnering alternatives against existing commercialization routines. As a result, established firms may develop preferences for opportunities that can be readily applied, creating value for the firm in the near term.

Another explanation draws on the idea of bounded rationality, which leads managers and decision makers to approach partnership alternatives in a sequential way (March & Simon, 1958). Immediate
payoffs strengthen the decision maker’s power within the firm and bring benefits from faster payoffs, including increased reputation and career advancement, which in the extreme case may lead the firm to overvalue initiatives with near-term payoffs (David et al., 2001; Laverty, 1996; Marginson & McAulay, 2008; Tyler & Steensma, 1995). Given firms’ and decision makers’ limited attention, firms observing partnering alternatives are likely to make compensatory tradeoffs and pursue partnerships with a shorter payoff horizon, overlooking partnerships with expected payoffs in the distant future (Miller, 2002).

While prior research has not explicitly tested this relationship, evidence suggests that established firms pay more attention to solutions that provide immediate payoffs and have proven track records (Monteiro, 2011). We follow this reasoning and suggest that firms may overlook partnering opportunities with a more distant payoff horizon.

**HYPOTHESIS 2 (H2) (temporal myopia): The likelihood of an established firm forming a partnership with a startup decreases with the distance of the startup’s technological solutions from expected payoffs.**

Firms that overlook novel technological solutions may be confined to pursuing technological solutions similar to their own internal problem-solving attempts and miss solutions that can render the firm’s existing competences obsolete (Gavetti, 2012; Tushman & Anderson, 1986). Similarly, recognizing technological opportunities at an early stage allows firms to have first mover advantages and avoid paying substantial premiums at a later stage of development owing to the increased bargaining power of startups that came up with the technology (Adegbesan & Higgins, 2011). It is therefore important to understand when firms go beyond local search and pursue partnering opportunities with novel elements of knowledge and opportunities that are distant from immediate payoffs. While myopia originates from a firm’s prior experiences, not all experiences are created equal. We next explore how extreme experiences with successes and failures in R&D may shape established firms’ myopic behavior in forming partnerships.

**Failures, Successes, and Firm Myopia**
Motivated by behavioral theory, researchers have started to differentiate failures and successes as important stimuli affecting organizational search and learning (e.g., Cyert & March, 1963; Haunschild & Sullivan, 2002; Kim et al., 2009; Madsen & Desai, 2010; Zellmer-Bruhn, 2003). In a similar vein, prior failures and successes may influence how firms search for, and make decisions about, emerging partnering opportunities.

We consider failures and successes as different types of experiences, which are rare but highly salient in organizations (Haunschild & Sullivan, 2002; Madsen & Desai, 2010). Firms make substantial financial and organizational commitments and develop expectations about the likelihood that R&D initiatives will succeed. Failures refer to the termination of R&D initiatives to which a firm committed substantial resources but which have unexpectedly fallen short of the firm’s goals (Cannon & Edmondson, 2001; Shepherd, Patzelt, & Wolfe, 2011). Successes refer to the completion of inherently risky R&D projects, as exemplified by the successful introduction of a marketable new product (Levinthal & March, 1981; March, Sproull, & Tamuz, 1991). We next explore how prior successes and failures shape spatial and temporal myopia in the partnering behavior of established firms.

Prior failures and spatial myopia: Experiencing failures may affect both the range of feasible alternatives considered as well as the support in decision making for solutions with novel elements of knowledge (Cyert & March, 1963). First, failures affect organizational search by revealing that the existing logic as to how problems and solutions are interrelated may be inadequate (Jansen et al., 2005; Lampel, Shamsie, & Shapira, 2009; Madsen & Desai, 2010). Prior failures may therefore motivate established firms to both re-evaluate and challenge the existing set of solutions considered in their search and broaden the range of alternative solutions they will consider as feasible in partnering (Cyert & March, 1963; Madsen & Desai, 2010). This approach increases the probability that when searching for new startup partners, firms will more likely search for technologically distant startup opportunities, thus attenuating spatial myopia. In a related vein, research has documented that prior failures may lead firms to
seek partners with which they have had no previous contact (Baum, Rowley, Shipilov, & Chuang, 2005) and that interruptions on the project team level may trigger new organizational routines (Zellmer-Bruhn, 2003).

Second, failures also alter the power structure and status quo within firms (Chuang & Baum, 2003:37), which may affect decision making about emerging partnering opportunities. Prior research has shown that failures weaken the power of organizational decision makers and increase pressure from external stakeholders (Girotra, Terwiesch, & Ulrich, 2007; Sitkin & Pablo, 1992). Accordingly, failure compels organizational decision makers to change direction in the types of solutions used to solve problems, lessening the likelihood that external initiatives are mere extensions of prior R&D activities. Therefore, we suggest:

**HYPOTHESIS 3a (H3a).** An established firm’s prior failures in solving R&D problems attenuate spatial myopia in partnership formations with startup firms.

**Prior successes and spatial myopia:** Prior successes in R&D may also serve as an important stimulus that reinforces existing problem-solving paths, implying that firms experiencing success may be particularly susceptible to overlooking partnering opportunities with novel elements of knowledge.

Successes in R&D suggest to firms that their knowledge is adequate, increasing their confidence in existing routines and ways of solving problems. As a result, organizations that have experienced success may increase specialization in technological search but decrease experimentation with alternative ways of solving problems (Levinthal & March, 1981; Sitkin & Pablo, 1992). This response is supported by prior research, which suggests that successes may lead to oversimplification as firms tend to seek local information sources while limiting the variety of new information processed (Hayward, Rindova, & Pollock, 2004; Lant & Montgomery, 1987; Sitkin & Pablo, 1992). Prior successes hence may “trap” firms into specialized knowledge paths (Audia et al., 2000; Leonard-Barton, 1992) and amplify their tendency to overlook partnering opportunities with novel elements of knowledge (i.e., spatial myopia).

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4 The authors use below-aspiration financial performance, not actual failures.
Prior successes also strengthen the power of organizational decision makers and increase their discretion to allocate resources without pressure, challenging prior attempts at problem solving (Levinthal & March, 1993). This effect increases the likelihood that when making decisions about emerging partnering opportunities, organizational coalitions use partnerships as an extension of their prior R&D attempts. At the same time, partnering opportunities with novel elements of knowledge and the potential to challenge existing ways of solving problems may be considered inadequate solutions, since they do not reinforce the firm’s current successful problem-solving logic.

Combined, our arguments imply that when exposed to a range of possible partnering opportunities, established firms with a history of prior successes adhere to existing problem-solving routines, exacerbating the tendency to overlook partnering opportunities with novel elements of knowledge.

**HYPOTHESIS 3b (H3b):** An established firm’s prior successes in solving R&D problems magnify spatial myopia in partnership formations with startup firms.

Figures 1 and 2 show the proposed effects of H3a and H3b. Our baseline case (H1/H2) is a simple local search graph demonstrated in Figure 1, which indicates both spatial and temporal myopia. We expect that prior failures will attenuate a firm’s tendency to overlook technological solutions with novel elements of knowledge, as reflected by a flattening of the local search curve in Figure 2. Conversely, we expect prior successes to magnify spatial myopia, which suggests a steepening of the local search curve.

---Insert Figures 1 and 2 about here---

The role of failures and success in affecting spatial myopia primarily stems from challenging the organizational representations of how problems and solutions are interrelated. Conversely, temporal myopia is related to how firms may balance short- and long-term demands. We hence expect prior failures and successes to affect temporal myopia very differently.

**Prior failures and temporal myopia:** We have identified that prior failures induce established firms to change direction by pursuing partnering opportunities with novel elements of knowledge. At the
same time, however, several indications suggest that prior failures may intensify myopic tendencies toward solutions with nearer or short-term payoffs.

First, failures may create a sense of urgency when a firm is evaluating emerging partnering opportunities (Madsen & Desai, 2010). This reaction resonates with the idea that firms experiencing crises, accidents, and failures turn to “problemistic” problem solving and efficiency concerns and limit the range of feasible alternatives to specific alternatives (Cyert & March, 1963:170; Staw, Sandelands, & Dutton, 1981). Given the long time lags in innovation, the more firms have experienced prior failures, the more they may consider partnering opportunities with very distant expected payoffs to be infeasible alternatives. Put differently, while prior failures may increase the likelihood of pursuing novel ways of solving problems (H1), at the same time they may magnify temporal myopia, as firms will first consider opportunities with near-term payoffs, leaving less attention to partnering opportunities with longer payoff horizons.

Second, since prior failures are also difficult to conceal, decision makers are held accountable for their decisions (Bushee, 1998; Haunschild & Sullivan, 2002). Accountability may profoundly affect subsequent decision making. As decision makers are expected to learn from previous failures, they may react by sacrificing long-term gains in favor of short-term demands within the organization (Laverty, 1996). Accordingly, firms with a history of failures in problem solving may push for immediate payoffs while not considering opportunities that will take much longer to affect a firm’s top and bottom line.

We therefore suggest that firms that have had a large number of prior failures in R&D may not perceive partnering opportunities with technologies that have distant payoff horizons to be feasible solutions.

HYPOTHESIS 4a (H4a): An established firm’s prior failures in solving R&D problems magnify temporal myopia in partnership formations with startup firms.

Prior successes and temporal myopia: Prior successes may quite differently shape a firm’s willingness to balance long- and short-term demands when considering a range of possible partnering opportunities. Prior successes allow firms to attend to a broader time horizon as they face less urgency to
address specific problems. Firms may be able to adhere to existing plans, which usually combine both short- and long-term considerations. Moreover, prior successes build confidence and competencies, which may increase a firm’s willingness to engage in partnerships at an earlier stage of development (Diestre & Rajagopalan, 2012; Levinthal & March, 1981). This willingness is solidified by the previously mentioned tendency to further specialize after experiencing success, which may allow firms to understand and pursue external opportunities that promise payoffs only in the distant future (Kim et al., 2009). While we theorized that confidence and specialization after successes may magnify spatial myopia (H2), they may attenuate temporal myopia as they allow firms to tap into opportunities with more distant payoff horizons.

Firm coalitions that have experienced prior successes may also find it easier to take accountability for decisions that will not have immediate performance outcomes, as they are less pressured toward efficiency and urgent problem solving (Sitkin & Pablo, 1992; Staw et al., 1981). These firms may also have adequate financial resources to support investments with longer time horizons (Souder & Shaver, 2010). This resonates with Cyert and March’s (1963:189) suggestion that “success tends to breed slack” that acts as a buffer for “risky” decisions, ultimately allowing firms to balance short- and long-term demands. Taking these arguments together, we propose that firms are more likely to pursue partnering opportunities with a distant payoff horizon when they have experienced prior successes in R&D.

**HYPOTHESIS 4b (H4b):** An established firm’s prior successes in solving R&D problems attenuate temporal myopia in partnership formations with startup firms.

Figure 3 shows the proposed effects of H4a and H4b. We expect that prior failures reinforce temporal myopia, or the overlooking of technological solutions with a longer payoff horizon (a steepening of the local search curve). Conversely, we expect prior successes to attenuate temporal myopia, leading to a flattening of the local search curve.

---Insert Figure 3 about here---

**Methods**

**Drug Development and Partnerships in the Bio-Pharmaceutical Industry**
Testing of our hypotheses required a research setting in which we could observe technological search by established firms, emerging partnering opportunities generated by startups, and the formation of partnerships. The bio-pharmaceutical industry allows tracking all of the above elements in the form of compounds in development, which are technological solutions addressing a therapeutic problem such as cancer or cardiovascular disease. Moreover, partnering in the industry is a key strategic activity for established firms (Anand et al., 2010; Rothaermel, 2001). We combine data on therapeutic compound development using Citeline’s Pharmaprojects and on partnering initiatives using Deloitte’s Recombinant Capital database (e.g., Hess & Rothaermel, 2011). The unique dataset allows us to capture (a) the range of “solutions” established firms have tried in addressing therapeutic problems, (b) experiences of failures and successes in therapeutic problem solving, and (c) emerging technological solutions available for partnering by startups as well as formed partnerships. Figure 4 shows a typical established firm in the bio-pharmaceutical industry active in developing drugs for cancer and neurology and three emerging partnering opportunities from startups A, B, and C. We will use this figure to illustrate the generation of the sample and key variables.

----Insert Figure 4 about here ----

Sample

We focused on the top 40 publicly traded pharmaceutical firms worldwide (by sales in 1997) active in new therapeutic drug development, which are searching for new partnerships with startup firms.\(^5\) The established firms included traditional firms such as Merck & Co. and Pfizer as well as three biotechnology firms with an established product portfolio (Amgen, Chiron, and Genentech).\(^6\)

We identified partnering opportunities by observing established firms’ partnerships with startups at the stage of preclinical trials (clinical development candidate selection and investigation of a new drug

\(^5\) Limiting the sample to the leading firms facilitated data collection across multiple databases and is consistent with prior research of established firms’ behavior in the bio-pharmaceutical industry (e.g. Anand et al., 2010; Rothaermel, 2001). It also allows to strike a balance between the number of firms included and the number of total observations based on a risk-set approach.

\(^6\) In a robustness test, we limited the sample to firms that started in the chemical-based drug development paradigm and obtained consistent results.
preparation), Phase I trials (evaluation of drug stability, side effects, and dosage), Phase II trials (efficacy), and Phase III trials (large-scale clinical testing). In these stages, partnering opportunities are clearly visible in the form of compounds in development. Using ReCap, we identified 311 startups partnering with the Top 40 established firms between 1997 and 2006. These firms provided a basis for generating a set of partnering opportunities for each established firm in a given year.

We first assumed that partnering opportunities were available in the year before an actual partnership was formed. For example, if established firm 1 in Figure 4 formed a partnership with startup A in year t, we assumed that startup A had a partnering opportunity available in year t-1. This analysis identified 429 startup-years in which startup firms had technologies available for partnering. To complement these partnering opportunities, we examined in which other years, between and inclusive of 1996 to 2005, the 311 startups had compounds available for partnering. By tracking the drug development of the 311 small startups in Pharmaprojects and determining whether any compounds of the firms were flagged as a licensing opportunity, we identified an additional 423 startup-years in which startups also had compounds available for partnering. We combined the 429 observations (based on actual partnering) and the additional 423 observations (based on available opportunities) into one risk set of partnering opportunities.

We then made the assumption that established firms will observe and evaluate all possible partnering opportunities in therapeutic areas in which they have had their own R&D experiences. For example, in Figure 4, established firm 1 has a history of drug development in cancer and neurology but not in sensory therapies. Consequently, we considered the opportunities from startup A and B but not the opportunity from startup C, which only develops sensory therapies at the risk of being partnered with

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7 We defined startups as firms founded after 1985 during the biotechnology revolution but without commercialized products on the market in 1997. The extensive time window is required owing to the lengthy period to reach Phase III trials.
8 The 429 opportunities led to 451 partnerships. In only 5 cases, a startup and an established firm formed multiple partnerships in a year, which is why we focused on whether a partnership was or was not formed.
9 Pharmaprojects reports a licensing opportunity if it has received information from a press release, annual reports, conferences or direct communication that a compound is available for partnering.
established firm 1. This approach led to a total set of 27,697 possible combinations between startups with partnering opportunities and established firms between 1997 and 2006.

Measures

*Dependent variable.* We coded the dependent variable, *Partnership Formed*, as a binary variable taking the value of 1 if an established firm formed a partnership with a startup firm with available partnering opportunities in year t and 0 otherwise. In total, we observed 451 formed partnerships from 27,697 possibilities between established and startup firms.

*Independent variables.* To measure the *Novelty* of a partnering opportunity, we compared each available opportunity from startups to the internal drug development of the established biopharmaceutical firms in the prior four years (e.g., Diestre & Rajagopalan, 2012). Using fine-grained product development data from Pharmaprojects, we examined two dimensions of novelty covering whether established firms had already used (1) the underlying material and (2) the mechanism of action within the therapeutic area of the partnering opportunity. The origin of material distinguishes between chemistry and derivatives of biotechnology. The mechanism of action classifies the pharmacological effect through which the drug may have an effect on the human body and that is a critical element of knowledge in any therapeutic solution (Polidoro & Toh, 2011). For example, in Figure 4, established firm 1 has a rich history in cancer drug development using chemical-based approaches (the ring-

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10 Pursuing a new therapeutic area resembles a diversification and does not fit into our theory of myopia, which requires prior experience. Also, such moves rarely occur through partnerships with small startup firms (we only observed 15 such partnerships in total). We control for the omission of such cases in the robustness tests.

11 The sample also reflects that some of the established firms merge (e.g., Bayer and Schering AG).

12 We inferred the relevance of the mechanism of action and the origin of material by recent research on drug discovery (e.g., Swinney & Anthony, 2011) Both elements also play important roles in the search guidelines outlined by pharmaceutical firms to potential partners on their partnering websites.

13 Biotechnology in a narrow sense means the development of large protein-based molecules (e.g., monoclonal antibodies). In our sample, 38% of the partnering opportunities were biotechnology-based (large molecules), 58% chemical-based (small molecules) and the remainder derived from natural plants.

14 Pharmaprojects contains thousands of mechanisms, and we employed a consulting firm to assess which mechanisms can be aggregated into important categories of knowledge. A pharmacology expert with 26 years of experience in drug development and a biotechnology graduate student at UPenn did the classification separately. We report our results based on the classification by the pharmacology expert (overall agreement between the two classifications was 93%). The table used can be downloaded at: http://bit.ly/12SHdfo.
structured molecules). Startup A’s partnering opportunity uses a biology-based monoclonal antibody (the y formed structure), which is a clear departure from the established firm 1’s origin of materials used and is novel to the firm. In a similar vein, we would compare the mechanism of action. Novelty takes scores between 0 and 2, with 0 indicating that the established firm has used the same mechanism and origin of material to solve a therapeutic problem and 2 indicating that the startup’s technological opportunity uses a mechanism of action and an origin of material new to the established firm, hence signaling a strong departure from prior problem-solving attempts.\(^{15}\)

We captured the Distance to Expected Payoffs by determining the payoff horizon, or the time until the expected returns of an investment will exceed its costs (Souder & Shaver, 2010). In the bio-pharmaceutical industry, this time greatly depends on the stage of the drug development process. We distinguished whether a partnering opportunity was in preclinical trials, Phase I, Phase II, or Phase III. Commercializing a drug at the preclinical stage can take up to 10 years, but only a few years for a drug in Phase III trials. The variable is reverse-coded, so that Phase III opportunities receive a score of 0 and preclinical opportunities, the most distant category from monetary payoffs in our sample, receive the highest scores.\(^{16}\) As an example, in Figure 4, the opportunity from startup A would have a low Distance to Expected Payoffs score as the opportunity is at a later stage of development, while the opportunity from startup B would receive a high Distance to Expected Payoffs score.

Additionally, using each established firm’s history of drug development, we determined whether firms had experienced Prior Successes or Prior Failures in the therapeutic area of the partnering opportunity. Successes are rare in the bio-pharmaceutical industry, with fewer than 70 drugs obtaining approval per year. However, an approved drug can profoundly shape a firm’s prospects and in many instances, a single blockbuster (>\$1B sales per year) can lead to the establishment of a therapeutic business unit. We measured Prior Successes as the number of successful drugs launched by the

\(^{15}\) Whenever we identified more than one compound available for partnering by a startup in a given year, we averaged the novelty score.

\(^{16}\) For a startup having more than one compound available for partnering, we selected the latest stage of all available compounds. Results are robust using the average stage.
established firm in the last four years within the therapeutic area addressed by the startup (e.g., Diestre & Rajagopalan, 2012). We counted as successes only the regulatory approvals in the U.S., Europe, or Japan. As an example in Figure 4, established firm 1 successfully received approval for a drug in neurology. Hence, the score for Prior Successes for established Firm 1 observing the partnering opportunity of startup B (active in neurology) would be 1.

Given that firms ultimately abandon most attempts in R&D, we took the perspective that failures represent discontinuation of product development attempts to which established firms had committed substantial resources and time (Shepherd et al., 2011). These commitments are particularly large once bio-pharmaceutical firms start efficacy and large-scale clinical testing, which is at Phases II and III of the drug development process. This perspective is supported by prior research that has identified substantial penalties from external stakeholders for failure at these stages of development (Girotra et al., 2007). Information on failed drug developments comes from Pharmaprojects, and Prior Failures is a four-year count of the number of failures in Phase II and Phase III within the broad therapeutic area of the partnering opportunity.17 As an example, the score for Prior Failures for established firm 1 from Figure 4 observing the partnering opportunity of startup A (active in cancer) would be 2 and observing the partnering opportunity of startup B (active in neurology) would be 0 (no failures).

Controls. We controlled for various factors that could drive partnership formations. We took into account characteristics of the startup such as the number of Available Compounds available for partnering, as a larger set of opportunities within a startup may lead to a higher likelihood of partnership formation. We also controlled for startup Age, as more mature startups may be considered to be more reliable partners (Stuart, Hoang, & Hybels, 1999). We further controlled for the main therapeutic area in which the startup is active through therapeutic area fixed effects. Next, we generated several dyadic measures between established firm and startup that could drive partnership formation. We used ReCap to

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17 When a startup had technological opportunities spanning more than one broad therapeutic area, we averaged the established firm’s number of failures and successes to calculate an average score.
count an established firm’s *Partnerships* in the same therapeutic area of the startup in the last four years, which captures a firm’s embeddedness in the startup’s research community (Stuart, 1998). While in most cases, startups and established firms had no prior contact, through an indicator we controlled for whether the established firm and the startup had a *Prior Partnership*, as it may affect subsequent partnerships formations (Rothaermel & Boeker, 2008). To control for challenges in crossing geographic boundaries (Rosenkopf & Almeida, 2003), we added an indicator of whether startups and established firms had their headquarters in the Same Country. Finally, we examined the general overlap of knowledge between the startup and established firm through patenting overlap (e.g., Diestre & Rajagopalan, 2012). Following Sampson (2007), we calculated the technological overlap between an established firm i and startup j as:

\[
\text{Knowledge Overlap}^{19} = \frac{F_iF_j'}{\sqrt{(F_iF_j')(F_iF_j')}}
\]

The variable is 1 when firms are identical in their patenting (strong overlap) and 0 if they are completely orthogonal (no overlap).

We further controlled for an established firm’s overall activity in the therapeutic domains addressed by the startup’s technological opportunities. First, we controlled for the established firm’s total number of ongoing projects (preclinical trial to Phase III) in the therapeutic domains of the partnering opportunity (*Project Pipeline*), as established firms may tend to partner in areas in which they are most active. We also considered whether the established firm had a history of addressing the same indication (*Prior Indication*, indicator) (e.g., Alzheimer’s as a subcategory of neurologic diseases). We controlled for a firm’s *Exploration Orientation*, which is the historic four-year tendency to explore novel elements of knowledge, by generating a ratio of projects with novel elements of knowledge (mechanism of action or

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18 We matched the therapeutic area in Recap to the therapeutic area from Pharmaprojects using a conversion table generated by observing over 3000 partnerships-compound matches between Pharmaprojects and Recap. The conversion table can be downloaded at http://bit.ly/ZIoSdJ.

19 We used a four-year window and considered all four-digit IPCs associated with a patent family in Derwent. The distribution of knowledge was captured by a multidimensional vector \( F_i = (F_i^1 \ldots F_i^s) \), where \( F_i^s \) represents the number of patents assigned to firm i in patent class s.

20 Indications come from Pharmaprojects, but many drugs are categorized into an “Other” indication category.
origin of material) to all projects within the therapeutic area of the partnering opportunity. A higher score reveals a greater tendency to explore new knowledge. As complementary assets may influence partnership formations, we also controlled for whether the established firm had any top-selling drug (Top 100 Drug)\(^{21}\) in the therapeutic areas addressed by a partnering opportunity.

Additionally, we added various financial controls of the established firms to proxy for available resources that could affect partnership formations. We used the Current Ratio to proxy for financial slack as the ratio of its current assets divided by its current liabilities. We also included Total Assets (logged) as a proxy for the firm’s size and performance (Return on Assets: RoA), which are known to influence organizational search (Greve, 2011).

**Empirical Specification**

Throughout our analysis, we took into account that our dependent variable is binary and use a logistic regression including established firm fixed effects\(^{22}\). We examined the full risk set (27,697 observations) as well as a choice-based sample with four control cases (2,255 observations) per realized partnership.\(^{23}\) The choice-based sample is used as a robustness test since the full risk set approach has been criticized as the total number of realized deals is low (around 1.61%) compared to the unrealized ones, which may affect standard errors (Sorenson & Stuart, 2001). The choice-based sample includes all partnering opportunities realized plus four randomly sampled partnering opportunities for which a partnership did not occur (e.g., Mitsuhashi & Greve, 2009). We verified that choice-based results were robust using the rare logit modification (King and Zeng (2001), which considers that the ratio of realized and unrealized partnerships is fixed at 20%. All independent variables were constructed with a lag structure so that we observe them in year t-1, when a partnering opportunity was available, and then check partnering formation in the next year t.

\(^{21}\) The Top 100 drugs came from Verispan and were linked to therapeutic areas through Pharmaprojects.

\(^{22}\) This meant that the variation explained would be within (not across) firms.

\(^{23}\) 451 partnerships + 4*451 control cases.
Results

Table 1 shows the summary statistics and correlations. We next examine both the entire sample and the choice-based sample to test our hypotheses (Table 2). Models 1a/1b show the effect of the control variables on the likelihood of partnership formation. Consistent with prior research, we find that geographic proximity (Same Country) and Prior Partnerships have a positive direct effect on the likelihood of forming a partnership with a startup. We also find that established firms pursue partnerships in areas where they were successful in launching new drugs (Prior Successes), have a major drug on sale (Top 100 Drug), and know the therapeutic indication (Prior Indication). We find only partial evidence that Knowledge Overlap increases the likelihood of partnership formations, and no effect from the firm’s overall activity (Project Pipeline) or from Prior Failures, indicating that firms do not necessarily seek opportunities in areas where they have recently failed.

Models 2a/2b add the Novelty and Distance to Commercial Payoff measures of the partnering opportunity to test H1 and H2. Testing myopia, we expect the two variables to have a negative effect on partnership formation. As both models show, Novelty and the Distance to Expected Payoff of the partnering opportunity both significantly reduce the likelihood of partnership formation (the marginal effects are equally significant at $p < 0.01$, holding all other variables at their mean values), suggesting strong support for H1 and H2.

To test the remaining hypotheses, we added moderation effects (using centered variables). We start in models 3a/3b by interacting Novelty with Prior Failures. In support of H3a, we find a positive and significant ($p < 0.01$) effect of the interaction, suggesting that firms that have experienced failures in drug development are more likely pursue partnerships with novel elements of knowledge. The effect is shown in Figure 5, which plots the moderation of Novelty at various levels of Prior Failures. The graph suggests that established firms search for partnering opportunities in the neighborhood of existing solutions, but

---Insert Tables 1 and 2 about here ----

24 Examing the correlations, we do not find evidence that multicollinearity is of concern. The mean VIF for the full models is below 3.23 and individual VIFs are all below 4.89.
this tendency lessens once firms experience failures. Overall, both empirical and graphical results indicate support for H3a.

---Insert Figure 5 about here---

Hypothesis 3b predicted an opposite effect with prior successes magnifying local search tendencies. When interacting Novelty and Prior Successes (models 4a/4b respectively), we do not find the expected negative interaction but instead find a positive, albeit insignificant, effect. We hence do not find support for H3b.

Next, we tested interactions of Distance to Expected Payoffs with Prior Failures (models 5a/5b in Table 3) and Prior Successes (models 6a/6b). We find some support for H4a, as the moderation of Prior Failures and Distance to Expected Payoffs in the full risk set model (6a) is marginally significant and significant in the choice-based model (6b). Figure 6 illustrates this effect, which suggests that at high levels of Prior Failures, established firms at least marginally prefer partnering opportunities that are close to commercialization, hence magnifying temporal myopia.

---Insert Figure 6 about here---

---Insert Table 3 about here---

We observe the opposite effect for the interaction of Distance to Expected Payoffs and Prior Successes, which is positive and significant (p < 0.01). This finding supports H4b, which suggested that prior successes may attenuate temporal myopia. Figure 7 graphically demonstrates the effect. Overall, our findings suggest that prior failures and prior successes very differently shape an established firm’s receptiveness toward partnering opportunities that are distant from commercial payoffs.

Models 7a/7b include all variables and interactions and support the findings from the prior models. In these models, the interaction of Distance to Expected Payoffs with Prior Failures reaches significance. All results hold with a conditional fixed effect model (Stata: xtlogit), as demonstrated in
models 8a/8b. Table 4 shows the marginal effects of Novelty and Distance to Expected Payoffs at different levels of the moderators, providing further support for H3a, H4a, and H4b.25

---Insert Tables 4 and 5 about here ---

---Insert Figure 7 about here---

We conducted several additional checks to establish the robustness of our findings (Table 5). We relaxed the assumption that all established firms in the sample were at risk of establishing a partnership in a given year. Omitting the years in which an established firm did not pursue a partnership equally supports our results (model R1). Similarly, we show that results are robust when considering a risk set that includes partnering opportunities in which the established firms had no prior experience in the broad therapeutic area (model R2).26

We also operationalized our key variables in different ways. We used indicator variables for Prior Failures and Prior Successes (models R3a/R3b), leading to very similar results when using count variables. We alternatively deployed a depreciated failure and success experience in which we considered the complete drug development history (starting from 1988) and a discount factor of 80% each year (models R4a/R4b). Results again coincide with our main findings.27 In further robustness tests we operationalized Novelty and Distance to Expected Payoffs differently. Namely, as models R5a/b and R6a/b show, we individually examined whether Novelty constructed using only the origin of material or only the mechanism of action led to similar results.28 The robustness tests (models R7a/b) show that operationalizing Distance to Expected Payoffs through an indicator (Phase II/III versus Preclinical/Phase I) supports our main results.

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25 We also ran additional graphical checks using the inteff command in Stata to understand the interaction effects, further validating our results (graphs available from the authors).
26 In a final check related to the sample (available from the authors), we excluded Genentech, Amgen, and Chiron to limit the analysis on firm that traditionally focused on chemistry-based drug development.
27 Both Prior Failures and Prior Successes also hold when operationalized as counts of the prior 3 years.
28 Examining the direct effects, origin of material supports H1 but not the mechanism of action (p < 0.13 only).
A final concern related to temporal myopia is that established bio-pharmaceutical firms manage their drug development pipeline in reaction to R&D successes and failures. We would thus expect the main effect to be negative for Prior Successes and positive for Prior Failures. Neither, however, is true (see model 1).

**Discussion**

**Implications and Contributions**

Increasingly, established firms search for and partner with startup firms to gain access to emerging and potentially radical technological solutions (e.g. Anand et al., 2010). At the same time, established firms’ partnering choices may still follow predictable routines and familiar (or local) knowledge paths. Hence, understanding what drives the selection of external opportunities has become an important question for researchers and practitioners alike (Rothaermel & Boeker, 2008; Tyler & Steensma, 1995). We contribute to this inquiry by examining myopic tendencies in partnership formations, manifested by established firms’ tendencies to overlook partnering opportunities with novel elements of knowledge (spatial myopia) and opportunities that are temporally distant from commercial payoffs (temporal myopia). We further consider that extreme experiences of failures and successes differ in the extent to which they challenge established firms’ conventional ways of solving problems and the degree to which they allow firms to balance long- and short-term demands. In doing so, we offer a framework suggesting that prior failures and successes affect myopic tendencies very differently.

The context for the study is the global bio-pharmaceutical industry, in which established firms increasingly rely on startup partners to develop innovative solutions (Rothaermel, 2001). We find that established firms tend to follow local search tendencies, as they forgo both opportunities that solve therapeutic problems in novel ways and opportunities with a distant payoff horizon. We also find that prior failures and successes are important boundary conditions shaping these relationships. Prior failures challenge firms’ existing ways of solving problems and increase the likelihood that they will choose a partner with novel ways of solving problems (attenuating spatial myopia). At the same time, prior failures
create urgency and increase the likelihood of pursuing partnerships that promise immediate payoffs (magnifying temporal myopia). Conversely, prior successes enable firms to take a more balanced approach when considering long- and short-term demands, thus increasing the likelihood of choosing partners with more distant payoffs (attenuating temporal myopia).

To the best of our knowledge, this study is the first attempt to systematically identify how established firms search for and make decisions about emerging technological opportunities by explicitly considering forces of myopia as well as rare but salient experiences of successes and failures. While scholars have identified firms’ tendency to seek similarities when selecting partners (e.g., Rothaermel & Boeker, 2008; Stuart, 1998) and previously known partners (Baum et al., 2005; Li & Rowley, 2002), they have not considered that firms also temporally balance long- and short-term demands. This study shows that opening up to new external solutions does not necessarily lead firms to pursue opportunities that substantially differ from what they already know or that may offer benefits only in the long run.

At the same time, we explicate the role of prior failures and successes to clarify when firms are more likely to pursue non-local partnering opportunities (Cyert & March, 1963; Greve, 2011), and we enrich the debate as to whether prior failures matter more than prior successes in organizational search and learning (Baum & Dahlin, 2007; Kim et al., 2009; Madsen & Desai, 2010; Sitkin & Pablo, 1992). We find that such questions cannot be easily answered without taking into account different types of myopic tendencies. For example, failures affect the two types of myopia in different ways. This finding helps to resolve conflicting arguments whether failures can lead to both local (Levinthal & March, 1981; Sitkin & Pablo, 1992; Staw & Ross, 1987) and distant type of search (Laursen, 2012; Levinthal & March, 1993; Madsen & Desai, 2010).

In a similar vein, the study contributes to the understanding of how prior successes shape organizational search. While we find no support for the idea that prior successes may trap firms into existing technological paths (Audia et al., 2000), we do reveal that prior successes may allow firms to take a long-term perspective, since firms are more likely to pursue partnering opportunities with technologies with more distant expected payoffs. Therefore, both successes and failures may contain the
seeds of change for firms searching and selecting from among a range of partnering opportunities
(March et al., 1991:7)

**Limitations and Future Research Directions**

The study has a number of limitations that should provide ample opportunities for future research. First, the study was conducted in the context of a single industry, and the generalizability of the findings and their boundary conditions needs to be validated through explorations in other empirical contexts. As a research context, however, the bio-pharmaceutical industry allows to capture successes and failures in R&D, which is challenging in other industry settings. In addition, the industry allows to unambiguous capture partnering opportunities, which may not be possible in other industries.

Second, the current study considers only reactions to emerging external technological opportunities through partnering. However, established firms possess a broad variety of tools for accessing external knowledge, including acquisitions or corporate venture capital investments. The study hence only captures a subset of actions at the disposal of established firms. However, restricting our analysis to partnering allows us to identify an unambiguous risk set of available opportunities. With an acquisition, firms gain access to the startup’s full knowledge, including all patents and prior projects, creating difficulty in defining what really was at risk before the acquisition.

Finally, the partnerships observed in this study constitute only a subset of all partnerships in which established firms engage. We do not capture very early stage discovery partnerships or commercialization partnerships that occur when drugs are already approved. Future research might expand the study to a broader set of value chain activities. Given that unambiguously identifying the partnering opportunities is difficult when no compound is yet available, we excluded very early stage research partnerships (at the discovery stage). Thus an important limitation is that the startups we observe already have some history and products in development, which can have taken a decade of research. We also excluded startups that had commercialized compounds available, because they may behave very differently in partnering since they have invested in complementary assets and started their transition to becoming more established industry firms (Adegbesan & Higgins, 2011).
Conclusion

This study develops and tests a theoretical framework that considers how established firms forming partnerships with startups may be subject to spatial and temporal myopia and how established firms’ histories of essential failures and successes in solving R&D problems moderate these tendencies. We argue that prior failures and successes differ in the extent to which they challenge established firms’ conventional ways of solving problems and in the degree to which they allow firms to balance long- and short-term organizational demands, so that prior failures and successes shape myopic behavior in partnership formations very differently. The study argues for the value of integrating perspectives on myopia with studies examining failures and successes in technological search.
References


Figure 1: Baseline Case Hypotheses

Figure 2: Moderation Spatial Myopia

Figure 3: Moderation Temporal Myopia

Figure 5: Moderation Novelty and Prior Failures

Figure 6: Moderation - Distance Expected Payoffs x Prior Failures

Figure 7: Moderation - Distance Expected Payoffs x Prior Successes
Figure 4: Drug Development in the Bio-Pharmaceutical Industry

Startup A:
Problem Area: Cancer

Solutions:

Established Firm 1
Problem Area: Cancer
Solutions:

Problem Area: Neurology
Solutions:

Startup B:
Problem Area: Neurology

Solutions:

Startup C:
Problem Area: Sensory

Solutions:
### Table 1: - Summary Statistics and Correlations

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n=27697 (based on Full Sample), TA – based on therapeutic area of partnering opportunity
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<td>2255</td>
<td>27697</td>
<td>2255</td>
<td>27697</td>
<td>2255</td>
<td>27697</td>
<td>2255</td>
</tr>
</tbody>
</table>

+ p<.10, * p<.05, ** p<.01, *** p<.001
### Table 4: Marginal effects:

<table>
<thead>
<tr>
<th>STATA – Marginal Effect</th>
<th>Novelty</th>
<th>Distance Expected Payoffs</th>
<th>STATA - Margins</th>
<th>Distance Expected Payoffs</th>
</tr>
</thead>
<tbody>
<tr>
<td>When Prior Failures is at 25th percentile</td>
<td>-0.0034991*** (0.0008391)</td>
<td>-0.015993 (0.010384)</td>
<td></td>
<td>-0.0452037*** (0.0108612)</td>
</tr>
<tr>
<td>When Prior Failures is at 75th percentile</td>
<td>-0.000644 (0.0009582)</td>
<td>-0.59898*** (0.015147)</td>
<td></td>
<td>-0.0022643 (0.0105943)</td>
</tr>
<tr>
<td>Chi Square Test in difference</td>
<td>***</td>
<td>*</td>
<td>Chi Square Test in difference</td>
<td>**</td>
</tr>
</tbody>
</table>

*p<.10, *p<.05, **p<.01, ***p<.001, using choice-based model coefficients

### Table 5: Robustness Tests – Logit - DV Partnership Formation

<table>
<thead>
<tr>
<th>DV Partnership Formation (includes Firm, Year and Therapeutic Area fixed effects)</th>
<th>(R1) Sample: Years firms had partnership</th>
<th>(R2) Sample: All therapy codes</th>
<th>(R3a) Full Sample: Moderators indicators</th>
<th>(R3b) Choice Based: Moderators indicators</th>
<th>(R4a) Full Sample: Depreciated Moderators indicators</th>
<th>(R4b) Choice Based: Depreciated Moderators indicators</th>
<th>(R 5a) Full: Novelty – Origin of Material</th>
<th>(R 5b) Full: Novelty – Mechanism of Action</th>
<th>(R 6a) Full: Novelty – Mechanism of Action</th>
<th>(R 6b) Choice: Novelty – Mechanism of Action</th>
<th>(R 7a) Full: Distance Payoffs indicator</th>
<th>(R 7b) Choice: Distance Payoffs indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure (TA)</td>
<td>0.059 (0.044)</td>
<td>0.065</td>
<td>0.115</td>
<td>0.087 (0.124)</td>
<td>0.014 (0.058)</td>
<td>0.052 (0.065)</td>
<td>0.035 (0.063)</td>
<td>-0.035 (0.063)</td>
<td>-0.056 (0.071)</td>
<td>-0.055 (0.071)</td>
<td>-0.214** (0.121)</td>
<td>0.320** (0.121)</td>
</tr>
<tr>
<td>Success (TA)</td>
<td>0.162** (0.061)</td>
<td>0.188**</td>
<td>0.537***</td>
<td>0.649*** (0.142)</td>
<td>0.231*** (0.085)</td>
<td>0.326*** (0.099)</td>
<td>0.136* (0.062)</td>
<td>0.136* (0.062)</td>
<td>0.125 (0.085)</td>
<td>0.133+ (0.077)</td>
<td>0.115 (0.109)</td>
<td>0.275*** -0.338***</td>
</tr>
<tr>
<td>Novelty</td>
<td>-0.284*** (0.078)</td>
<td>-0.377***</td>
<td>-0.419***</td>
<td>-0.469*** (0.150)</td>
<td>-0.280*** (0.075)</td>
<td>-0.333*** (0.095)</td>
<td>-0.217+ (0.116)</td>
<td>-0.217+ (0.116)</td>
<td>-0.277* (0.135)</td>
<td>-0.216* (0.102)</td>
<td>-0.279* (0.119)</td>
<td>-0.475*** -0.488***</td>
</tr>
<tr>
<td>Distance Expected Payoffs</td>
<td>-0.235*** (0.056)</td>
<td>-0.235***</td>
<td>-0.325**</td>
<td>-0.318* (0.139)</td>
<td>-0.212* (0.053)</td>
<td>-0.221*** (0.062)</td>
<td>-0.239*** (0.057)</td>
<td>-0.239*** (0.057)</td>
<td>-0.237*** (0.065)</td>
<td>-0.235*** (0.065)</td>
<td>-0.234*** (0.065)</td>
<td>-0.475*** -0.488***</td>
</tr>
<tr>
<td>Novelty x Prior Failures</td>
<td>0.147*** (0.038)</td>
<td>0.164***</td>
<td>0.342**</td>
<td>0.269+ (0.142)</td>
<td>0.146** (0.045)</td>
<td>0.204* (0.053)</td>
<td>0.215* (0.097)</td>
<td>0.215* (0.097)</td>
<td>0.198* (0.076)</td>
<td>0.197* (0.078)</td>
<td>0.198* (0.078)</td>
<td>0.146*** 0.183***</td>
</tr>
<tr>
<td>Novelty x Prior Success</td>
<td>0.031 (0.070)</td>
<td>0.071</td>
<td>-0.009</td>
<td>0.125 (0.154)</td>
<td>0.085 (0.080)</td>
<td>0.180* (0.086)</td>
<td>0.025 (0.118)</td>
<td>0.025 (0.118)</td>
<td>0.175 (0.141)</td>
<td>0.040 (0.090)</td>
<td>0.086 (0.099)</td>
<td>0.028 (0.074)</td>
</tr>
<tr>
<td>Distance Expected Payoffs x</td>
<td>0.087** (0.029)</td>
<td>-0.081**</td>
<td>-0.223*</td>
<td>-0.212+ (0.031)</td>
<td>-0.088* (0.040)</td>
<td>-0.086* (0.046)</td>
<td>-0.101** (0.038)</td>
<td>-0.101** (0.038)</td>
<td>-0.099* (0.031)</td>
<td>-0.086* (0.038)</td>
<td>-0.101** (0.039)</td>
<td>0.216* -0.275*</td>
</tr>
<tr>
<td>Prior Failures</td>
<td>0.153*** (0.045)</td>
<td>0.167***</td>
<td>0.400**</td>
<td>0.392** (0.124)</td>
<td>0.143** (0.051)</td>
<td>0.164** (0.053)</td>
<td>0.161*** (0.054)</td>
<td>0.161*** (0.054)</td>
<td>0.157** (0.045)</td>
<td>0.156*** (0.046)</td>
<td>0.162** (0.055)</td>
<td>0.385*** 0.350**</td>
</tr>
<tr>
<td>Distance Expected Payoffs x</td>
<td>-0.1952.72 (21663)</td>
<td>-2244.72</td>
<td>-2098.73</td>
<td>-1047.91 (32682)</td>
<td>-2106.51 (27697)</td>
<td>-1050.54 (27697)</td>
<td>-2106.45 (27697)</td>
<td>-2106.45 (27697)</td>
<td>-2106.25 (27697)</td>
<td>-2110.68 (27697)</td>
<td>-1054.93 (27697)</td>
<td>-2106.62 -1047.97</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>0.16683 (26282)</td>
<td>27697</td>
<td>2255</td>
<td>27697 (26282)</td>
<td>27697</td>
<td>2255</td>
<td>27697</td>
<td>2255</td>
<td>27697</td>
<td>2255</td>
<td>27697</td>
<td>2255</td>
</tr>
</tbody>
</table>

*p<.10, *p<.05, **p<.01, ***p<.001, variables not shown but included: Startup Age, Compounds Available, Partnerships, Prior Partnership, Same Country, Overlap Knowledge, New Projects, Exploration Orientation, Prior Indication, Top 100 Drug, Total Assets, Return on Assets, Financial Slack, Constant.