

# Advancing the Conceptualization and Operationalization of Novelty in Organizational Research

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**T**he construct of novelty is an important primitive for theories of organization learning, strategic change, and innovation. The organizational pursuit of novelty is generally theorized as necessary for long-term organizational adaptation and survival yet variance increasing in the short term. We argue that the recent explosion of studies of exploration and exploitation tend to conceptualize and operationalize novelty quite narrowly. In contrast, we treat novelty as a multidimensional construct and discuss implications of this approach for future research.

*Key words:* exploration and exploitation; innovation management; novelty; organizational learning; portfolio management  
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## Introduction

Paradoxically, novelty has been portrayed both as a savior and villain in theories of organizational performance. Although novelty is a critical component of studies of organizational renewal, an organization's embrace of novelty implies risk and uncertainty, which can inhibit predictable performance (Benner and Tushman 2003). At the same time, reliable and routine behavior, although profitable in the short term, may impede adaptation necessary for changing environments (Hannan and Freeman 1984). Thus, many examinations of learning and evolution in the field of management distinguish novel from routine behavior and consider the antecedents and consequences of portfolios of behaviors that vary in their ratios of novel to routine behavior.

Conventional wisdom in our field suggests that a moderate embrace of novelty (that is, not too novel or too routine across some set of organizational activities) is critical for organization adaptation and survival, demonstrated deftly by March's (1991) simulation of exploration and exploitation behaviors. Additional support for this view is generated by a normative literature that celebrates exemplary behaviors by organizations at particular times and contexts; this literature also proposes corresponding managerial practices and prescriptions, such as "managing ambidextrously" (Tushman and O'Reilly 1996, p. 8), "choreographed transitions" (Brown and Eisenhardt 1997, p. 29), or deploying "adaptation modes" appropriate to "conflicting (and changing) strategic contingencies" (Westerman et al. 2006, p. 237), that might encourage these types of behaviors and their putative outcomes. More recently, the term "organizational ambidexterity" has been applied well beyond the normative literature on management of innovation; it is

also being used to denote some balance of exploration and exploitation in more deductive research.

Yet systematic empirical study of multiple organizations over time demonstrates the challenges of maintaining some sort of balance between novelty and routine. Indeed, the general tendency of organizations seems to be a drift toward less novel behavior (Benner and Tushman 2002, Sørensen and Stuart 2000). Our contention in this paper is that organizational research needs to embrace a multidimensional conceptualization of novelty to better capture the trade-offs undertaken by organizations in their pursuit (or avoidance) of novelty. To develop our argument, we focus on the role of novelty in the organization learning literature, reviewing both its conceptualization and operationalization. Because we contend that the research methods in this area typically shortchange the nuances necessary for thorough understanding, we both examine these nuances in some recent research and also offer a practice-based illustration. We close with several recommendations for future research.

## Novelty and Balance in the Organization Learning Literature

March's (1991, p. 71) seminal work distinguishing exploration from exploitation offered a host of synonyms for these two concepts: "Exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution. . . ." In subsequent work (Levinthal and March 1993, p. 105), exploration was defined as "the pursuit of new knowledge" and exploitation as "the use and development of things already known." All of these

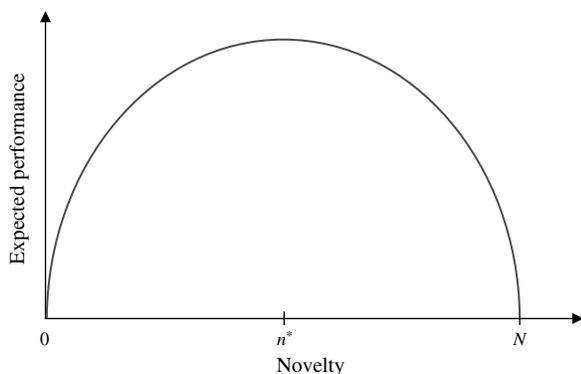
synonyms and the definitions suggest that exploration is associated with the pursuit of novelty, whereas exploitation represents less novel, or more routine, behavior.

March (1991) further asserted that exploration yields lower returns than exploitation, on average, because of the higher likelihood of failure for nonroutine behavior. At the same time, however, returns to exploration have higher variance than returns to exploitation. Thus, when examining the specific activities through which exploration and exploitation behaviors are enacted, this variance makes it possible that particular exploration activities may outperform exploitation activities. Ultimately, then, “an appropriate balance between exploration and exploitation is a primary factor in system survival and prosperity” (March 1991, p. 71).

Representing this balance, the relationship between the level of novelty and performance is then hypothesized to be curvilinear, as shown in Figure 1. Peak performance is achieved at some moderate level of novelty,  $n^*$ . The question of what  $n^*$  might be is an open one. Simulations can pinpoint particular values of  $n^*$ —for example, Levinthal (1997) suggested that organizations that make “long jumps” one of every seven times are most effective—but these values are a function of the assumptions built into the model. In contrast, in an empirical study of alliances, Lin et al. (2007) conceptualized ambidexterity as an even balance of exploratory and exploitative activities (i.e., exploration represents 50% of the activity) but empirically operationalized ambidexterity as a dichotomous variable valued at 1 when a firm had between 20% and 80% exploration activity. They found that balance is expensive to pursue, and only larger firms had the resources to generate higher performance from ambidexterity.

Although much research has been grounded in March’s (1991) emphasis on the necessity of balance between exploration and exploitation, the conceptualization of balance employed by scholars varies. Some scholars, such as Lavie et al. (2010), theorize more of a conflict between the two behaviors and accordingly will calculate relative levels of each behavior.

**Figure 1** Expected Performance vs. Novelty



This continuum-based trade-off is embraced by balance-management approaches like those of the “punctuated equilibrium” variety, where exploitation pursuits are “punctuated” by periods of exploration (Burgelman 2002). In contrast, rather than viewing exploration and exploitation as competing behaviors at opposing ends of a continuous spectrum, they may instead be interpreted as orthogonal dimensions. With this approach, ambidexterity does not mandate a trade-off of one behavior against the other; rather, successful organizations can and should attempt exploration and exploitation simultaneously (Gibson and Birkinshaw 2004). There are numerous pathways for potentially doing so (Raisch et al. 2009), including structural approaches that enable different organizational units or areas to have different objectives (Benner and Tushman 2003, Tushman and O’Reilly 1996), or even through processes—such as decentralization of decision-making authority or participation in cross-functional interfaces—that drive variation in individual-level ambidexterity among managers (Mom et al. 2009). Furthermore, an organization may simultaneously engage in several of these balancing options to manage exploration–exploitation trade-offs, although multimode empirical research has been limited to date (Lavie et al. 2010).

In their summary of four such questions around the analysis of exploration and exploitation—the clarity of their definition, the interpretation of their continuity versus orthogonality, the efficacy of ambidextrous versus punctuated equilibrium approaches to balance, and the feasibility of a specialized (one or the other) versus a dual organizational focus—Gupta et al. (2006) concluded that context plays an important role in their resolution. For example, conditions of resource scarcity (thereby pitting exploration against exploitation) or consideration of a single domain setting (where the analyses are restricted to an individual or a subsystem) suggest the mutual exclusivity of the continuum model. The empirical study by Puranam et al. (2006) of postacquisition innovation outcomes in the information technology hardware industry highlighted the importance of context. Their findings showed that, although both are important for innovation, the relative need for exploration or exploitation depends on the stage of the acquired firm’s technological trajectory, and therefore structural integration choices should be made accordingly. On the other hand, contexts that are rich in resources or encompass multiple different or loosely coupled domains suggest the orthogonal interpretation. Cao et al. (2009) similarly found that firms in resource-rich environments can and should simultaneously pursue both exploration and exploitation, but those firms that are resource constrained benefit from making trade-offs between the two.

Given the central role of context, it is unsurprising that despite the plethora of recent research on exploration and exploitation in organization learning, clear

generalizability of these findings can be difficult because of the inherent specificity of the various empirical settings examined. In other words, any ideal ratio of exploration to exploitation is likely to vary from one industry context to another, as is one firm-specific set of practices to another. Furthermore, generalizability and comparisons between studies are hampered by researchers' use of different measures to operationalize the concepts of exploration, exploitation, and/or ambidexterity (Cao et al. 2009, Lavie et al. 2010).

Table 1 provides a high-level overview of several survey-based studies in the exploration–exploitation arena. Because of the ample number of studies available, we focused our selection on papers that have been highlighted in journal special issues and reviews (see Gupta et al. 2006, Raisch and Birkinshaw 2008, Raisch et al. 2009). We targeted papers conducted at the organization level of analysis to provide a point of methodological commonality. However, even in this small collection, differences in operationalizations—and thus difficulties in generalizability—are apparent. Empirical settings vary from high-tech in California to packaged food in The Netherlands to financial services in Europe. Moreover, these papers display fundamental differences in their approaches to exploration and exploitation, both theoretical (continuum or orthogonal) and operational (innovation, marketing, sourcing, or strategy). To wit, consider the Jansen et al. (2009) survey of executives in a random, multi-industry sample of 230 private firms. The authors viewed exploration and exploitation as orthogonal dimensions, choosing (based on regression results with performance as the dependent variable) to measure ambidexterity by summing their study's constructs of “exploratory innovation” and “exploitative innovation.” Their exploratory innovation measure tracked the level to which firms pursued radical innovations for new customers (therefore departing from existing knowledge), whereas their exploitative innovation measure tracked the degree to which the firms pursued incremental innovations for current customers (therefore building on existing knowledge). Both survey measures were based on scales developed previously by the authors (Jansen et al. 2006).

Compare this to Rothaermel and Alexandre's (2009) survey study. Whereas both studies used the frame of an organization's search for knowledge with an orthogonal interpretation of explore–exploit, Rothaermel and Alexandre (2009) applied the ambidexterity lens to firms' technology-sourcing strategies—a very different approach from the Jansen et al. (2009) product innovation perspective. Moreover, Rothaermel and Alexandre (2009) considered two distinct dimensions where trade-offs stemming from a firm's concurrent pursuit of exploration and exploitation could occur: (1) organizational boundaries (i.e., whether technology sourcing takes place internal or external to the

firm) and (2) technological boundaries (i.e., whether the sourced technology is new, and thus explorative, or known to the firm, and thus exploitative). This then leads to four exploration–exploitation combinations for evaluation: internal exploration (a firm's sourcing new technology from internal sources), external exploration (new technology sourced externally), internal exploitation (known technology sourced internally), and external exploitation (known technology sourced externally). These organizational–technological pairings are examined in the analysis, as opposed to the more singular focus of Jansen et al. (2009) on their additive ambidexterity measure. To collect the data for their explore–exploit independent variables, Rothaermel and Alexandre (2009) asked survey respondents to provide the percentage of each technology type (new or known) that the firm sourced internally versus externally. Thus, they used their survey to pointedly ask a quantitatively oriented question, whereas the inquiries posed by Jansen et al. (2009, p. 809) were more qualitative (e.g., “We frequently utilize new opportunities in new markets”). Moreover, although both papers surveyed firm executives in random, multi-industry samples, differences such as private (Jansen et al. 2009) versus public (Rothaermel and Alexandre 2009) firms might need to be accounted for by researchers aiming to build on these papers.

As these survey studies illustrate, direct comparisons between construct operationalizations can be challenging, and results may be difficult to generalize beyond their specific empirical settings. Variation stems from the myriad of methodological choices researchers must make. A wide range of issues—such as construct definition, the nature and number of scale items, and data aggregation—all represent potential points of deviation. Given the plausible sensitivity of research results to each of these alternatives, the combined ramifications of a full suite of decisions are not insignificant. The cascading impact of these method decisions is emphasized by Lavie et al. (2010), who argued that scholars' inconsistencies in just a single choice—ambidexterity operationalization—are so pernicious empirically that they recommend using the explore–exploit continuum model as a theoretical basis to allow researchers to bypass these challenges.

Moreover, the research method itself can lead to reliability concerns. For survey studies, and for those concerning multidimensional constructs like ambidexterity or novelty in particular, construct validity may be threatened by issues like common method bias and single-informant bias (Podsakoff and Organ 1986, Spector 2006). Certainly, there are established methodological procedures for addressing the potential issues associated with these biases. For example, in the study referenced previously, Jansen et al. (2009) temporarily separated the independent and dependent variables in their surveys, and they also gathered data at two different points

**Table 1** Operationalization of Exploration and Exploitation in Selected Survey Studies Conducted at the Organization Level of Analysis

Study	Empirical setting and sample	Approach	Survey instrument design and measurement	Key variable operationalization
Auh and Menguc (2005)	Leaders of 260 Australian manufacturing firms in diverse sectors	Continuum	<ul style="list-style-type: none"> <li>Adapted from Spanos and Lioukas (2001)</li> <li>Four-item scale for exploration and a three-item scale for exploitation, with both on five-point Likert scales</li> <li>Exploration and exploitation correspond to different organizational learning modes</li> <li>Focused on behaviors associated with exploration and exploitation firm strategies</li> </ul>	Exploration and exploitation are IVs
Beckman (2006)	Founders of 170 start-up firms in California in narrow range of high-tech industries	Orthogonal	<ul style="list-style-type: none"> <li>From surveys, collected product launch dates: firms with exploitation strategies are likely to ship products faster (also used interview and archival data)</li> <li>Scales from He and Wong (2004)</li> <li>Exploration is the firm's innovation orientation toward the introduction of new products/markets and exploitation is its innovation orientation toward the improvement of existing products/markets</li> <li>Eight-items on six-point semantic-differential format</li> <li>For each question, firms scored on a continuum from flexibility to efficiency (1 to 6)</li> <li>Firms used an efficiency strategy (offer standard products), a flexibility strategy (made-to-order products), or mixed (both)</li> </ul>	Exploration strategy and exploitation strategy are the DVs
Cao et al. (2009)	CEO and CTO of 122 randomly selected, multi-industry, small- or medium-sized firms in three high-tech parks in China	Orthogonal	<ul style="list-style-type: none"> <li>Developed separate three-item scales for alignment and adaptability</li> <li>Although measured separately, these two capacities were nonsubstitutable and interdependent</li> </ul>	<ul style="list-style-type: none"> <li>Exploration and exploitation are IVs</li> <li>Ambidexterity has two dimensions:               <ol style="list-style-type: none"> <li>Balance—absolute difference between exploration and exploitation</li> <li>Combined—product of exploration and exploitation</li> </ol> </li> <li>Firm strategy is the IV</li> </ul>
Ebben and Johnson (2005)	Top managers of a random sample of 144 privately held U.S. manufacturing firms	Continuum	<ul style="list-style-type: none"> <li>Eight-item measure, with four each for exploration and exploitation, on a five-point Likert scale</li> <li>Exploratory innovation measured "technological innovation activities aimed at entering new product-market domains"</li> <li>Exploitative innovation measured "technological innovation activities aimed at improving existing product-market positions"</li> </ul>	<ul style="list-style-type: none"> <li>Ambidexterity is a independent mediator variable, defined by the multiplicative interaction of alignment and adaptability</li> </ul>
Gibson and Birkinshaw (2004)	Individuals (4,195 in all) in 41 units of 10 multinational, multi-industry firms	Orthogonal	<ul style="list-style-type: none"> <li>Stratified random sample of 50–500 employees at four levels in units</li> </ul>	<ul style="list-style-type: none"> <li>Explorative and exploitative innovation strategy are DVs</li> <li>Ambidexterity is a dependent variable, measured in two ways:               <ol style="list-style-type: none"> <li>Product of explorative and exploitative innovation strategy scores for strategic "fit as moderating"</li> <li>Absolute difference for strategic "fit as matching"</li> </ol> </li> </ul>
He and Wong (2004)	CEOs of 206 manufacturing firms in Singapore and Malaysia	Orthogonal	<ul style="list-style-type: none"> <li>Scale adapted from Jansen et al. (2006)</li> <li>Exploratory and exploitative innovation were both four-item measures on seven-point Likert scales</li> <li>Exploratory innovation measured extent firms "depart from existing knowledge and pursue radical innovation for emerging customers"</li> <li>Exploitative innovation measured extent firms "build on existing knowledge and pursue incremental innovation to meet the needs of existing customers"</li> </ul>	<ul style="list-style-type: none"> <li>Ambidexterity is the DV, calculated by adding exploratory and exploitative innovation</li> </ul>
Jansen et al. (2009)	Senior managers of 230 private firms in multiple industries	Orthogonal	<ul style="list-style-type: none"> <li>Exploratory and exploitative innovation are both six-item measures on seven-point Likert scales</li> </ul>	Exploration and exploitation are DVs
Jansen et al. (2006)	Two hundred eighty-three unit managers in a European financial services firm	Orthogonal		

**Table 1 (cont'd.)**

Study	Empirical setting and sample	Approach	Survey instrument design and measurement	Key variable operationalization
Jansen et al. (2005)	Three hundred sixty-three unit managers in a European financial services firm	Orthogonal	Exploratory and exploitative innovation are both six-item measures	Unit's ambidexterity is the DV, calculated by the multiplicative interaction between exploratory and exploitative innovation
Kyriakopoulos and Moorman (2004)	Marketing VPs of 75 business units in a random sample from the Dutch packaged food industry	Orthogonal	<ul style="list-style-type: none"> <li>Marketing exploration strategy and marketing exploitation strategy were both seven-item measures on seven-point Likert scales</li> <li>Marketing exploration strategies challenge prior approaches to interfacing with the market</li> <li>Marketing exploitation strategies improve current skills associated with existing marketing strategies</li> </ul>	Marketing exploitation strategy and marketing exploration strategy are IVs
Lubatkin et al. (2006)	CEOs and top management team members from 139 U.S. small- or medium-sized firms	Orthogonal	<ul style="list-style-type: none"> <li>Scales adapted from He and Wong (2004) and incorporated Benner and Tushman (2003)</li> <li>Twelve-item measure, with six each for exploration and exploitation, on a five-point Likert scale</li> <li>Exploratory and exploitative orientations differ by innovation's proximity to firm's current technological trajectory and existing market segment</li> </ul>	Ambidextrous orientation is an IV, calculated by adding exploration and exploitation
Rothaermel and Alexandre (2009)	CTOs of 141 U.S. manufacturing firms in a random, multi-industry sample	Orthogonal	<ul style="list-style-type: none"> <li>Ambidexterity in a firm's technology sourcing strategy occurs on two dimensions:                             <ol style="list-style-type: none"> <li>Organizational—internal vs. external technology sourcing</li> <li>Technological—known technology (exploitation) vs. new technology (exploration) sourcing</li> </ol> </li> <li>Respondents gave percentages of each technology type that the firm sourced internally or externally</li> </ul>	<ul style="list-style-type: none"> <li>Exploration and exploitation are IVs</li> <li>Ambidexterity is measured through technology sourcing mix ratios; these are independent variables</li> </ul>

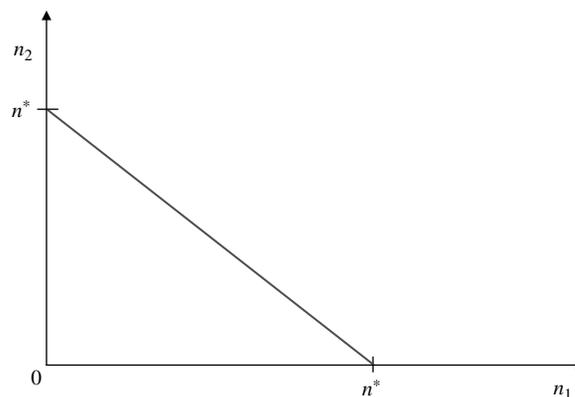
Notes. CEO, chief executive officer; CTO, chief technology officer; DV, dependent variable; IV, independent variable; VP, vice president.

in time, one year apart. Similar steps were taken by Rothaermel and Alexandre (2009). To defend against single-informant bias, both sets of authors checked interrater reliability by surveying additional managers within the same sampled firms. Although these illustrative approaches are sound ones, concerns surrounding challenges like common method bias often cannot be fully ruled out, and thus any resultant limitations to a study's potency must be acknowledged.

As we move from survey-based research to large-sample archival research, even fewer systematic findings about the antecedents of exploration and exploitation have been identified. For example, Beckman et al. (2004) suggested that larger firms are more exploratory, whereas Rothaermel and Deeds (2004) suggested that larger firms are more exploitative. We argue here that most large-scale empirical studies of exploration and exploitation tend to use a single dimension on which they discriminate the amount of novelty versus the amount of routine inherent in an activity. Indeed, although both Beckman et al. (2004) and Rothaermel and Deeds (2004) focused on the mechanism of alliance formation to examine exploration and exploitation, the contexts in which they examined the alliance mechanism differed. Specifically, Beckman et al. (2004) distinguished exploration from exploitation by examining whether alliances were formed with new versus prior partners, whereas Rothaermel and Deeds (2004) distinguished exploration from exploitation by examining whether alliances were formed for research and development (R&D) versus commercialization purposes. Thus, divergent contexts for classifying alliances as exploratory or exploitative can easily generate divergent findings.

To address this concern, Lavie and Rosenkopf (2006) included both of these contexts for evaluating novelty in alliance formation decisions simultaneously. Specifically, they classified each alliance formation decision as exploratory in the “functional domain” if it was an R&D alliance and exploratory in the “structural domain” if it was formed with a new partner. This approach demonstrated divergent predictors of exploration across these two contexts and also clarified that firms trade off one type of exploration against the other. Conceptually, this implies that novelty exposure over two contexts is additive: if the optimal level of novelty is represented as  $n^*$ , then  $n_1 + n_2 = n^*$  (see Figure 2). However, in subsequent work, Lavie et al. (2011) suggested that certain solutions along this line may be more effective. Specifically, by modeling the interaction between the two levels ( $n_1 \times n_2$ ), they found that developing balance within each context (that is,  $n_1 = n_2 = n^*/2$ ) decreases performance, which implies that  $n_1$  should be significantly higher than  $n_2$ , or vice versa. They attribute this finding to the costs of managing resource conflicts and developing routines for this purpose, because the result is driven by larger firms.

**Figure 2** Novelty Exposure Over Two Contexts

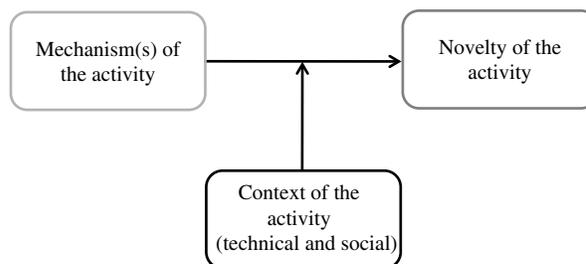


### Operationalizing Novelty: Mechanisms and Contexts

Researchers seeking to analyze the effects of exploration and exploitation activities typically operationalize novelty via two empirical design choices. First, a *mechanism* (or “process”) that provides or demonstrates exposure to new knowledge is chosen. Thus, as seen in Figure 3, any activity, be it for learning, innovation, or other strategic behavior, should be recognized as the application of a specific mechanism in a particular context. Although our example directly above utilized alliances as the mechanism, other common approaches include (but are not limited to) activities such as patents resulting from internal R&D (Sørensen and Stuart 2000, Benner and Tushman 2003), acquisitions (Puranam et al. 2006, Vermeulen and Barkema 2001), and mobility (Rosenkopf and Almeida 2003, Groysberg and Lee 2009), or new product development (Danneels 2002, Katila and Chen 2008).

Of course, most studies in the management literature tend to evaluate the effectiveness of one type of learning or innovation mechanism, with other mechanisms included at best as controls. For example, Lavie et al. (2011) examined the effects of alliance portfolios in depth while employing control variables for other mechanisms such as acquisitions (via a yearly count) and internal R&D (measured by R&D intensity). Such an approach begins to grapple with alternative mechanisms for learning, and in turn performance, but it can-

**Figure 3** Operationalizing Novelty



not acknowledge the interactions between these resource allocations as forms of balance. Although there may be multiple effective strategies for balancing exploration and exploitation across these multiple mechanisms, a study design of this type does not classify exploration and exploitation for the controlled mechanisms, and therefore it cannot address overall exposure to novelty.

Given the design choice about which mechanism(s) to feature in the study, each application of this mechanism can then be classified as more or less novel based on some *context* (or “landscape” or “space” or “dimension”) by which the focal mechanism can be compared with past activity to assess novelty or familiarity. Families of various constructs and operationalizations used in the literature to distinguish novelty from routine tend to congregate in both technical and social contexts. As described in more detail below, technical context captures the novelty manifest in an innovation itself or in its application, whereas the novelty of social context is demarcated through intra- and interorganizational relationships. We discuss each in turn.

### Technical Context

Several varied approaches have been used to indicate whether the knowledge rooted in products or services is similar to or different from knowledge demonstrated previously by the firm. For example, Katila and Chen (2008) examined four different user-focused product attributes (repeatability, speed, load capacity, and degrees of freedom) to assess the novelty of new product introductions in the robotics industry. In their empirical study of incumbent firm entry into new market niches in the disk drive industry, King and Tucci (2002) characterized a firm’s experience by separating it into two categories: static experience (i.e., in production and sales to existing markets) and transformational experience (i.e., with major change).

At the same time, by focusing on the customers targeted for the new product or service, we can usually discern whether the new product or service will serve the same markets as the organization’s prior ones or markets previously unserved by the focal organization. Levinthal (1998) argued that “speciation,” or the application of familiar technology to a new market domain, is a key source of innovation. Sorenson et al. (2006) discussed the riskiness of niche expansion and demonstrated the dynamics of sorting industries into generalists versus specialists.

A related way of considering technical context can be observed in the strategy literature on alliances. Here, exploration has been distinguished from exploitation by focusing on the function of the alliance: R&D alliances tend to be classified as exploration, whereas commercialization alliances tend to be classified as exploitation (e.g., Koza and Lewin 1998, Rothaermel 2001). Thus,

the position of an alliance on the value chain may be an indicator of the novelty a focal firm can experience.

Another manifestation of technical context, which is sometimes termed “technology space” or the “technological landscape,” is obtained by examining the patent portfolios of firms. As patents serve as basic building blocks around which products and services are constructed, researchers can assess whether newly issued patents represent incremental extensions to the existing knowledge base or more radical departures (cf. Sørensen and Stuart 2000, Rosenkopf and Nerkar 2001, Katila and Ahuja 2002). This assessment can be made in varied ways; for example, researchers can examine whether new patents reside in the same classes as prior ones or whether they cite other patents in familiar or unfamiliar areas.

Other research on knowledge building has examined whether the knowledge incorporated in an innovation is contemporaneous or more distantly produced; in this regard, time offers a potential proxy for technical context. Studies that rigorously examine temporal issues have unfortunately been limited, and their results vary. Nerkar (2003) suggested that patents with citations that range in age yield more impact, whereas Katila (2002) suggested that the use of older patents is helpful across industries but harmful within industries. The general criticism that a temporal lens is underrepresented in research (Ancona et al. 2001, Mitchell and James 2001) is clearly applicable in this field as well.

### Social Context

One form of social context rests on organizational boundaries. Thus, we can examine whether the activity involves only the focal organization or draws upon other organizations. For example, Rosenkopf and Nerkar (2001) distinguished between patent citations to the patenting firm versus other firms, implying that knowledge already possessed by the firm would represent more familiar territory, whereas incorporating knowledge possessed by other firms would represent more novelty. Such an approach is also implicit in the analyses of learning from experience within firms, franchise chains, and industries at large (cf. Darr et al. 1995, Ingram and Baum 1997).

Geographic space is another proxy for novelty’s social context, where it is assumed that local contexts are familiar and distant contexts are unfamiliar. For example, Rosenkopf and Almeida (2003) argue that alliances with or mobility from firms in distant regions are more likely to provide exposure to nonredundant technological know-how. In a large-scale, longitudinal empirical analysis using U.S. patents from 1975 to 1996, Singh (2005) examined the interplay between interpersonal networks (determined by inventor collaboration across patents) and geography in patterns of knowledge flow. In addition to rigorously demonstrating that regional and firm

boundaries restrict knowledge diffusion, Singh further showed that the distance challenges posed to knowledge flow in interfirm and interregion contexts may be tempered by strong network ties (represented through previous inventor collaborations).

Also using patent citation data to represent knowledge, Phene et al. (2006) examined how a firm's external knowledge—specifically, from outside its technological and geographic boundaries—affects its ability to develop breakthrough innovations. Set in the U.S. biotechnology industry in 1998, their study considers the impact of four types of knowledge defined by technological areas and national boundaries—specifically, technologically proximate knowledge of national origin, technologically proximate knowledge of international origin, technologically distant knowledge of national origin, and technologically distant knowledge of international origin. In demonstrating different effects (ranging from curvilinear to positive to no impact) on breakthrough innovations for different combinations of technological and geographic knowledge characteristics, this research underscores the need to critically consider multiple dimensions of novelty, including geography.

Interestingly, although more scholars need to embed a multidimensional approach in their work, Feinberg and Gupta's (2004) paper indicates that the importance of geography's role, and its interplay with other contextual characteristics, has not been lost on practitioners. They showed that a multinational firm's decision to locate R&D responsibilities in its foreign subsidiaries is shaped by the firm's assessment of the potential for knowledge spillover opportunities in the host country, in combination with the firm's internal capabilities for utilizing that knowledge both locally and globally. Thus, the U.S.-based multinational firms in their sample, when formulating their R&D strategies, appear to take a multifaceted view of context—with a thorough consideration of geography—when assessing their abilities to capture knowledge and comprehensively utilize it.

Another form of social context, as we have foreshadowed with the discussion of alliance formation decisions above, considers the relationships themselves as the learning activities (Kogut and Zander 1992) and evaluates them with respect to the preexisting network of relationships. Thus, alliance research in the more organization-theoretic or network tradition focuses on whether an alliance is formed with a repeat (prior) partner or a new partner (Beckman et al. 2004). Here, alliances with repeat partners are presumed to generate less exposure to overall novelty, because prior partners have developed joint routines, previous exposure to each other's knowledge, effective governance, and trust. A new partnership, in contrast, requires more substantive management of all these issues (Dyer and Singh 1998). Relatedly, albeit in an intraorganizational empirical setting, this echoes Gibson and Birkinshaw's (2004)

empirical approach to measuring organizational context. In this study, their “social context” variable represented a combination of the “support” and “trust” attributes displayed by 41 business units in 10 multinational firms.

### Multiple Contexts and Multiple Mechanisms

As might be expected, the operating realities of many firms necessarily cause them to leverage multiple mechanisms within multiple contexts concurrently. The ensuing complexity may be readily imagined, giving credence to our position of the importance of treating novelty as a multidimensional construct. Although it is our view that research studies need to aggressively take on this challenge more frequently, one management arena that has made significant strides in this direction is the entrepreneurship literature, particularly in their consideration of business models. Although the lexicons are different, there are strong similarities between entrepreneurship-based discussions of business model innovations and our treatment of novel activities. As defined by Amit and Zott (2001, p. 511), a business model describes “the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities.” The authors subsequently explain how, given the linkage between transactions and activities, that a business model may be equivalently characterized as a system of activities that is enabled by the focal firm and directed toward total value creation for all network constituents—for the focal firm itself and for the customers, suppliers, and partners external to the firm's boundaries—as well as toward value appropriation for the focal firm (Zott and Amit 2010). Framed in terms of activity systems, Zott and Amit (2010) explained that an important set of the business model's design parameters is encompassed by three design elements: what activities are selected, or content; how the activities are linked and prioritized, or structure; and who performs the activities, or governance. Thus, their characterization of business model innovation notably takes *both* mechanism and context into consideration. This interpretation of business model innovation recognizes and capitalizes on the multidimensionality of novelty.

### Modeling Novelty

In contrast to the empirical studies rooted in archival data, organizational scholars have used a variety of simulation models to demonstrate both the traps of local search and the benefits of occasional outreach. Most common in the recent literature are the NK models borrowed from Kauffman (1993). The beauty of the NK model is its flexibility to represent multiple dimensions simultaneously. Researchers set the number of relevant dimensions ( $N$ ) and represent an organization's position as an  $N$ -dimensional vector, where each entry is a

binary value. Given an organization’s current position in  $N$ -space, the novelty of an alternative position is then the number of dimensions that differ from the current position.

A challenge for the application of this model to practice or empirical research is that it is essentially agnostic about the primacy of any particular dimension. The NK model’s treatment of these multidimensional landscapes is blind to any nuances among the  $N$  dimensions determining novelty across the  $N$ -space. Interdependence is distributed evenly across all dimensions, so no dimension appears more salient than any other. Specifically, the parameter  $K$  indicates the extent to which “neighboring” dimensions simultaneously determine expected performance. Complexity, meaning the extent to which returns associated with any one dimension are affected by other dimensions, is denoted by  $K$ . In general, more complex landscapes have more idiosyncratic performance characteristics that are harder to understand using only local search (Levinthal 1997).

In the organizational learning literature, the chosen value of  $N$  seems to vary between 4 and 24 (e.g., Rivkin 2000), with much of the work of Levinthal and colleagues (cf. Levinthal 1997, Gavetti and Levinthal 2000) in the smaller range of 6 to 10. Recognizing the inability of social actors to process 10 dimensions effectively, Gavetti and Levinthal (2000) examined how “cognition” (defined as the ability to perceive a subset (three) of their 10 landscape dimensions) affects search. Tellingly, they demonstrated that actors that periodically were able to change their cognitions (i.e., release the emphasis on current dimensions and replace it with an emphasis on new dimensions) achieved the highest performance, suggesting the importance of reorienting approaches to novelty periodically.

Our emphasis on the NK model, and on modeling novelty in simulation studies more broadly, is not intended to be a singular prescription. Indeed, there are intriguing alternatives that researchers may leverage to capture and study the multidimensionality of novelty. One such alternative for operationalizing and analyzing novelty as a multidimensional construct is through set theory. Set-theoretic methods have been compellingly applied in the realm of organization configurations (Fiss 2007) and across social science (Ragin 2007). In applying a set-theoretic approach to novelty, mechanisms and contexts could be treated as sets rather than as disaggregated independent variables. Their numerous configurations combine to create different novel outcomes. Treating novelty as a qualitative outcome that is calibrated rather than measured, where the nature of the novel outcome is a consequence of the particular case’s combinations of attributes, offers some powerful capabilities that conventional approaches may not. For example, set theory is well equipped to address the

phenomenon of equifinality, in which two or more configurations may be equally effective at achieving a particular state of novelty. Likewise, set theory methods can assist researchers in unpacking situations of “limited diversity”—those situations where certain combinations of mechanisms and contexts might be infrequently observed or perhaps wholly unobserved in practice.

### Managing Innovation by Moderating Novelty Exposure: Perspectives from Practice

The commercial reality that practitioners inhabit is inherently and unavoidably multidimensional. The better that managers are able to address multiple dimensions in their thinking and approach to novelty, the better they are positioned for sensible, successful decision making. As such, numerous tools and processes have been developed that encourage managers to comprehensively consider the multidimensional character of novelty in their working realities, instead of simply fixating on only one or two dimensions. These approaches have originated from academia (such as Roberts and Berry’s 1985 framework for entering new businesses, Wheelwright and Clark’s 1992 aggregate project planning, McGrath and MacMillan’s 2000 opportunity matrix) and from consultants (such as McKinsey’s 3 horizons framework; see Baghai et al. 1999), as well as from the industry players themselves.

General Electric (GE)<sup>1</sup> provides one example of a practice-developed approach to managing the multidimensional nature of novelty. By necessity, GE must consider its exposure to novelty as it pursues innovation against the backdrop of its wide business and geographic scope. One way that GE facilitates innovation communication and coordination within and between business units is by means of a tool named “the GE Innovation 9-Blocker” (Figure 4, adapted from GE as per Endnote 1), a matrix that modifies Day’s (2007) framework.

The GE Innovation 9-Blocker follows in the tradition of well-known normative models in the management of innovation literature,<sup>2</sup> categorizing innovation along two

Figure 4 The GE Innovation 9-Blocker

Current GE space	Box 1 (core)		
		Box 2 (adjacent)	
			Box 3 (new)
	Current GE business model	Adjacent GE business model	New GE business model

dimensions. The  $x$  axis represents whether the business model is routine (“current”) for GE, versus extended (“adjacent”) or fully novel (“new”). To illustrate, consider how this could potentially be applied to one of GE’s business units, such as NBC Universal. Revenue realized with an advertiser’s purchase of a 30-second commercial spot on its network is a routine business model for NBC, one that is well known and has been well honed over decades. An adjacency to this core case could be exemplified by the “product placement” approach, wherein an advertiser pays NBC to have its product woven into the content of a television show. In this business model adjacency, note that the attributes of the “space” dimension (explained more fully below) remain essentially the same—the end-user audience, the geographic reach of the broadcast, and the program product itself are all held constant. Last, an innovation leap from the incremental type that typically characterizes activity in the core business (i.e., the routine, familiar, well-honed business “engine”) into the fully novel regime might be characterized by money made via online downloads. In one potential expression of this wholly new approach, end consumers directly pay NBC a per-episode fee for downloading from the company’s virtual storefront.

Likewise, the  $y$  axis represents whether the “space” (which can be interpreted as the customer “offering,” be it a product or service, for a given set of end users in a specific geography) is current, adjacent, or new. Hence, this characterization of space combines elements of the technical and social contexts we defined above. The combination of business model and space constructs results in a  $3 \times 3$  structure with nine possible cases, which GE then compacts into three “boxes” (indicated by the shading of the nine blocks). The origin anchors the framework in the “Box 1” type of innovation, which is focused on the unit’s current operations. Traversing the matrix from lower left to upper right, one next encounters “Box 2” innovation. In this arena of core business adjacencies, the core’s boundaries are pushed along one, two, or several innovation attributes. Box 3 represents the outermost ring of the matrix. Box 3 innovation, known colloquially as “whitespace” or “big-swing” innovation, is characterized by its material novelty to GE across the vast majority of innovation dimensions. Broadly speaking, Box 1 innovations typically address performance gaps and gains in an incremental fashion, whereas Boxes 2 and 3 innovations attack increasingly radical opportunities.

Two features of this innovation matrix’s structure merit special consideration. First, note that the  $y$  axis concept of space actually projects (at least) four dimensions on which novelty might be assessed (product, technology, end-user market, and geography) into a single dimension. Conceptually, this might mean that each of these dimensions are essentially substitutable for one another or that there are threshold levels of novelty for

each of these dimensions that are independent of each other. Pragmatically, this could suggest that incorporating more than two dimensions may have been viewed by the organization as unnecessarily complex for its needs. Yet, at the same time, there does appear to be a minimum level of complexity required to ensure that the framework sufficiently represents the reality of the working environment. This is illustrated by the second structural feature of the matrix that deserves extra emphasis—its  $3 \times 3$  design (and thus the three-box construct that it enables). Given that a simpler  $2 \times 2$  structure could have been used, this suggests that the  $3 \times 3$  choice was deliberate. One impetus behind the selection could be that the  $3 \times 3$  construction encourages more comprehensive decision making regarding the composition of the innovation portfolio, especially when compared to the cruder guidance that the  $2 \times 2$  structure intrinsically offers. The  $3 \times 3$  design diverts managers away from binary assessments (i.e., novel/not novel) and instead forces a multifaceted consideration of an innovation opportunity’s novelty level—not only on the stand-alone basis of a single project but also in terms of that project’s relative contribution to the novelty level of the holistic portfolio. Therefore, it appears that the flexibility in portfolio representation provided by the  $3 \times 3$  frame outweighs its additional complexity cost over the elementary  $2 \times 2$  design.

When used as innovation portfolio management tools, constructs like these may provide a forcing function for balance between novelty and routine in practice. Left to their own devices, driven by the typical incentive structures and pressures for surer-bet, shorter-term results, managers might choose quite rationally to focus on Box 1 exclusively. Yet the presence of Boxes 2 and 3, with the implied accountability associated with them, encourages managers to break from Box 1’s gravitational pull and apply resources to projects across the matrix. Indeed, it is an understandably unnatural act for an individual manager to concurrently maintain both incremental and (potentially cannibalizing) radical innovations in the same portfolio. For such a balancing act to succeed, norms must be established and activity monitored at the corporate level, as highlighted in the more normative literature discussed earlier.

## Implications for Research

We call for several additional directions in research that can bridge the gaps between research, models, and practice. Specifically, we exhort empirical researchers to incorporate more contextual nuances and more portfolio effects in their analyses of the pursuit of novelty and its associated effects.

## Incorporating More Multidimensionality in Context

Given the existing tendency in empirical research to simplify context, we see opportunities for substantial

contribution via the incorporation of additional contextual nuances as well as typical contexts important for practice. First, for a given context discriminating novelty and routine, there may be ways to further distinguish the degree of novelty inherent in particular activities. As we have discussed, researchers frequently classify knowledge building in patents by sorting the citations contained in these patents into self-citations versus citations to other entities (e.g., Sørensen and Stuart 2000, Rosenkopf and Nerkar 2001). However, Benner and Tushman (2002) refined this distinction of knowledge within and outside the firm by assuming that only the first citation of another firm's patent should represent exploration, whereas subsequent uses would be considered exploitation. This distinction between a new citation to another firm denoting novelty versus either a self-citation or a "repeat" citation as more exploitative addresses only two cells of the  $2 \times 2$  structure that includes the distinctions of self- versus non-self-citation and initial citation versus repeat citation. Considering all four cells in this  $2 \times 2$  structure would raise the questions of whether a firm's first citation of its own patent has similar or different antecedents or outcomes than repeat citations of that same patent. Likewise, researchers should question the extent to which treatments considering repeat uses of other firms' patents versus only the first use might differ.

More significantly, we need to recognize that studies such as Sørensen and Stuart (2000) and Benner and Tushman (2002) focus on the balance of exploration and exploitation as their outcome, and this balance is denoted via attention to one context at a time. Each of these organization-theoretic papers is content to note that firms are tending toward exploitation of their own technologies, whereas consideration of the broader issues of application of these technologies and value captured in this way, which bears important relevance to practitioners, is deemphasized. Are we able to incorporate how novelty might be pursued in functional or geographic markets even when these firms are becoming technologically more myopic and address the performance implications of these choices for firms? Indeed, Adner and Levinthal (2008) suggested that what we perceive as entrepreneurship occurs because a firm applies knowledge in a new dimension that is familiar to them but unfamiliar to others in the space. Thus, what appears novel and exploratory to the naïve observer is actually more exploitative for the entrepreneur.

As discussed earlier, Lavie and Rosenkopf (2006) and Lavie et al. (2011) demonstrated that by classifying alliances as exploratory or exploitative by both functional and structural contexts, firms then appear to trade off function-based and structure-based exploration. This suggests that classifications rooted in one context

may mask important variation that can lead to inappropriate prescriptions for managers and again demonstrates the need for simultaneous consideration of multiple contexts. Furthermore, they find that balance within one domain is not associated with higher performance, whereas balance across the two domains is. This suggests that the cost of developing routines to simultaneously support novelty and routine is high and that firms might consider their overall exposure to novelty across multiple domains. Indeed, their analysis of performance suggests that firms that balance across the two domains rather than within each domain achieve higher performance. It is also noteworthy that their findings may well indicate that managers already are perceiving and simultaneously considering both of these dimensions.

More generally, researchers need to identify which families of contexts, or which specific measures within contexts, dominate observed outcomes, as well as when this happens. Ahuja and Lampert (2001) suggested that organizations fall victim to three "traps"—familiarity, maturity, and propinquity. Certainly, in practice, managers could succumb to these traps in both the technical and the social contexts we have discussed above. Of course, meta-analyses of extant studies and ongoing studies may allow better specification of these families as well as guiding researchers toward key measures that should be included in any study of this type.

Little evidence exists to help researchers and practitioners speculate on the ideal value of  $n^*$ , or the ways in which novelty exposure actors domains may aggregate. The Lavie et al. (2011) approach suggests that novelty in different domains may be substitutive. In a different approach, Sorenson and Stuart (2001) have suggested that familiarity in one domain can overcome distance in another. Specifically, their work on venture capital syndicates demonstrates that although syndicate membership is generally predicted by geographic or industrial proximity of their targets, venture capitalists become more likely to fund distant targets when another venture capitalist that they have previously invested with is participating in the syndicate. In this way, social ties are posited to contract distance. Similarly, Rosenkopf and Almeida (2003) demonstrated that both alliances and mobility increase the likelihood of semiconductor firms learning from each other when they are technologically distant. To what extent might our low-dimensional classifications of similarity versus distance contract when additional mechanisms promoting familiarity are incorporated? At the same time, Alcácer and Zhao (2006) approached this issue from the opposite viewpoint, demonstrating that semiconductor firms opening R&D facilities in new geographic regions tend to pursue R&D that is less similar to neighboring facilities. They hypothesized that this is a strategic choice to maximize inbound knowledge spillovers while minimizing outbound ones. Clearly, more research is needed to understand these complementary effects.

Taking a more microlevel perspective on the consideration of multiple dimensions of novelty, studies focusing more explicitly on product innovation have examined varied characteristics of these products. For example, Katila and Chen (2008) utilized a continuous measure of the novelty of a new industrial automation product, derived by averaging improvement in the four distinct product dimensions such as repeatability, speed, load capacity, and degrees of freedom. Like the NK models discussed previously, this approach is agnostic about the role of any particular dimension as well as any particular interdependence among dimensions. It raises the interesting issue of whether and when firms choose to prioritize certain dimensions as well as address new ones.

### Portfolio Effects

Recognizing the uncertainty inherent in any given innovation attempt, much of the literature on the management of innovation focuses on a broader portfolio of activities and the balance of novelty and routine among them (e.g., Tushman and O'Reilly 2002). Thus, although much of our discussion has focused on measurement strategies for research to ascertain the degree of novelty inherent in a particular activity, any assessment of performance is likely to be more informative when it examines a portfolio of activities. However, just as much of our research has focused on limited contexts, it has also focused on limited mechanisms. For example, we have discussed the research on novelty exposure via alliances and as demonstrated in patent production, but these research streams are largely separate—at best, studies in one area posit the other area as a control variable of sorts. Clearly, organizations consistently face the choice of whether to pursue new business opportunities through means such as internal development, collaborative partnerships like alliances, independent joint ventures, or acquisition of firms with key capabilities, or by a hybrid of such options. Future research needs to embrace the fact that organizations make choices among these relational modes, which, taken together, affect their levels of novelty exposure and interact to generate performance outcomes.

For example, Hess and Rothaermel (2011) suggested that biotechnology firms trade off exploration activity via alliances versus via the development of internal human capital in the form of star scientists. Moreover, the innovation management literature typically prescribes that opportunities in the core business (that is, existing technologies for existing customers; see Roberts and Berry 1985) be pursued via internal development, whereas novelty necessitates outside-oriented approaches (e.g., Chesbrough 2003, Powell et al. 1996, von Hippel 1998). Although work like this begins to unpack activity portfolio effects, more research comparing multiple mechanisms and multiple contexts simultaneously is needed.

To this end, we call for deeper investigation into mechanism–context matching. Researchers should seek to develop contingency theories specifying appropriate mechanisms for varied contexts. Although it may be tempting for researchers and practitioners alike to evaluate context and mechanism separately, simultaneous consideration might prove more effective, because the likelihood of success of varying combinations should influence portfolio choices and outcomes. If it can be determined which combinations of mechanisms and contexts are predisposed for success, firms can leverage this knowledge to optimize their portfolio choices and outcomes.

### Conclusion

Exposure to novelty is indeed a key concept animating theories of both antecedents and consequences of organizational learning. Here, we have argued that systematic empirical research needs to undertake a richer treatment of the multiple contexts and mechanisms by which organizations simultaneously pursue (or avoid) novelty. In this way, we hope to bridge the gap between our academic research, normative typologies, and practice.

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### Endnotes

<sup>1</sup>The GE example and corresponding diagram were presented previously by GE in forums that include the Marketing Science Institute June 2009 Conference, Customer Insights for Innovation; the Wharton Impact June 2009 Conference, Innovation Networks—New Insights, Open Questions and Management Fashions; and the Frost and Sullivan Fourth Annual Innovation in New Product Development and Marketing June 2008 Conference. Additional online references include Welch (2008) and McGrath (2009). Figure 4 is an adaptation of the diagrams shared by GE in these forums.

<sup>2</sup>For example, the well-established technology and market/customer dimensions used to prescribe strategies for entering new businesses (Danneels 2002, Roberts and Berry 1985) or to suggest the need for multiple innovation streams that cover multiple cells of the typology (Tushman and O'Reilly 1996).

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