Prolegomena on Coevolution: A Framework for Research on Strategy and New Organizational Forms

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Introduction

Does intentionality matter? How does it matter? These questions have occupied center stage in research on adaptation and selection and in practitioner-oriented writings since the dawn of modern theorizing and research on management and organization. Intentionality is rooted in social–psychological theories of human behavior and purposeful action. It underlies theories of rationality in economics, strategic management, and decision sciences. It has been the foundation of management practice and the raison d'être for the thriving enterprise of teaching and research in schools of business.

Decades of research in strategy and organization science and in branches of economics and decision sciences have not resolved the adaptation–selection debate (Baum 1996). This debate continues in the face of a concerted research effort and vast growth in the stock of knowledge in this area. The proliferation of research and persistence of this debate reflects the different theoretical lenses and empirical methods employed in advancing knowledge and understanding of intentionality in the adaptation process of organizations. A comparison of strategic management and organizational ecology theories highlights the nature and source of the debate. While organizational ecology theories focus on selection, variation, and retention processes for explicating the evolution of populations of organizations, strategic management theories focus on firm-level adaptation as a function of strategy and organization design. Organizational ecology research is based on longitudinal data and shares essential variable definitions and measurements across studies. Strategic choice research has employed mostly cross-sectional designs or studies of short-term adaptation events or single case studies. Moreover, the weak comparability of empirical findings across strategic management studies derives from the many competing theoretical formulations, proliferation of model specifications, and the absence of shared definitions for variables and measures. Organizational ecology research, however, is disconnected from adaptation at the level of the individual organizational unit and therefore cannot directly contribute to explicating firm level adaptation. As a consequence, the adaptation selection debate rages on.

Another cause for the lack of progress has been the premature maturation of theoretical and empirical inquiry in the field of organization studies. In their inaugural essay in *Organization Science,* Daft and Lewin (1990) argue for the imperative of loosening and breaking out of the "straight-jacket" of organization science research. In their view, the field of organization studies had already lost its innovative vitality because of isomorphic forces that defined, reinforced, and prematurely legitimized certain research paradigms and methodological approaches. The ensuing decade has been characterized by a new vitality reflected in the diversity of empirical methods and new theoretical perspectives. However, the dominant discourse still takes place within single-theme theoretical silos. Recognizing that loosening the "straitjacket" was by itself not sufficient, Daft and Lewin (1993) published a second editorial essay calling for new organization theories informed by the problems of management practice and addressing the challenge of adaptation in times of cataclysmic change.

Research on the emergence or evolution of new organizations has been attracting more attention (Tushman and Romanelli 1985, Romanelli 1991). Most research on evolution of organizations involves studies of short-term adaptations under various contingencies, or retrospective case studies (Pettigrew 1985, Baden-Fuller and Stopford 1992), and panel studies (e.g., Whittington et al., this issue). Such studies, however, focus on restructuring and

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transformations within the prevalent M-Form and are not specifically concerned with emergence of new organizational forms. Several theories propose that new organizational forms emerge from entrepreneurial activities of new entrants (Aldrich and Mueller 1982, Aldrich and Zimmer 1986) or from the creative technology-destroying competencies of industries (Schumpeter 1950, Tushman and Anderson 1986). In all of these studies, the new form of interest is the population or industry.

Contemporaneously, many popular and academic writers speculate on the features or characteristics of new organizational forms (cf. Lewin and Stephens 1993; Volberda 1996, 1998). Management futurologists conceptualize the new organization landscape as virtual corporation (Davidow and Malone 1992); hollow corporation; dynamic network form (Miles and Snow 1986); cellular organization (Miles, et al. 1997); hypertext organization (Nonaka and Takeuchi 1995); platform organization (Ciborra 1996); and shamrock organization (Handy 1995). Most of these studies, however, represent retrospective accounts of single case examples of a successful adaptive organizational form at a cross-section of time (e.g., Sun Microsystems' virtual organization; Dell Computer's dynamic network; Acer's cellular form; Sharp's hypertext form; Olivetti's platform organization; or F International's electronic shamrock). The popular business press accounts of new forms serve as an important signpost, but the theory underlying these ideas remains to be more fully developed. In particular, theories of evolution and mutation process of new organizational forms remain to be developed (cf. Lewin et al., this issue).

With this focused issue, we advance the coevolution perspective as a new lens for research in organization studies and for reintegrating organization theory and strategy. We believe that coevolution frameworks will inform any research in organization studies, which spans levels of analyses and involves adaptation over time. In our judgement, coevolution frameworks could prove especially useful for progress in bridging the adaptation selection chasm and for developing insights into the mutation process of the existing stock of organizations. The coevolution lens has the potential for integrating micro- and macro-level evolution within a unifying framework, incorporating multiple levels of analyses and contingent effects, and leading to new insights, new theories, new empirical methods, and new understanding.

Key Themes in Adaptation-Selection Research

How do firms coevolve with their environment? Most scholars in strategy and organization theory study this question by considering environmental change as an exogenous variable (cf. Baum and Singh 1994, Baum and Korn 1999, March 1994). Moreover, they employ a single theme for describing how and why organizations tend to become isomorphic with their environments through processes of either adaptation or selection. Less frequently examined are questions of how organizations systematically influence their environments and how organizational environments (comprised of other organizations and populations) influence those organizations in turn. In this section, we briefly summarize key theoretical frameworks in sociology, economics, and strategy and organization theory; the dominant themes of these frameworks as they relate to adaptation and selection; and the implications of each approach for firm strategy and adaptation.

Sociology encompasses two dominant views. According to *population ecology* (Hannan and Freeman 1977, 1984; Aldrich and Pfeffer 1976), managerial intentionality should have little or no impact on adaptation. Environments select organizations through resource scarcity and competition. The analysis of this selection process is applied at the population level of organizations, because the distribution of fitness across the population of organizations, rather than the fitness of any single organization, is the object of interest. Furthermore, organizational attempts at restructuring and transformation are taken to be futile and even to decrease firm chances of survival. The inability to adapt is a direct outcome of inertial pressures that prevent organizations from changing in response to their environments. The concept of structural inertia, like that of fitness, refers to a correspondence between the adaptive behavioral capabilities of a class of organizations and their particular environments (Hannan and Freeman 1984, p. 152; Mason 1949). Organizations accumulate structural and procedural baggage through retention processes, and the ability of an organization to respond to changes in its environment is directly related to the buildup of structural inertia. In population–ecology theory, firm survival is a function of high reliability and specialization. However, selection rates increase as environmental rates of change exceed firm rates of change. The extreme implications for strategy are that management makes no difference. The best management can do is focus on the firm's niche, optimize the firm's specialization, and hope for the best. As new entrants define a new environment and the old niche decays, firms in the niche become increasingly isomorphic and are selected out (Miller 1990).

Institutional theories focus on why organizations within a population exhibit similar characteristics. This

population isomorphism results from coercive, normative, and mimetic isomorphism, perceived to be legitimate (DiMaggio and Powell 1983). Population isomorphism allows initiatives that are not driven by necessity or obvious advantage to diffuse through an industry group. Greenwood and Hinings (1996) illustrate the dynamic potential of institutional theory to explain adaptation. The embeddedness of organizations in their institutional context is a basic reason for organizations' resistance to change. The more organizations are coupled to a prevailing organizational template in a highly structured institutional context, the higher the resistance to change. Moreover, internal dynamics of organizations are the reason for differences in the pace of change within sectors. For firm strategy, institutional and neo-institutional theories imply that longevity and survival is achieved through maintaining congruence with shifting industry norms and shared logics. Therefore, firms should adopt a fast follower strategy, which is assumed to be directly related to long-term survival.

Economics has brought forward several theories that consider the selection–adaptation debate. These theories range from industrial organization and the behavioral theory of the firm to recent evolutionary theories of economic change and resource- and knowledge-based theories of the firm.

Industrial organization theorists focus on the selection of industries and the positioning of firms within that industry to achieve sustained competitive advantage (Porter 1980, 1985). The industrial organization approach originated from the structure–conduct–performance paradigm of industrial organization developed by Mason (1949) and Bain (1959). In particular, the structure–conduct–performance paradigm places more emphasis on structure (context) than on conduct (strategy) and on implications for public policy as opposed to firm strategy. Porter (1980), however, applies the paradigm at the firm level to develop generic strategies of competitive advantage. In this formulation, the focus is on the quest for monopoly rents through industry and segment selection and the manipulation of market structure to create market power. The implications for strategy and adaptation are that business unit managers should choose an attractive industry and define the frontier for a generic strategy such as cost leadership. Moreover, because greater rivalry will destroy value, managers should erect barriers to entry and use oligopolistic bargains to prevent competitive escalation within an industry.

The *transaction costs view* focuses on the optimum level of internalization of transactions versus contracting via the market (Coase 1937; Williamson 1975, 1991). Markets and hierarchies are alternatives for structuring and conducting transactions. Firms continuously balance market coordination costs with bureaucratic control costs. The implications for strategy are that managers, in particular transaction partners, are rational, risk averse, and opportunistic. The strategic task of managers is to focus on relative coordination costs of transacting inside versus outside the firm.

The *behavioral theory of the firm* (Cyert and March 1963) has a managerial view of the firm as balancing the resource allocation processes to satisfy multiple stakeholders demands, while maximizing the personal goals of managers. The overall thesis is that managers are rational in striving to maximize their personal goals while satisfying stakeholder expectations. They seek to avoid uncertainty by negotiating their environment, employing satisficing decision making, maintaining firm performance within industry average, and seeking stability (equilibrium). Organization slack buffers environmental uncertainty and is a necessary but not sufficient condition for innovation. The implications for strategy are threefold. First, firm ability to innovate and create new opportunities for above-average returns is determined primarily by availability and control of organization slack and by the strategic intent to allocate slack to innovation. Second, the theory provides a process description for growth of structural inertia and a justification for periodic rejuvenation through restructuring and rationalization. Third, firm survival and longevity is directly related to scale and organization slack, and allocation of slack resources to innovation.

Consistent with *behavioral theory of the firm* (Cyert and March 1963), *evolutionary theories* assume that organizations accumulate know-how and tacit knowledge in the course of their existence (Nelson and Winter 1982). Organizations become repositories of unique skills that are often difficult to transfer. These skills are the source of both inertia and distinctive competence. The inertia is caused by sunk costs of past investments; escalation of commitment; entrenched social structures; and organization member attachment to cognitive styles, behavioral dispositions, and decision heuristics. The accumulated skills that render firms inert are also the source of opportunities for strengthening firm-unique advantages and furthering and improving their know-how and tacit knowledge. The potential benefits include greater reliability in delivering sound and comprehensible products, and many economies of efficiency and routine (Miller and Chen 1994, p. 1). The implications for strategy are that adaptation is contingent on proximity to tacit knowledge and to prior and commensurate skills. Improvements occur slowly and incrementally. The repositories of tacit knowledge and routines endow firms with an opportunity and

capacity to search. Yet the same routines suppress attention span and the capacity to absorb new information by specifying behavior that restricts search to new ideas consistent with prior learning.

In a similar way, the firm in the *resource-based theory* is seen as a bundle of tangible and intangible resources and tacit know-how that must be identified, selected, developed, and deployed to generate superior performance (Penrose 1959, Learned 1969, Wernerfelt 1984). Competitive advantage originates from firm heterogeneity in resources and capabilities (Penrose 1959, Teece et al. 1993, Barney 1991, Lippman and Rumelt 1982, Peteraf 1993). The implications for strategy are that competitive advantage can be sustained through barriers to imitation by investing in inimitable idiosyncratic capabilities (Lippman and Rumelt 1982, Winter 1987) and leveraging these firm-core-specific assets for competitive advantage.

Many studies show that in highly competitive environments a core competence can become core rigidity (Teece 1984, p. 106; Leonard-Barton 1992; Burgelman 1994; Barnett et al. 1994) or a competence trap (Levitt and March 1988, Levinthal and March 1993). Teece et al. (1997) suggest that the mechanisms by which firms accumulate and dissipate new skills and capabilities is the source of competitive advantage. They propose that *dynamic capabilities* represent the firm's latent abilities to renew, augment, and adapt its core competence over time. This idea led to the view that knowledge is the most strategically significant resource of the firm (Leonard-Barton 1992, Conner and Prahalad 1996, Grant 1996). In other words, knowledge is the crucial inimitable strategic resource of the firm. The implications for strategy and adaptation are that the organization should maximize knowledge creation and integration. Managers should facilitate all sources of knowledge creation such as improvisation and emergent processes, as well as external network relationships (Cohen and Levinthal 1990). Organizations should be designed and managed as learning organizations while at the same time safeguarding unique knowledge capabilities (Nonaka and Takeuchi 1995).

Finally, several theories in strategy and organization design are considered here as they inform selection–adaptation research. These theories encompass contingency, strategic choice, learning, and life cycle and punctuated equilibrium theories (Volberda 1998).

In *contingency theory* environmental conditions are regarded as a direct cause of variation in organizational forms. Management task is to achieve "good fits" with the environment. The proponents of this approach (Burns and Stalker 1961, Donaldson 1988, Lawrence and Lorsch 1967, Woodward 1965) give primary emphasis to reactive adaptation and discount or ignore the opportunity firms have to influence their environment. Successful adaptation of organization to environment is assumed to be directly dependent on the ability of top management to interpret the conditions facing the firm in an appropriate manner and to adopt relevant courses of action. The implication of contingency theory for firm strategy is that firms should achieve fits with changing competitive environments through appropriate organizational forms.

The *managerial choice or strategic choice* perspective (Child 1972, 1997; Miles and Snow 1978, 1994; Thompson 1967) argues that organizations are not always passive recipients of environmental influence but also have the opportunity and power to reshape the environment. Hrebiniak and Joyce (1985), Khandwalla (1977), Mintzberg (1979), and many other neocontingency theorists assert that adaptation is a dynamic process subject to both managerial action and environmental forces. The implications of strategic choice theories for firm strategy are that management should take into account the multiple ways in which organizations interact with their environments through the process of mutual adaptation between the organization and its environmental domain.

To align themselves with their environments, firms must have some unique skills for learning, unlearning, or relearning on the basis of their past behavior. *Organizational learning theory* or reflective change concerns the development of insights, knowledge, and associations between past actions, the effectiveness of those actions, and future actions (Fiol and Lyles 1985, p. 811; Huber 1991). This learning process is both adaptive and manipulative, in the sense that organizations adjust defensively to reality and use the resulting knowledge offensively to improve the fits between organization and environment (Hedberg 1981, p. 3). An organization needs local search to develop and enhance competencies. At the same time, an organization must remain open for expanded search. In the terminology of Argyris and Schön (1978), organizations need single-loop learning to accomplish some of their most important functions, such as creating continuity, consistency, and stability. On the other hand, organizational designs are imperfect and incomplete and thus require continual reflection and monitoring to meet challenges from both the changing external environment and the inertia-prone internal environment. The implications for strategy are that organizations can remain vital by balancing single- and double-loop learning (Hedberg et al. 1976, Volberda 1996). Single-loop learning, where existing norms and values are not questioned, creates rigidity. By contrast, a wholesale discrediting of norms creates chaos (Weick 1982). The extent to which organizations' exploration of unknown futures and their

exploitation of the known pasts balance each other is of crucial importance to effective learning (March 1991, Hedberg and Jönsson 1978). These forms of learning need not be contradictory processes. They can be complementary, and organizations must learn how to carry out both forms.

Life cycle and *punctuated equilibrium* theories model adaptation and selection over time. Adaptation is assumed to hold during one time period and selection during a different time period. Consequently, several types of temporal relationships may exist among contrary forces. Utterback and Abernathy (1975) suggested that the dominant type of innovation, whether technologically complex or simple, and whether applied to product or process, depends upon the stage of development. Tushman and Anderson (1986) propose, on the basis of a number of product–class case studies, that technology progresses in stages through relatively long periods of incremental, competence-enhancing innovation by elaborating a particular dominant design. These periods of increasing consolidation and learning-by-doing may be punctuated by radical competence-destroying technological innovations. These so-called punctuated equilibrium models, discussed most explicitly by Tushman and Romanelli (1985), posit alternating cycles of preservation "which elaborate structures, systems, controls, and resources toward increased coalignment," and cycles of fundamental change—"periods of discontinuous transition where strategies, structure, and systems are fundamentally transformed towards a new basis of alignment." The implications for strategy are that firms should develop organizational forms that are immune to the cycles of technology-destroying competencies and can survive the periodic alternation between incremental and radical change (Duncan 1976; Shepard 1967; Tushman and O'Reilly 1996). The central question is not what technology, structure, or culture to put in place to encourage innovation, but how to manage the dichotomy between routinizing current activities while simultaneously supplanting these same routines. Table 1 summarizes the salient adaptation selection characteristics of the single-lens perspectives and their implications for firm strategy.

The table shows that certain lenses, such as industrial organization, the behavioral theory of the firm, and strategic choice perspectives attempt to further elaborate the role of managerial intentionality. Other lenses highlight the limitations of managerial intentionality. Perspectives, such as population–ecology, institutionalism, and, to some extent, evolutionary theories, discount the ability of organizations to self-consciously change themselves significantly or repeatedly, or that conscious change initiatives by management are likely to succeed. Instead, using variables such as resource scarcity, industry norms, static routines, and structural inertia, these perspectives focus on the way environments select organizations.

While these various single-lens perspectives have made profound contributions to the strategy and organization field, the resolution of the adaptation–selection debate has not progressed very much. We believe that single-theme explanations for the adaptation–selection phenomenon have reached their limit. Progress in the field requires combining and recombining multiple lenses instead of increasing fragmentation. We should consider the joint outcomes of managerial adaptation and environmental selection instead of naïve selection or naïve adaptation. Empirical work exists that clearly supports one of the extremes (selection versus adaptation). With a few exceptions (e.g., Baum and Singh 1994, Bruderer and Singh 1996, Lant and Mezias 1990, Levinthal 1997), researchers have tended not to address the interrelationships between processes of firm-level adaptation and population-level selection pressures. Adaptation and selection are not wholly opposed forces but are fundamentally interrelated. Such a coevolutionary approach assumes that change may occur in all interacting populations of organizations, permitting change to be driven by both direct interactions and feedback from the rest of the system. In other words, change is not an outcome of managerial adaptation or environmental selection but rather the joint outcome of intentionality and environmental effects.

The purpose of this focused issue is to focus on how firms coevolve with each other and with a changing organizational environment (Baum and Korn 1999). The next section reviews the extant evolutionary theories of organizational change. On the basis of this critical reflection, we describe several properties of coevolution: multilevelness/embeddedness, multidirectional causalities, nonlinearity, positive feedback, and path and history dependence. These properties of coevolutionary systems lead us to reconsider accepted research directions, and to consider fundamentally new research approaches on the role that intentionality plays in organization adaptation and change.

Coevolutionary Theory and Adaptation Selection Research

Evolutionary theory is not a new idea in organization science. Coevolution was implicit in the early work on the emergence of bureaucracy. Weber (1978) argued that the bureaucratic form of organization arose at particular time in history in response to the confluence of forces of change that ushered in the industrial age. Chandler (1962)

Table 1 Single-Lens Theories Informing Selection Adaptation Discourse

Theoretical Roots	Dominant Paradigm	Selection/Adaptation	Managerial Implications
Sociology	Population Ecology	Population selection and structural inertia	Management makes no difference; new entrants redefine industries; established firms should focus on what they do best until selected out
	Institutional Theories	Population isomorphism based on industry norms and shared logics	Established firms should adopt fast follower strategy
Economics	Industrial Organization	Level of industry attractiveness and competitive advantage within that industry	Managers should choose an attractive industry; define performance frontier for a generic strategy; reduce intra-industry rivalry
	Transaction Costs	Minimization of transactions costs	Managers should focus on relative coordination costs of transacting inside versus outside the firm
	Behavioral Theory of the Firm	Satisfying multiple stakeholders, structural inertia due to satisficing, uncertainty avoidance and slack	Periodic restructuring and rationalization. Exploration requires strategic intent to allocate slack to innovation
	Evolutionary Theories	Success reinforces incremental improvements and proliferation of routines as source of inertia (e.g. sunk costs, commitments, social structures).	Managers should overcome preference for improvement of prior and commensurate skills that result in incremental innovations
	Resource-Based Theory of the Firm	Idiosyncratic resources are the basis of sustained competitive advantage; causal ambiguity in evaluating own and competitor core competencies is the source of suboptimal performance	Managers should maximize unique core competency, correct causal ambiguity in judging own and competitors core competencies
	Dynamic Capabilities/ Knowledge-Based Theory of the Firm	Sustained competitive advantage based on dynamic capabilities and intellectual capital	Management should focus on knowledge creation and integration, continuously renew knowledge base
Strategy and Organization Design	Contingency Theory	Environment source of variation in performance	Top management must interpret and react to changes in environment, maintain fit through changes to organization form
	Strategic Choice	Variation in performance results from environmental changes and from firm shaping of environment.	Managers should achieve dynamic fit through monitoring and shaping of environment
	Organizational Learning	Variation in performance results from changes in environment and organization ability to adapt through learning.	Managers need to balance single and double loop learning
	Life cycle/punctuated equilibrium	Periods of adaptation and consolidation are followed by periods of radical competence-destroying change.	Managers should anticipate radical change by managing dichotomy between incremental and radical innovation

makes a similar coevolution argument, noting that the M-Form of organization coevolved with the development of the transportation and communication industries, which enabled business enterprises to manage across time and space and to diversify their business interests. Kieser (1989) describes how medieval guilds were replaced by mercantilist factories as markets and institutions coevolved. He shows how coevolutionary processes resulted in

an increase of functional specialization of institutions, demonopolization of social monopolies, and decoupling of individual motives and organizational goals. Table 2 summarizes selected antecedents of coevolution.

Weick (1979) conceptualizes a view of organizing in which organization members are seen as enacting and socially constructing their environment. Weick thus represents the environment simultaneously as endogenous and exogenous. Aldrich (1979) outlined an evolutionary theory based on processes of variation, selection, and retention. Nelson and Winter (1982) and Levitt and March (1988) have proposed variations of mutual learning frameworks that retain and reinforce learning and incremental improvements of successful routines. Levinthal and Myatt (1994) study the macroevolution of the mutual fund industry in terms of the coevolution of industry market activities and distinctive capabilities of firms within the industry. These studies, which incorporate both firm and industry levels of analysis, subsume possible interactions between genealogical processes (replication of routines, capabilities, competencies) and ecological processes (dynamics of competition and selection).

Firm–industry analysis also points to search behavior potential in moving toward a coevolutionary view of capabilities and competition (Huygens 1999). In a study on evolution among Illinois banks, Barnett and Hansen (1996) report findings that support dynamic interactions between firm learning and adaptation on the one hand, and higher levels of competition and selection on the other. This form of persistent coevolution is dubbed an "arms race" or "the Red Queen effect" (Beinhocker 1997, Kauffman 1995, Van Valen 1973) after the comment to Alice, "It takes all the running you can do to keep in the same place" (Carroll 1946). The concept of hypercompetition (D'Aveni and Gunther 1994), in which escalating competition results in short periods of advantage punctuated by frequent disruptions, represents a similar approach (Illinitch et al. 1998). In these coevolutionary models, the assumed symmetry between forces of adaptation and selection results in their canceling each other

Table 2 Antecedents of Coevolution

Aspects of Coevolution	Contributors
Historical Embeddedness	• Replacement of medieval guilds by mercantilist factories (Kieser 1989) • Emergence of bureaucracy (Weber 1978, 1910) • Diffusion of M-form (Chandler 1962) • Historical institutional analysis of French and British firms (Calori et al. 1997)
Levels of Coevolution	• Micro- and macrocoevolution (McKelvey 1997) • Intraorganization, organization, population, and community coevolution (Baum and Singh 1994) • Internal and external context (Pettigrew 1995)
Interaction Genealogical and Ecological Processes	• Enactment, double interacts (Weick 1979) • Variation, selection, retention (Aldrich 1979) • Mutual learning (Nelson and Winter 1982, Levitt and March 1988) • Coevolution of capabilities and competition (Huygens 1999; Levinthal and Myatt 1994) • Synthesis of ecological and genealogical processes (Baum and Singh 1994, Levinthal 1991, Mezias and Lant 1994)
Zero-sum Competitive Coevolutionary Systems	• Red Queen Race (Beinhocker 1997, Kauffman 1995, Van Valen 1973) • Hypercompetition (D'Aveni and Gunther 1994)
Pluralistic Competitive Coevolutionary Systems	• Adaptation on various fitness landscapes (Levinthal 1997) • Competitive coevolutionary configurations (Baum 1999, Heylighen and Campbell 1995)
Cooperative Coevolutionary Systems	• Learning alliances (Harnel 1991) • Coevolution of alliances (Koza and Lewin 1998)
Microcoevolution	• Intraorganizational ecological processes (Burgelman 1991, 1994, 1996) • Selection and adaptation at intracorporate levels of analysis (Barnett et al. 1994, Galunic and Eisenhardt 1996)

out. That is, search behavior on firm level may lead to unique capabilities and competitive advantage, but as a result of increased competitive dynamics, these advantages are quickly eroded. The implication is that all species keep changing in a neverending race only to sustain their current level of fitness.

Of course, a much larger variety of coevolutionary systems can be studied. Levinthal (1997) shows the relative impact of different levels of firm adaptation and population selection in a changing environment by simulating adaptation on smooth versus rugged fitness landscapes. Moreover, on the basis of Heylighen and Campbell's (1995) competitive configurations, Baum (1999, p. 120) illustrates various alternatives to zero-sum, purely competitive coevolutionary systems that are supercompetitive (increase in a firm's fitness results in a decrease in rival firms' fitness); partly competitive (some resources are shared and others not); synergistic (an increase in one firm's fitness results in an increase in rival firms' fitness); and independent (an increase in one firm's fitness does not affect rival firms' fitness).

In addition to various competitive coevolutionary configurations, there are several studies that investigate cooperative coevolutionary systems. For example, Hamel (1991) concludes that international alliances that are thought at the start to be synergetic turn out to be supercompetitive. Moreover, Koza and Lewin (1998) argue that strategic alliances are embedded in the firm strategic portfolio and coevolve with firm strategy; institutional, organizational, and competitive environment; and managerial intentionality for the alliance.

Other studies beyond aggregate studies on dynamic competitive and cooperative interactions between firms involve intraorganization evolution or microevolution. These studies consider coevolution of intrafirm resources, dynamic capabilities and competencies in an intrafirm competitive context (Barnett et al. 1994; Galunic and Eisenhardt 1996; Burgelman 1991, 1994, 1996). Galunic and Eisenhardt (1996) study selection and adaptation at the intracorporate level of analysis. They used charter changes to align and realign the competencies of various divisions with coevolving markets and opportunities. They report that charter loss in M-Form firms involves a mix of selection and adaptation processes. Selection occurs among competing divisions but losses involve purposive action by group executives and major adaptive shifts by divisions. Burgelman's (1994, 1996) intraorganizational-process model shifts the locus of selection from the firm as whole to classes of strategic action inside the firm, and views managing intraorganizational ecological processes as a means by which the firm can achieve the learning benefits of both external and internal selection.

However, studies of simultaneous evolution or coevolution of organizations and their environments are still rare. We define coevolution as the joint outcome of managerial intentionality, environment, and institutional effects. Coevolution assumes that change may occur in all interacting populations of organizations. Change can be driven by direct interactions and feedback from the rest of the system. In other words, change can be recursive and need not be an outcome of either managerial adaptation or environmental selection but rather the joint outcome of managerial intentionality and environmental effects.

Properties of Coevolution and Requirements for Coevolutionary Research

Although the coevolution construct has been gaining adherents, coevolutionary effects are far from being well accepted or understood. In this section we consider some of the essential properties of coevolution and their implications for strategic management and organization adaptation research.

Multilevelness/Embeddedness. Coevolutionary effects take place at multiple levels within firms as well as between firms. While coevolution has been studied on a single level of analysis, McKelvey (1997, p. 360) argues that coevolution takes place at multiple levels. He makes a distinction between coevolution within the firm (microcoevolution) and coevolution between firms and their niche (macrocoevolution). This approach recognizes that processes of variation, selection, and retention operate within the organization and interact with similar processes operating at the population level. The focus of macrocoevolutionary theory is on firms existing in a coevolutionary competitive context, while microcoevolution considers coevolution of intrafirm resources, dynamic capabilities, and competencies in an intrafirm competitive context.

Pettigrew (1995), for example, makes a distinction between the external context involving economic, political, and social forces and the internal context focusing on resources, capabilities, culture, and internal politics. In a more formal formulation, Baum and Singh (1994) consider coevolution at community, population, organization, and intra-organization level. However, multilevel coevolutionary thinking requires scholars to consider the interactions between multiple levels of coevolution. Nonetheless, McKelvey (1997) as well as Baum and

Singh (1994) argue that coevolution by lower levels always occurs in the context of higher levels of coevolution. In other words, microcoevolutionary order within firms emerges in the context of macroevolutionary selectionist competitive pressure (McKelvey 1997, p. 361; Cohen and Stewart 1994). Studies that use such a nested coevolutionary perspective are sparse (Tushman and Rosenkopf 1996, Garud and Van de Ven 1992). An exception is March's (1991) study of the interaction of evolutionary adaptive thinking at both the microstate level (changes in individual beliefs) and the firm level (changes in the organizational code), in the context of environmental turbulence. The volume *Variations in Organization Science* (Baum and McKelvey 1999) contains several chapters on multilevel coevolution (Ingram and Roberts 1999, Rosenkopf and Nerkar 1999, Van de Ven and Grazman 1999).

Multidirectional Causalities. Organizations and their parts do not merely evolve. They coevolve with each other and with a changing organizational environment (Baum 1999, Kauffman 1993, McKelvey 1997). Changes may occur in all interacting populations of organizations, permitting change to be driven by mutual direct interactions and by feedback from the rest of the system. In this connection, Baum and Singh (1994), for example, make the distinction between direct coevolution, in which one population evolves in response to another population, and diffuse coevolution, in which one or more populations evolve in response to several other populations in a broader ecological system. In such complex systems of relationships, dependent-independent variable distinctions become less meaningful since changes in any one variable may be caused endogenously by changes in others.

Nonlinearity. As a consequence of indeterminate feedback paths, changes in one variable can produce quite counterintuitive changes in another variable. For example, as a result of higher order feedback processes, the effects of changes in one variable frequently contradict inferences based on simple cause-effect logic of linear relations between independent and dependent variables (Baum and Singh 1994, Casti 1994). That is, coevolution subsumes nonlinear feedback among interacting populations, and such nonlinearities can substantially complicate attempts to understand evolutionary change. Scholars in strategy and organization research have abstracted away nonlinear interactions for the sake of analytical tractability (Anderson 1999a). A coevolutionary approach, however, requires that sets of co-acting organizations and their environments be the object of study, and that changes in all interacting organizations be allowed to result not only from the direct interactions between pairs of organizations, but also by indirect feedback through the rest of the system.

Positive Feedback. Organizations systematically influence their environments, and organizational environments fundamentally comprised of other organizations in turn influence organizations. These recursive interactions result in interdependencies and circular causality; each firm influencing the other and in turn being influenced by the behavior of the other. In this mutual interaction feedback perspective, the unidirectional view of cause-and-effect relationships gives way to a recursive bidirectional view of mutual causality.

Path and History Dependence. Adaptation in a coevolutionary process is path- or history-dependent (Calori et al. 1997, Kieser 1989, McKelvey 1997). Variation in adaptations among constituent firms in a population may reflect heterogeneity in the population of firms at earlier points in time (Stinchcombe 1965, Levinthal 1997), rather than variation in niches in the environment (as suggested in population ecology) or a set of distinct external conditions (as generally suggested by contingency theories).

On the basis of these properties of coevolution, we identify several requirements that distinguish coevolutionary research from non-coevolutionary research. However, not all of these requirements must be satisfied in each study. Under conditions of coevolutionary equilibrium, conventional single-lens perspectives in which the environment is treated as exogenous may be quite appropriate (independent coevolutionary systems). Nonetheless, a large and important class of phenomena involves conditions of simultaneous evolution that persist over long time periods. We conclude that the application of a coevolutionary perspective should at a minimum (Lewin et al., this issue) consider the following dimensions:

- Studying organization adaptations over a *long period of time* (McKelvey 1997, Levinthal 1997) by using longitudinal time series of microstate adaptation events and measures of rate of change or pace of change;
- Examining organization adaptation within a *historical context* of the firm and its environment (Calori et al. 1997, Kieser 1989, Kieser 1994, Stinchcombe 1965);
- Considering *multidirectional causalities* between micro- and macrocoevolution (McKelvey 1997), as well as between and across other system elements (Baum 1999). In such systems of relationships among variables, the dependent-independent variable distinction becomes less meaningful. Changes in any one variable are caused endogenously by changes in the other;
- Incorporating *mutual, simultaneous, lagged, and nested effects.* Such effects are not very likely to be linear, and as a consequence of feedback flows, changes in one

variable can produce counterintuitive changes in another variable;

- Considering *path dependence, which enables and restricts adaptation* at the firm level and at the population level, thereby driving both retention and variation at different rates;
- Incorporating changes occurring at the level of *different institutional systems* within which firms and industries are embedded. Change in the regulatory environment can affect the firm and the industry, but the firm and/or the industry may have also influenced these changes;
- Accommodating *economic, social, and political macrovariables* that may change over time and influence the deep structure within which micro- and macroevolution operate. (For example, the aging of the population is not impacting each of the affected populations of organizations or individual organizations to the same extent.) It is necessary to identify and incorporate the simultaneous or lagged effect of such macrovariables.

The Challenge of Coevolution Research

We have argued that coevolution has the potential to serve as a unifying framework for research in strategy and organization studies and for reinterpreting, reframing, and redirecting the selection adaptation discourse. Realizing this potential, however, will be contingent on further *theoretical breakthroughs* as well as dramatic increases in *empirical research* within coevolutionary inquiry systems.

It is evident to us that progress in complexity science (Anderson et al. 1999), emergence (Holland 1999), computational organization theory (Carley 1995), and population ecology are converging toward creating a much needed theoretical footing for coevolutionary research. It appears to us that the pace of theory building, new analytical models and new theoretical insights are outstripping commensurate progress with empirical approaches. Empirical coevolution research requires longitudinal methods of analyses and time series data. Although the relevance and need for longitudinal research in strategic management and organization adaptation research is widely recognized (Miller and Friesen 1982, Huber and Van de Ven 1995, Henderson and Mitchell 1997, Barnett and Burgelman 1996), such research is far from becoming the norm. For example, *Organizational Research Methods,* a new journal sponsored by the Academy of Management Research Methods Division, has published only one article that directly informs longitudinal research (Chan 1998) in its first two years of publication. Longitudinal coevolutionary research will require a richer arsenal of methods and techniques beyond traditional time series methods and hazard or rate function models. For example, sequence analyses (Abbott 1990; Sabherwal and Robey 1993) are not often considered in strategic adaptation research where the data could be represented as strings (sequences) of microadaptation events over time. Similarly, the rapid rise of computational organization theory has not significantly affected empirical methods needed for studying coevolutionary phenomena such as multidirectional causalities, simultaneous and lagged effects, nonlinearity and positive feedback loops. These methodological challenges continue to pose thorny obstacles for coevolutionary empirical research.

Measurement issues and accessibility to appropriate time series data also present new challenges—in particular, the use of rates of change and velocity measures. Cross-sectional survey based studies and economic time series modeling dominate by far the empirical research landscape in strategic management. The PIMS data base was a major source for time series research in strategic management and marketing strategy research with a focus on economic model formulations of competitive dynamics (Boulding and Staelin 1995). The cause of empirical coevolution research would advance greatly with the advent of new types of time series data consisting of microstate adaptations (McKelvey 1997).

Efforts at creating such data sources are still in their infancy. Appropriate microstate adaptation data sequences will vary with research questions being investigated and with the particular coevolutionary system under study. Examples of microstate data sequences include product changes and new product introductions (Sanderson and Uzumeri 1997), strategic adaptations such as mergers, acquisitions, divestitures, greenfield investments, (Webb and Pettigrew, this issue; Lewin and Weigelt 1999), strategic partnerships and alliances (Lawless et al. 1999), changes in organization design (Hunter 1999, Utikal et al. 1999, Obel et al. 1999) and IT implementation events (Hunter 1998, Hanaoka and Sakano 1999). Combining such microadaptation sequences with other event histories, such as regulatory changes, technological innovations, and demographic changes, with performance time series, and with founding conditions establishes an organization environment system within which coevolutionary studies can take place. It becomes viable to investigate dynamic phenomena involving firm microevolution, industry macroevolution, environmental and technological evolution and coevolution processes within such a system. Such studies, for example, can reveal new insights into organization failures, seemingly permanent failing organizations, and mutation and emergence of new organizational forms.

Coevolution studies of the type envisioned here are still

a rare exception because the required data sequences are not readily available. The research and assembly of such large-scale primary data sequences requires time and resources on a scale not generally available to most researchers in strategic management and organization studies.

Moreover, the time horizon for undertaking coevolution studies remains indeterminate. Theories and models of coevolution are silent on this issue. Yet the choice of the time horizon can be important in the conduct and interpretation of any longitudinal time series or coevolution study. Barnett and Hansen (1996), for example, create a data set for the years 1900 to 1993. At present, the choice of the time dimension in longitudinal research remains an arbitrary factor. Nevertheless, early coevolution studies using strategic and organization adaptation data sequences (Hunter 1999; Lewin and Weigelt 1999; Van den Bosch et al., this issue; Baden-Fuller et al. 1999; Webb and Pettigrew, this issue) reveal new insights about population phenomena and, more important, about the adaptive behavior of individual and outlier organizations—those that significantly outperform or underperform the population average.

McKelvey (1997) argues that coevolution studies should use data consisting of rates of change in the variables and measures of interest. The underlying assumption is that time series of rates of change capture or reflect adaptation outcomes that are independent of firm microcontextual details. For example, in strategic management, research contrasting above- and below-average performance over long time periods can be assumed to reflect firm-specific adaptation factors (e.g., exploitation and exploration, absorptive capacity, path dependence) that distinguish between these two subpopulations when founding conditions and environmental change event histories have been incorporated in the coevolutionary analysis. Although such large-scale longitudinal coevolutionary studies are only starting to appear, they point to new directions in empirical research on the selection adaptation puzzle.

Research on New Organizational Forms

In the previous section we discussed the "how" of understanding coevolution research. This section addresses where and when scholars should undertake research on the emergence of new organizational forms. Specifically, which organizations and what aspects of organizational forms should be studied? The mutation of new organizational forms from the existing stock of organizations is largely underresearched. New entrants and/or radical technological innovations have been shown to originate new organizational forms. Punctuated equilibrium theories (e.g., Gersick 1991, Tushman and Romanelli 1985, Miller and Chen 1994) theorize that organizations proceed through life cycles of preservation and radical change. Presumably, during periods of radical change, new organizational forms would emerge. Many empirical retrospective case studies report on major organization rejuvenation and restructuring (e.g., Baden-Fuller and Stopford 1992, Miller 1990, Pettigrew 1985). But the empirical evidence does not seem to support reinvention and mutation of organization form. To a large extent, this is because of the lack of adequate theory for guiding research on mutation of organizations over time with a focus on tracking firm level adaptations. In our view, genealogical evolution or mutation of new organizational forms cannot be ruled out (Lewin et al., this issue). Processes affecting the mutation of new genealogical entities from the old remain largely unexplored (Baum and Singh 1994).

Under what conditions are new organizational forms likely to emerge from the existing stock? The same environmental discontinuities that usher in new entrants can be expected to promote conditions of mutation of the existing stock of organizations. Therefore, populations of organizations undergoing discontinuous change should become the focal object of such studies—industries undergoing deconstruction involving technological, environmental, and economic discontinuities (e.g., retailing, financial services, biotechnology, and telecommunications). The challenge of undertaking such research in real time is to study the total population, to specify the appropriate coevolutionary system, to identify the elements of new organizational forms most likely to be mutated, and to adopt an open-ended program of research.

It is altogether clear to us that if current organizational diversity is to be interpreted as a reflection of a long history of variation and selection, a deeper understanding of how organizational forms come to be different and remain different through time is required. We have already suggested that populations of organizations in deconstructing environments should become the research target. This still leaves open the question of which organizations and what dimensions of organizational forms should be studied.

The new organizational forms are assumed to evolve new higher order capabilities to explore new opportunities effectively, as well as to exploit those opportunities of flexibility and adaptivity (Volberda 1998). These so-called hyperadaptive forms have been variously described as disposable organizations (March 1995), poised organization (Kauffman 1995), at the edge of chaos (Brown

and Eisenhardt 1998, Kauffman 1995), dissipative structures (Prigogine and Stengers 1984), semistructures (Brown and Eisenhardt 1997), hypertext form (Nonaka and Takeuchi 1995) or, more generally, flexible organizations that somehow internalize friction between change and preservation (Volberda 1996, 1998). While the ideas are not new (Weick 1979), complexity theory develops the basic arguments for how organizations coevolve on a fitness landscape to a poised state between order and chaos (Kauffman 1995).

At this "edge of chaos," an organization is assumed to optimize the benefits of stability, while retaining the capacity to change, by combining and recombining both path dependence and path creation processes (Baum and Korn 1999). Such an organization creates sufficient structure to maintain basic order but minimizes structural interdependencies. It evolves internal processes that unleash emergent processes such as improvisation (Weick 1998), self-organizing (Anderson 1999b), emergent strategies (Ilinitch et al. 1998, Brown and Eisenhardt 1998), and strange attractors (e.g., product champions). It involves a new underlying management logic founded on principles of self-organization, trust in bottom-up processes, and effectiveness of equifinal outcomes (Lewin 1999; Dijksterhuis et al., this issue).

Because no single organization will discover and mutate the ultimate "reduced form" of the emerging hyperadaptive organization, the research challenge is to gather data on microstate adaptations that track the mutation of the anticipated desired attributes. One suggestion is to target organizations that have a history of sustaining rising rates of wealth creation in times of disorder (Lewin et al., this issue). Such organizations are more likely to have internalized both exploitation and exploration adaptation capabilities and therefore may be better positioned to mutate higher order adaptive capabilities. In this focused issue, for example, Djelic and Ainamo (this issue) develop a historical perspective on coevolution of new forms in the high-fashion industry. The paper details the effect of institutional constraints and historical legacy on coevolution of new forms in the luxury fashion market. Similarly, Sakano and Lewin (this issue) report country effects (Japan vs. U.S.), as well as CEO intentionality as important driving factors of coevolution of firm strategies and organizational forms. Also, Whittington et al. (this issue) show the impact of national institutional contexts on organizational change in the new competitive landscape. Webb and Pettigrew (this issue) illuminate the nature of dynamic changes unfolding within the insurance industry in the U.K. and that these changes were also affected by competitive moves of the players themselves, as well as by strategic change and mimetic isomorphism. Dijksterhuis et al. (this issue) stress the role of management logics as contextual intervening variable in the coevolution of organizational forms. In this paper, organization adaptations executed by managers are expected to reflect the managerial schema (contextual application of management logic) regardless of the rate of change in the environment. As a consequence, firms that tend to favor classical logic will be selected out at increasing rates as the environment becomes more turbulent. Van den Bosch et al. (this issue) develop a framework that operationalizes organization absorptive capacity for assimilating new knowledge as mediating variable of organization adaptation. This paper serves to highlight the importance of operationalizing and documenting mediating processes such as absorptive capacity, knowledge creation, legacy, semiautonomous structures, and managerial intentionality. Finally, v. Werder (this issue) raises the issue of argumentation rationality of managerial decision making. The paper links levels of argumentation rationality to decisions involving exploration adaptations and, indirectly, to coevolutionary outcomes.

In conclusion with this Prolegomena we advance arguments for why and how a coevolutionary perspective and framework of analysis can provide a new lens and new directions for research in strategic management and organization studies. We identify the distinguishing properties of coevolution in an attempt to define coevolutionary research from other evolutionary research in social sciences. We also outline and discuss the empirical challenges and requirements for undertaking research within coevolutionary inquiry systems. In particular we stress the relevance of specifying coevolutionary models for reframing the selection adaptation standoff when applied to research on organization change over time, in general, and specifically to the mutation and emergence of new organizational forms.

Furthermore, a coevolutionary framework has the potential to bridge and reintegrate strategy and organization theory teaching and research within a holistic framework. In our view such a reintegration is the sine qua non for studying organizational change over time and parallels the world of management practice where organization adaptations and strategy are intertwined and interdependent processes. We believe that the direction that we have outlined in this Prolegomena and the collection of papers in this volume will unleash a sense of renewed purpose for the field of organization studies and answer the call of Daft and Lewin (1993) for new theories and research on organizational forms.

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