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# Seeking Adaptive Advantage: Evolutionary Theory and Managerial Action

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Observers of outstanding high-technology organizations report that senior managers often set vague goals, embrace simplistic slogans, propel internal teams into cutthroat competition, set up processes but no outcome standards, and permit employees to use time on unapproved projects (Quinn, 1986; Van de Ven, Angle, and Poole, 1989; Nonako, 1988). These practices seem to violate crucial management principles such as setting clear goals, enhancing cooperation, and assuring that each employee efficiently focus on top priorities.

In this chapter, I suggest that such high tech practices may not violate good *management principles*, but illuminate instead a *potential integrating* framework for managerial action. In particular, I explore a simple evolutionary framework for conceptualizing a wide variety of potentially valuable managerial practices. A basic evolutionary model of an organization envisions it as a collection of routines, or stable bundles of activities. Over time, both intentional and unintentional variation occurs in the routines. Some of the new routines are selected into the ongoing practices. This simple variation-selection-retention cycle repeats *continuously (Weick, 1979; Baum, 1988)*. This cycle can also be seen as a form of organizational learning but will be referred to as the evolutionary framework in this chapter.

In this framework, the manager's role is to enhance the probability that these processes will generate organizational survival and prosperity—to seek adaptive advantage. The high tech manager who permits employees to pursue individual projects or directs two research teams to pursue the same question has *basically decided to strengthen* the variation process. In accepting inconsistencies and local inefficiency created by this practice, the manager chooses to sacrifice some retention (or consistency) in return for the possible benefits of enhanced variation.

In the first section I outline some of the evolutionary model's potential implications for internal managerial action, drawing especially on findings from field investigations of the management *of technology*. In the second I explicate *four promising research* areas suggested by this framework: (1) competency driven action; (2)

I appreciate the suggestions of Theresa Lant and Joel Baum.

recombinations of organizational routines as a source of variation; (3) acquisition of external routines; and (4) second-order interactions between organizational routines. I also discuss the importance of incorporating the social bases and the symbolic nature of organizational routines. I conclude by noting some of the disadvantages and advantages of adopting an evolutionary approach to normative theory.

## The Manager's Role

The evolutionary perspective envisions organizations as evolving systems nested in other evolving systems at higher levels of analysis (Aldrich, 1979; Singh and Lumsden, 1990). Individual organizations can be seen as collections of routines which continuously go through the variation-selection-retention cycle. At a higher level of analysis, populations of organizations also go through variation, selection, and retention processes (Schumpeter, 1934; Hannan and Freeman, 1989) and may coevolve with technological and social systems. For example, some organizations introduced home video systems based on discs, while others developed tape technologies during a period of early technical variation in video reproduction systems. Market and social forces eventually selected the dominant design of VCR tape systems. Organizations whose fate rested on alternative designs—such as disc technologies or inclusion of the unit inside TVs—failed.

In this setting, the manager's two primary roles are (1) to adjust the organization's relationship to higher level evolutionary processes (including sometimes directly intervening in those processes) and (2) to influence the internal evolutionary process. The manager seeks organizational survival and organizational prosperity. This chapter focuses on the internal evolutionary system. There, managers affect the individual levels and forms of variation, selection, and retention. In addition, they continuously seek adaptive balance of the *relative* levels of (a) variation and retention (including the degree of incremental versus radical change) and (b) competition and mutualism.

### Responsibility for Adaptive Variation, Selection, and Retention

*Variation.* Much literature on organizational innovation has an "innovation" bias which assumes that innovation itself is useful (Clark, 1987). Innovation in routines can be random or harmful, however, especially if current routines are the product of trial and error learning in a stable setting (Holand, Levitt, and March, 1988; Miner, 1991). In general, then, the organization is more likely to survive and prosper when **potentially valuable** innovation occurs.

For technology driven organizations this presents a familiar but difficult problem. If a manager could specify *exactly* in advance what needs to be discovered to produce a new product or solve a known technical barrier, the discovery—and high priced scientists to make it—would not be needed. On the other hand, the organization can affect the types and levels of variation and/or innovation in several distinct ways.

One thing organizations do to facilitate useful variation is engage in *institutionalized experimentation.* Formalized research and development has existed, of course

since the end of the last century (Freeman, 1982). In firms, it may range from highly unstructured research to very focused projects designed to solve quite specific technical problems. More recently, the roles of "champion" and "entrepreneur" have been made explicit, providing a conscious engine of variation within some organizations (Maidique, 1980; Quinn, 1986). Several total quality management statistical control practices also embody institutionalized experimentation (Deming, 1981). Finally, some firms create parallel projects in which several teams work on the same general technical problem, generating intentional variation among potential new technologies. In the development of the VCR, for example, Sony is reported to have had more than five teams working on development of early VCR prototypes.

Firms also provide *direct and indirect incentives* for individuals to produce valuable variation. Many firms seek to establish that useful innovation is part of normal employee duties. Total quality programs emphasizing continuous improvement through employee suggestions seek to establish such expectations. In scientific areas, firms sometimes intentionally create direct competition between individual scientists, for example with competitive rewards of status and scientific resources. Others also provide specific material incentives for discoveries such as a percentage of licensing fees from patents produced by the new ideas. In exteme cases, venture divisions are set up in which employees involved in risky projects share an equity interest in new products to be developed.

Finally, firms sometimes even tacitly acknowledge the value of unfocused variation or pure *playfulness* (March, 1976). Research labs embrace informality in part because they cannot keep good scientists in other ways, but also because informal contact may encourage completely unplanned variations in ideas. "Skunkworks" are tolerated or even encouraged, in which small groups of employees work informally on unapproved projects. Organizations may tolerate a certain level of slack resources as a form of hidden permission for variation to occur (March, 1976, 1991). Table 5.1 summarizes these activities along with examples of mechanisms used for selection and retention.

Management theory has tended to see many of these practices to induce promising innovation as a special activity required of scientific or artistic organizations whose immediate survival depends on innovation. In an evolutionary framework, they simply represent points in a continuum of ways in which management in all organizations facilitates variation. At one extreme of the continuum lies classical rational planning. Here, the manager sets a goal, examines alternative actions available to meet a goal, chooses the best actions, and assures their implementation. The variation process occurs as alternatives are considered *before* action. The variation occurs symbolically or vicariously. The selection process then occurs when a choice is made between the symbolized alternatives. Rational planning and choice, then, represent one mechanism for variation and selection.

At the other extreme of the continuum lies permission for playfulness, in which management encourages variation with almost no control and no direct involvement in its content. Variation mechanisms differ in terms of how much management directly produces the specific content, whether the content is symbolic or enacted, and whether the entire process is intentional or not. However, the role of stimulating appropriate variation is universal.

TABLE 5.1 Sample Organizational Variation-Selection-Retention Processes

| *Variation* | *Selection* | *Retention* |
|---|---|---|
| 1. Institutionalized experimentation<br>a. Research and development<br>b. Champion and entrepreneurial roles<br>c. Some total quality experiments<br>d. Parallel projects | 1. Goals | 1. Active controls<br>a. Budgets<br>b. Information systems<br>c. Audits |
| 2. Direct and indirect incentives<br>a. Innovation norms<br>b. Professional individual incentives<br>c. Material individual incentives value<br>d. Equity interests | 2. Values | 2. Formalization<br>a. Rules<br>b. Job descriptions<br>c. Procedures<br>d. Research protocols |
| 3. Playfulness<br>a. Informality<br>b. Skunkworks<br>c. Slack resources | 3. Project criteria | 3. Social values |
| | 4. Project checkpoints | |
| | 5. Competition<br>a. Shoot-outs<br>b. Managerial competition for resources | |

*Selection.* In the rational choice model of management, selection occurs through deliberate managerial choice among alternatives for future action. Once more, however, there is a continuum of approaches management may use to execute or facilitate adaptive selection processes. *Setting goals* but not determining the methods to reach them represents a first move away from complete advance selection of action by the manager. Goals can be seen as a device for providing selection criteria for lower levels of employees to use in determining what they should do (Quinn, 1980; Imai, Nonaka, and Takeuchi, 1985). Employees can ask the question, Does this action or routine further progress toward goals X? as the criterion for selection actions to take and routines to retain. The goals establish premises for decisions made by others in the future (Simon, 1976).

Where fundamental uncertainty or ambiguity is involved, however—as in basic science, some areas of product design, artistic ventures, or times of powerful exogenous change—management may lack the knowledge to specify clear goals in advance.

Managers in high tech companies sometimes eschew narrow goals and *establish broad values* instead. The values can be instrumental—"Will this project further our general value of completing profitable innovations?"—in which case they verge on goals. But they may also be broadly normative—"Is this what a world class biotechnology company would do?" For example, observers note that upper management exerted indirect control at Epson through promoting a value of "thinking the unthinkable." This slogan helped sustain an unwritten rule of thumb that the next generation project should represent a 40 percent improvement in the last generation

(Imai, Nonaka, and Takeuchi, 1985). Values may permit actors to follow a logic of appropriateness rather than instrumentality (March and Olson, 1989).

Management may put in place *preidentified checkpoints* or establish very *basic screening criteria* for project survival. Quinn (1986), for example, describes "chaos within milestones," in which managers give only very broad goals but specify certain decision points at which they will intervene, along with a few critical technical limits. Large firms dependent on new product development routinely attempt to use screening criteria such as minimal level of anticipated return on investment or maximum time intervals before the break-even point.

In some cases, it may even be inappropriate to establish criteria before the actual selection process. In technology management, organizations often set up powerful competitive processes with only modest specification of ultimate selection criteria to be applied. For example, a firm may use parallel teams to generate variation and then arrange for formal "shoot-outs" between the teams (Quinn, 1986). Part of the final shoot-out may include *competition over what standards should be applied* to the product choice. Teams working on different early VCR technologies, for example, needed to persuade upper management that the features on which their design excelled were most relevant to commercial success.

More broadly, individual managers have long set up informal competition between divisions and departments for budget allocations, attention, and institutional legitimacy (Pfeffer, 1981a). Strategic contingency theory argues that departments that mediate critical external dependencies and uncertainties tend to receive more resources over time (Salancik and Pfeffer, 1977). The political struggle within the organization then becomes the selection mechanism that leads to the dominance of certain departments and routines. Senior managers consciously facilitate such a process, providing funds and legitimacy to several units, designing the rules of the game, and waiting to see who makes the best case for further funds and investment. The evolutionary framework would regard these processes as one possible selection system whose effectiveness would vary under different conditions.

*Retention.* The crucial concept underlying the retention process is that of consistency. Constant innovation prevents the system from harvesting the value of prior innovation, a crucial competency for adaptive systems (Holland, 1975). In rational planning, variation and selection occur in the planning phase. Implementation and control systems then constitute the retention process: the manager seeks to maintain consistency beween the actions outlined in the plan with the actual behavior of individuals and groups. The formal plan may itself work as a mechanism to create consistency across time and units. Active review through budgets, management information systems, and audits is used to seek consistency by controlling behavior across time and subunits. Once more, however, alternative devices can also sustain retention.

*Formalization or codification* of apparently effective routines—whether planned or not—serves as a retention process. Management may formalize apparently successful actions into rules, policies, organization charts, job descriptions, or research protocols, moving the practices into the "taken for granted" part of organizational life. The U.S. Army, for example, provides its members with handbooks of explicit,

illustrated microroutines for literally hundreds of situations (Department of the Army, 1990). Total quality efforts to identify "current best practices" similarly seek to enhance the chances effective routines will be followed by all. Specific routines may even be codified physically through such practices as redesigning equipment to encourage specific behaviors or drawing lines at the place a worker should stand at a particular machine.

Technological organizations have long contended that their need for effective and rapid variation forecloses using written formalization as the primary retention mechanism. Many high tech firms seek to sustain consistency through company "cultures" and informal socialization into particular *values*. One can argue that Japanese firms can avoid detailed narrow job descriptions precisely because lifetime employment enhances such shared values (Miner, 1990). Thus while values can serve as a selection device for future action, they also serve as a retention mechanism.

## Responsibility for Balance

Managerial action affects not only the specific modes of variation, selection, and retention, but also the continuous balance between internal evolutionary processes. Two relationships are especially crucial: (1) the balance between variation and retention, including questions of incremental versus radical variation, and (2) the balance between competition and mutualism.

*Variation and Retention.* The manager who increases the relative level of investment in research and development for product innovation has decided that variation must be increased relative to retention. Many observers have noted that the potential value of new discoveries must always be weighed against the value of harvesting current knowledge (Holland, 1975; Levitt and March, 1988; Miner, 1990; Leonard-Barton, 1991).

In a stable, clear environment variation in the world can be represented rather well in "thought experiments" in the planning process and in traditional managerial control mechanisms used for retention. Even if causal processes are not known, effective trial and error learning can occur. Visibly effective procedures, machines, policies, or people can be selected and sustained for long periods, although the reason they are effective is unknown. The crucial task is to maintain high consistency in organizational action (Deming, 1981; Hannan and Freeman, 1984). Thus, in a stable environment the retention system should be very strong relative to variation, and selection mechanisms can be stable and stringent (Miner, 1990).

A changing or ambiguous setting can shift the required balance, however. If no current routine will be effective for long, higher levels of variation are needed to provide sufficient candidates for new routines. If the effects of routines are very ambiguous, higher levels of experimentation are needed to permit organizational learning. Traditional expectations about 'organic' organizations under uncertainty reflect these ideas. In addition, strategic management theorists have noted for some time that senior managers play a crucial role in designing the overall balance of discovery versus continuity (Mintzberg, 1973; Burgelman, 1983). The specifically evolutionary perspective implies in addition that (1) *all* managers must continuously assess this

balance, (2) hidden factors may crucially affect the balance, and (3) managers must address issues of incremental versus radical change.

*Levels.* The evolutionary perspective implies that managers at all levels need to address this balance continuously (Weick, 1979; Robey, 1982; Miner, 1990) because variation and selection are continuous at all levels of the organization. Operational managers in high technology firms that use cross-functional teams for product development, for example, have reported that one crucial task is to achieve the correct balance of variation—through new team members and diversity in functions—and continuity—through experienced team members and fewer functions (Imai et al., 1985; Williams, 1991, personal communication). In a study of university administrators Miner (1990) observed a midlevel development officer who steadily generated well-researched mathematical plans for future fundraising efforts but also put together unusual groups of volunteers in surprising settings and encouraged irrelevant topics in meetings. He believed he needed a minor but consistent flow of such inefficient activities to maintain a successful fundraising program in the long run.

*Hidden Factors.* Deciding how much to invest in research and development relative to manufacturing is a decision that obviously affects the balance of variation and retention. Decisions on organizational structure, accounting systems, and human resource policies also affect the balance, however. They may be especially powerful, because their effects are pervasive but invisible.

Some high technology firms, for example, make many natural experiments in structural revisions with high impact on the relationship between variation and retention (Peters, 1990). Consider a firm whose leadership acquires a small innovative scientific firm. To keep the innovative culture, they turn this firm into a research driven division which balances the original manufacturing core of the original company. To hold key high risk research scientists from the new division, however, the firm creates a scheme in which scientists with high risk new ideas can help create a venture subsidiary partially financed by the company. The scientists then hold equity interest in the subsidiary they work for. If the new ideas pay off, the firm reintegrates the subsidiary and the scientists realize exceptional gains.

After ten years the firm finds that the subsidiary system designed to foster innovation (variation) creates problems in the main firm that threaten the entire firm's survival. The firm cannot maintain sufficient morale or consistency within the manufacturing division and reintegrated subsidiary personnel. Yet it cannot survive without these core divisions which produce the products and incremental research. The firm then gets rid of or reduces funds allocated to the subsidiary system to adjust the balance of variation and retention in the total system.

Similarly, choices of accounting and human resource practices affect the ongoing balance and mechanisms for variation and retention. Activity based accounting, for example, can change the apparent cost basis for innovative products and provide visibility to the effects of process innovations. Internal promotion and training policies profoundly affect not only the levels of retention but the types of consistency and variation in the organization. Information and decisionmaking structures can be modeled in which beliefs and values can themselves can evolve as a function of experience (Cohen and Axelrod, 1984).

*Incremental Versus Radical Change.* Punctuational theorists have argued that in most organizations, long periods of strong retention or incremental change are followed by occasional bursts of major variation and reselection (Tushman and Romanelli, 1985). Others (March, 1982) have suggested that continuous replacement of small routines may have major impact. Although wars, major technological advances, and social revolutions may lead to periods of radical variation outside managerial control, managers can affect the balance of incremental versus radical variation and retention shifts. Indeed, much writing on the management of technology focuses precisely on ideas about how managers can replace inertial patterns with sufficiently strong incremental variation (Nonaka, 1988).

*Competition and Mutualism (Cooperation).* By competition I refer to situations in which two or more players have incompatible goals or requirements. The parties may or may not be aware of their conflicting interests. I define mutualism as occurring when each party's behavior enhances the other party's interests. When mutualism is intentional, it can be called cooperation. Much traditional theory has assumed that (1) mutualism should dominate relationships *within* organizations, while (2) competition should dominate relationships *between* organizations. The evolutionary framework implies that (1) competition and mutualism should regularly occur both between and within organizations, and that (2) an organization's balance between competition and mutualism at both levels will affect its survival and prosperity.

If an organization has clear, consistent goals, internal conflict and competition needlessly waste energy and reduce efficiency. We know, of course, that conflict routinely marks ordinary organizations (Strauss, 1978; Edwards, 1979; Pfeffer, 1981b). Current management texts also acknowledge that a certain amount of conflict can stimulate healthy action, internal cohesion, and invention (Aldag and Stearns, 1991; Dunham and Pierce, 1989). This prescription is typically grounded in heuristics, however, and is hard to link to rational planning models.

In an evolutionary perspective, the competition-mutualism conflict can be conceptualized as a special case of balancing variation and retention. The crucial concept in the process of retention is consistency: across time and across units. Competition, by definition, represents a form of inconsistency between existing routines or people (variation). Mutualism represents one type of consistency (retention). Looking inside organizations, we saw earlier that managers in high technology organizations sometimes (1) intentionally enhance conflict to generate innovations from current practices (variation), (2) use direct competition to select between variations (selection), and yet, and (3) seek cooperation and congruence in exploiting the innovations (retention).

Looking at the organization's external links, it has become a cliché to note that firms in many fast-moving technological areas now form a variety of cooperative organizational arrangements such as formal joint ventures, research consortia, complex subcontrasts, and joint technological projects. Interorganizational mutualism has always existed, however, including direct cooperation in trade associations, educational associations, private elite clubs, and professional associations. The complex relationships among high technology firms are not a new phenomenon but simply reflect a shift in the balance and forms of interorganizational mutualism.

The evolutionary framework highlights the fact that competition and mutual-

ism routinely occur within a single relationship. Firms in successful joint research projects, for example, may jointly develop 'precompetitive' findings which will help one country's industry survive international competition. Each firm must simultaneously guard its distinctive competencies, however, because of direct economic competition from the other firms in the consortium.

## Research Implications of the Evolutionary Model of Managerial Action

The evolutionary perspective suggests several areas for research, including: (1) the value and dangers of competency driven action, (2) recombinations of organizational routines as a source of useful innovation, (3) acquisition of external routines, and (4) second-order interactions between organizational routines. Such research should prove fruitful if it is closely linked with research on the relationships of social interaction routines and the nature of symbolic routines.

*Competency Driven Action.* For the most part, management theory aggressively cautioned managers about the danger of using current competencies to pick future actions. There are solid theoretical grounds for this position, of course. Managers may fail to see obviously better practices because they do not search beyond current routines. In addition, "competency traps" may arise in which the organization are aware of alternatives but fail to choose them because of switching costs (March, 1991). The short-term lure of exploiting current competencies takes the organization down a path which ultimately leads to failure (Starbuck, 1983; Levitt and March, 1988; March, 1991).

For example, when only firms that have competency in a new technology will survive, action based on old competencies by other firms can lead to their failure. Indeed, it is widely believed by students of the management of technological innovation that firms with a highly developed competency in one generation of a technology may be least likely to survive in the next round of competition, because the temptation to exploit their existing base will be too strong to overcome (Cooper and Schendel, 1976; Peters, 1990).

On the other hand, competency driven action has consistently been observed (Cohen, March, and Olsen, 1972) and can clearly represent an intelligent practice. Change can be costly and lead to unintended destructive outcomes. Reliability or consistency in and of itself may enhance survival (Hannan and Freeman, 1984). With an abundance of both problems and opportunities, it may be efficient to "build capabilities and then encourage the development of plans for exploiting them" (Hayes, 1985:118). Miner (1985) argued, for example, that building jobs around existing employee competencies may be a sensible strategy in the face of uncertainty and ambiguity and found some evidence consistent with this idea. Strategy research in general has increasingly argued that firms should try to identify and exploit core competencies. Quinn (1980) stressed "logical incrementalism" in which the firm generally exploits current competencies, making incremental adaptations as exploratory probes of alternative pathways.

In general, the management literature has combined a theoretical preference for avoiding competency based action with the field based observation that it sometimes *makes* sense. The evolutionary framework provides a theoretical rationale for both competency based action and its dangers. The organization is a bundle of routines, some of which constitute crucial competencies (Aldrich, 1978; McElvey, 1982; Winter, *1987).* Competency driven action focuses on capturing value from existing routines, the underlying purpose of retention processes. Research, then, should focus on conditions enhancing the likely value of competency based action (retention) versus that of the search for new competencies (variation).

*Recombination of Organizational Routines.* Theorists have long noted that systems may be more efficient if they are composed of stable subunits which can be reassembled, if necessary, after shocks (Simon, 1957). More recently studies of adaptive systems have emphasized that recombinations of routines or subunits have powerful adaptive potential (Holland, 1975). Indeed, while early models of genetic evolution focused on individual mutations as a major engine of change, later work emphasized recombinations of genes and groups of gene fragments as the source of importance genetic innovation. Similarly, early theorizing about organizational innovation focused on wholly novel individual practices.

Increasingly, field research points to recombinations of existing routines as an important source of fruitful change (Schroeder et al., 1989). Product innovation, for example, may consist of recombinations of existing products. Manufacturing flexibility, innovation, and speed may depend directly on the use of preidentified subunits or technological modules. Crucial innovation also arises for new combinations of preexisting products and marketing channels. For example, Timex combined certain watch technologies with the new marketing channel of drugstores (instead of jewelry stores) (Abernathy and Clark, 1985). Administrative reorganization may consist of reassigning old sets of duties to existing employees in new ways that lead to substantial change.

The idea that recombinations of old routines may have important impact has powerful implications. It implies we cannot deduce the original scale of managerial intervention from the scale of impact. Small interventions—if they produce crucial recombinations—could have major impact. Similarly, innovations may have little or no impact unless combined with other routines. If so, we may need to remain agnostic about the ultimate impact of particular practices which research has shown to have little effect when studied separately. For example, Kochan, Cutcher-Gershenfeld, and MacDuffie (1992) suggest that employee involvement may indeed have little reliable impact when implemented by itself, but powerful effects when combined with other new managerial practices.

Studying recombinations or organizational routines should prove somewhat more tractable for quantitative empirical work than studying the formation of initial routines themselves. While recombinations of technical routines offer an obvious starting point, recombinations of administrative routines may yield more fundamental results. Fruitful questions include both the degree of evidence that recombination is an important source of variations and insight into how managers might design routines to offer the highest promise for recombinations.

*Incorporation of Routines from External Sources.* While studies of the diffusion of innovations track routines moving from one organization to another, they have not yet yielded a comprehensive, empirically supported theory about the processes and impact of importing routines (Clark, 1987). The evolutionary perspective directs attention to imitation as an intelligent way of acquiring new routines (generating variation). It can be more efficient than invention or trial and error learning, allowing others to absorb the costs of search and experimentation (Dutton and Freeman, 1985; Teece, 1987).

Because the organization is nested in a dynamic system of interacting organizations, however, imitation may or may not be a consistently effective tool for organizational survival. Among other things, imitation may lead the organization to copy faulty practices, may attract it into areas that have already been exploited, or may cause it to wait when fast action would be preferred (Dutton and Freeman, 1985; Bourgeois and Eisenhardt, 1988; Lant and Mezias, 1990). Although recent related work has included field studies and simulation studies, clearly additional empirical research is needed on the impact of importing routines. In addition, much work remains to be done on the actual processes and costs of being able to import external routines (Van de Ven and Poole, 1989; Cohen and Levinthal, 1990).

Many observers have noted that benign opportunism and improvisation routinely occur in organizations (Alinsky, 1971; Quinn, 1980; Miner, 1987). The evolutionary perspective should permit us to move from rediscovering the existence of such behavior and explore when such behavior is most likely to be productive and what skills support effective scanning and importation.

*Second-Order Interactions.* Existing theory already identifies many more complex ecologies of interacting organizational routines above and beyond the simple variation-selection-retention model (Nelson and Winter, 1982; Levitt and March, 1990; McKelvey, 1982; March, 1991). The validity of intuition falls away quickly when we consider second-order effects of interactions of routines. Qualitative researchers have already documented in careful ethnographic research the banality of surprises (March and Olsen, 1976; Strauss, 1978; Van de Ven, Angle, and Poole, 1989), accidental combinations of people and events (Allison, 1971; March and Olsen, 1976), and the role of serendipity in even major organizational change (Allison, 1971; Quinn, 1980). Even simple models of interacting routines can and most likely will produce unexpected—even startling—outcomes (Schelling, 1978).

Simulation studies are attractive for studying these interactions, because they permit one to model multiple elements interacting over multiple trials, with specifically stochastic elements built into the process these studies serve the useful function of testing our intuition against the actual implications of particular mathematical assumptions and suggest important possible second-order effects (e.g., March, 1991). However, the sensitivity of simulations to assumptions and their degrees of freedom make them unsatisfying as the primary tool for exploring this area. Direct field research on the interaction of routines over time is called for at this time (Hutchins, 1991; Miner, 1991; Van de Ven and Garud on coevolution, chapter 20, this volume).

It will be particularly helpful to try to identify circumstances under which small variations may cascade into systemwide outcomes, or in which patterns of effects are counterintuitive (Starbuck, 1976; Weick, 1979; Van de Ven, Angle, and Poole, 1989;

March, 1991; Ginsberg and Baum, chapter 7, this volume). At a minimum, field research may provide a warning about where prudence is most needed. At best, it could point to circumstances in which small interventions (or lack of intervention) could have large positive consequences.

*Linkage with Other Current Perspectives.* Although research on the themes described should prove fruitful, it could lapse into a sterile exercise unless it builds on and extends current work on the role of social interaction and the role of symbolic routines.

*Social Interaction and Organizational Routines.* Some theorists have argued that crucial variation and selection processes operate over individual human beings (Starbuck, 1976; Aldrich, 1979; McKelvey, 1982; Boyd and Richerson, 1985). Variation occurs among individuals, some of whom are selected to remain or be given more influence. New organizational patterns arise from the activity of these new individuals.

For the most part, however, most evolutionary discussions of organizational change discuss routines as though they exist independent of individual human beings (Cyert and March, 1963; Aldrich, 1979; McKelvey, 1982; Nelson and Winter, 1982). "Standard operating procedures," assembly lines, accounting practices, rules of war, and strategies, for example, evoke images of disembodied entities removed from day-to-day human interaction. Like structural and rational theories, evolutionary models can easily lapse into ignoring social interaction (Granovetter, 1985).

Most observers of technology transfer, for example, have concluded that personal interaction plays a central role in the fruitful transfer of new technologies. But the processes are likely to be more complex than simple communication of information across known dyads. "Information" does not move about in organizations as a disembodied, atomistic entity (Granovetter, 1985; Leonard-Barton, 1990; Papa, 1990). Competencies may also be embedded in the day to day functioning of informal social networks of practice (Barley, 1988; Brown and Duguid, 1991; Hutchins, 1991). Networks of practice may even function outside the full awareness of their members (Hutchins, 1991). Imitation may occur through structural rather than direct mechanisms.

What is needed now is more precise theory on the subtle ways through which social ties relate to organizational routines. Two issues deserve attention. First, how does individual behavior—which may or may not be the product of stable traits—create and support organizational routines (Berger and Luckman, 1967; Zucker, 1977; Strauss, 1978; Barley, 1988; Miner, 1991)? Second, how do social networks themselves function as agents or objects of selection (Baum, 1988)?

*Symbolic Routines.* Although Weick (1979) put the active human interpretive role of organizations at the forefront of his evolutionary model of organizations, empirical research on this theme has proved difficult. Two directions offer substantial promise at this time, however. First, we can use a variation, selection, and retention framework to study symbolic routines. In doing so, we will need to incorporate the instability in the meaning of events as well as uncertainty about which particular event will occur, however (Weick, 1979; Dutton, 1993). Early research on innova-

tion, for example, tended to treat innovations as though they were stable collections of fixed technical routines passively absorbed by adopters. Later work showed that developers and adopters of innovations often unbundle and reinterpret the meanings of subroutines (Van de Ven, Angle, and Poole, 1989; Dougherty, 1992). An evolutionary framework suggests looking for events which affect the unbundling of combinations of symbols or open unclaimed fields of meaning. These periods permit variation and competition over the meaning of routines. In a work setting, for example, Barley (1988) describes periods in which radiologists and technicians actively negotiate the meaning of their own actions after the introduction of new technology. At other times, the meaning of certain actions becomes part of a take-for-granted set of stable roles (retention) (Berger and Luckman, 1967; Barley, 1988). Current work on knowledge structures within organizations provides an important foundation for this line of inquiry (Walsh, 1990).

Second, we need to study how symbolic and material routines interact. Symbols, of course, have quite material impact in human affairs. Legitimacy facilitates the flow of actual resources; symbols enhancing trust lead to real actions of generosity. In the technology area, observers have noted that the fate of new products can be influenced by the precise way they are linked (or not linked) to dominant beliefs about firm competencies (Leanard-Barton, 1991). Most observers of organizational change note that linking a new routine to existing core competencies or values enhances its legitimacy. On the other hand, managers sometimes consciously sharpen the distinctions between new projects and current core competencies as part of a broader renewal process (Leonard-Barton, 1991).

Interestingly, the existence of ecologies of symbolic routines implies there may be more degrees of freedom for managers than implied by traditional models of technological evolution. If managerial innovation involves active interpretation of ambiguous internal and internal events, then managers can introduce variation not only by introducing a new practices or products, but by reinterpreting old practices and products in ways that carry new meaning (Daft and Weick, 1984).

Nearly a decade ago, Pfeffer (1982:1) lamented, "The domain of organization theory is coming to resemble more of a weed patch than a well-tended garden." The internal evolutionary perspective has generally been regarded as an amusing but marginal theory in this garden: useful perhaps as a metaphor for arts and scientific organizations, or for irreligious questioning of ideologies of managerial control. In this essay I suggest in contrast that the evolutionary perspective represents a strong candidate for an integrated general theory of managerial action.

In this framework, managerial action can affect the organization's internal evolution, the evolutionary system in which it is nested, and the coevolution of organizations and their contexts (Tushman and Rosenkopf, 1992; Baum and Singh, chapter 18, this volume). Managers appropriately seek adaptive advantage through increasing the probability that their organization both survive and prosper over time. Focusing on the internal processes, I have described managerial action as affecting variation, selection, and retention processes both separately and in relation to each other. Close examination of these steps indicates that in many cases one can reframe apparently contradictory current theoretical models—including rational, political, and learning models—as special cases of the more general evolutionary framework.

Adoption of the evolutionary framework as an overarching normative theory carries obvious dangers. Empirical research on internal evolution has proved difficult. A new literature with complex theoretical elaboration but little solid empirical research is not needed. In addition, it is easy to lapse into dangerous functionalism when using this perspective, blindly assuming that whatever is, must be good (Hannan and Freeman, 1977; Gould, 1980).

On the other hand, this framework offers several advantages. First, it is inherently dynamic and interactive, consistent with many seasoned observers' intuition regarding processes underlying organizational action. Second, although at first glance it appears contradictory to several current theories, it can actually incorporate and suggest links between the theories. A textbook grounded in this framework, for example, could begin with an overarching vision of nested evolutionary systems and treat traditional planning, organizing, directing, and controlling steps as appropriate vehicles for variation, selection, and retention under conditions of some stability. Organizational change, entrepreneurship, and technology management—which sometimes appear as awkward appendages to the planning model—could describe the alternative variation, selection, and retention devices managers use under less stable or clear conditions.

Third, the evolutionary framework generates potentially fruitful research questions, including (1) the role of competency based action, (2) innovation through recombinations of routines, (3) acquisition of routines from outside organizations, and (4) unintended outcomes of organizational practices. Such research would appropriately incorporate issues of social ties and symbolic organizational routines. An obvious additional area for immediate attention is the link between organizational evolution and organizational learning (Miner, 1991).

In terms of applied research, this framework offers an intellectually responsible structure for research on current trends such as total quality practices, problems in product development, technology transfer, and interorganizational cooperation. Managerial practices in high technology organizations are themselves organizational routines that have diffused over time and may represent both superstitious and appropriate learning, for example.

Finally, the evolutionary framework may assist managers not only through applied research, but through influence on their conception of management's role. The evolutionary approach described here implies managers can affect organizational outcome, but only on a probalistic basis, and only by using highly varied influence techniques including process design, political processes, improvisation, and symbolic routines. The approach does not reduce the stature of the managerial role but implies a fairly subtle but heroic managerial mission. A realistic understanding of this mission may better equip current managers to deal realistically with the current explosion of competition, international communication and trade, social diversity, and technological change.

Overall, then, the evolutionary framework offers refreshing verisimilitude, and the potential for integration of multiple theories, rich research, and potential practical value. In terms of Pfeffer's concern about the ill-tended garden of organization theory, evolutionary theory may offer a previously hidden underlying pattern for the existing plantings, while also providing fertile ground for promising new growth.