

The Cultural Ecology of the Corporation: Explaining Diversity in Work Group Responses to Organizational Transformation

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The concepts of human and cultural ecology are extended to explain divergent work group responses to a transformational change program in a Fortune 100 manufacturing corporation. The internal environment of the corporation, specifically the product development process (PDP), is conceptualized as an ecological system containing a diverse population of distinctive work group subcultures. Different ecological zones within the PDP harbor populations that may be distinguished on the basis of work niche and effective environment (including relationships with other work groups and the availability of computing resources). Although work groups in different ecological zones are found to be virtually identical with respect to demographic characteristics, they displayed highly divergent responses to the transformation initiative (a change program aimed at the commonization of tools and methods involved in the PDP). Differences in work group responses to change are explained as a logical outgrowth of complex interactions among communities of work groups and their environments.

The cultural diversity of American work organizations is a fact that is recognized increasingly in the literatures of organizational and management science. Where organizations once were portrayed as cultural monoliths (e.g., Peters & Waterman, 1982; Schein, 1985), there is a growing appreciation for the multiplicity of cultures

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that coexist within a single corporate entity (Gregory, 1983; Trice & Beyer, 1993). Cultural diversity within the corporation reflects the diversity of social groups that exist on the inside—social groups that may be viewed as *subcultures*.¹ The literature has identified a wide range of social groups that give rise to subcultures within corporations including occupational communities (Van Maanen & Barley, 1984), functional units (Briody & Baba, 1991), geographical locations (Hamada & Sibley, 1994), and countercultures that form around personalities (Martin and Siehl, 1983). The cultural complexity of American corporations is exacerbated by the fact that myriad internal subcultures exist in relation to a larger cultural context that is itself diverse—the culture(s) of American society. The most fundamental source of cultural diversity in corporations is the heterogeneity of American society.²

A variety of interrelationships exist among the diverse subcultures of the corporation including various types of relationships between professional or occupational subcultures and managerial elites (e.g., accommodative and assimilative relations; see Trice, 1993), power hierarchies and/or egalitarian networks connecting nonmanagerial occupations, and bonds of cultural identity linking internal subcultures with cultural communities *external* to the corporation (e.g., ethnic or racial groups, occupational or labor communities, or transnational elites; see Applebaum, 1984; Trice, 1993). Managerial elites play an especially important role in such relationships because their policies and practices shape the internal environment of other corporate subcultures.³

The complex relationships among diverse subcultures in the American corporation are not simple or easy to conceptualize theoretically, particularly given the theoretical limits of the culture concept (Baba, 1989). In a complex society, the classical concept of culture—developed initially to explain differences between small-scale, relatively homogeneous societies—is challenged by a profusion of competing, conflicting, and collaborating social groups whose boundaries are permeable and whose memberships may overlap, with allegiances shifting contingent on the situation at hand (Hamada & Jordan, 1990).

Several potential models of multilevel cultural interaction have been proposed, but each has inherent limitations. One intuitively appealing approach views cultures at different levels of analysis—national, organizational, and/or internal subcultures—as hierarchically related, with cultures of smaller scope and scale (e.g., organizational or occupational subcultures) nested inside those of larger proportions (e.g., national culture; see Baba, Hill, & Falkenburg, in press). Elegant in its simplicity and useful in certain ways, this model is perhaps overly deterministic and fails to consider that many subcultural forms cannot be explained simply as subsidiary derivatives of a single larger culture. Another approach, captured by the metaphor of organizations as holograms (Morgan, 1986), suggests that each subculture is a miniature replica or microcosm of its larger host. In reality, however, no subculture (by definition, and especially in a heterogeneous society such as the United States) is ever a perfect

recognizing the balanced reciprocity phenomenon in Case 1. I am most thankful to anonymous managers and workers at MDC (fictitious company name) who provided access to their organization, spent hours helping us to understand what was going on and correcting our misconceptions, and supplied ample funding that enabled us to continue our research for 4 years. Any errors or omissions in this article are strictly the author's responsibility.

reflection of the larger cultural body. Theoretical models that rely on historical analyses of power and hierarchy to explain intercultural relations (e.g., critical theory) certainly are relevant because interactions between cultural levels and subcultures often involve implicit or explicit struggles for domination and control of resources. There are some phenomena, however, that such models neglect (e.g., balanced reciprocity between peer-level subcultures). Finally, the notion of an ego-centered, shifting web of cultural orientations (Frost, Moore, Louis, Lundberg, & Martin, 1991) provides an intriguing mechanism for relationships between cultures. If each individual is capable of living in several subcultures simultaneously, then multiple subcultures should not be viewed as "colliding billiard balls" (Wolf, 1982) but rather as fluid, interpenetrating pools of influence whose relative strengths are contingent on a variety of emergent contextual factors (Brannen, 1992). A limitation of this latter model is that it seems to assume that all forms of culture hold equal influence in the mind of the autonomous individual actor, a dubious assumption if the classical concept of culture is to be taken seriously.

An alternative theoretical framework—one drawn from human and cultural ecology (Hawley, 1986; Steward, 1955)—provides a robust conceptual schema for organizing ideas about complex relationships among diverse populations. Cultural ecology conceptualizes the culture of a human social group as a response to that group's environment including influences emanating from other cultures in that environment. Within a corporation, a subunit's environment is composed primarily of other human groups (rather than the flora, fauna, and climatic features that are emphasized in classical studies of cultural ecology). From this perspective, cultural diversity within a corporation not only would be a function of demographic differences between subgroups (e.g., occupational or ethnic differences) but also would reflect the subtle interplay and complex relationships that form among the subgroups. This approach has the potential to accommodate the simultaneous coexistence of hierarchical, egalitarian, shifting networks and other kinds of relationships among subgroups. Complex interrelationships among subgroups could be a powerful, generative source of cultural differentiation, a source yielding greater diversity than would be expected solely on the basis of demographic differences. Indeed, the cultural ecology approach predicts important differences between groups that, on the basis of demographic characteristics alone, would appear to be quite similar.

In this article, a cultural ecology framework is employed to describe and explain differences between the subcultures of work groups within and around a Fortune 100 American manufacturing corporation. This approach emerged from a 4-year study of work group responses to a major corporate transformation initiative. The company, Multi-Divisional Corporation (MDC, a fictitious name), in the late 1980s launched a massive effort to *integrate its product development process* (or PDP, a sequence of operations through which new products are designed, developed, and manufactured in prototype form). Integration meant the achievement of closer cooperation and coordination among different functions and units involved in the PDP, thereby enabling faster times to market for new products (an important competitive priority). A key aspect of the integration program was the replacement of MDC's many different and incompatible technologies and work processes with a single, strategic CAD/CAM⁴ system that would enable all work groups to access a common product database and

to share design information simultaneously via electronic communication. The program was aimed at the *commonization of tools and methods* or the *reduction of technical diversity* across the corporation. This strategy is referred to throughout the article as the *commonization program*.

Work groups in different areas of the corporation, including groups that were virtually identical with respect to demographic characteristics, displayed highly divergent responses to this initiative, revealing basic differences in work group patterns of behavior and belief. This article explains such diversity by showing that differences between work group subcultures are created and maintained through complex interactions among communities of work groups and their environments and that subcultural differences, once formed, play a crucial role in shaping organizational members' acceptance or rejection of transformational change.

DATA AND METHODS

Data presented here are drawn from a 4-year study of 15 MDC work groups located in several different divisions based in the Midwest. All of these work groups either were in the process of or had just completed pilot tests or full-scale implementation of new computer-aided tools and/or redesigned processes that were part of the transformation program. The types of work groups studied included product design, engineering support (e.g., transportation, purchasing), and manufacturing engineering. The membership of these work groups was overwhelmingly Anglo-American and male. This particular set of work groups provides a database that is especially well-suited to test the prediction about subcultural diversity in corporations stated previously (i.e., that we should expect differences between groups even where demographic characteristics are similar) because many of the common sources of diversity are (more or less) controlled (i.e., diversity based on differences in ethnicity or race, gender, geographical region, and even differences in type of work performed).

Members of our multidisciplinary research team spent 18 months observing work processes, attending meetings related to the PDP transformation program, and talking in depth with work group members and supervisors in the 15 work groups. In total, we spent approximately 400 hours in the field and conducted semistructured interviews with nearly 200 operations-level employees and their supervisors. For small work groups (less than 15 members), all employees were interviewed. For larger groups, a sample of employees stratified by age, role, and technological experience was interviewed. Table 1 provides detailed information on the work groups studied, hours spent in the field, and number of individuals interviewed in each work group. We also administered a survey on technology use and attitudes to 150 individuals across the work groups.

For each work group, a structured set of comparative field data was collected, including the following:

1. ethnohistorical material documenting the technological history of the work group and the larger division or company (for discussion of ethnohistory, see Baba, 1988);

TABLE 1
Database

<i>Focal Work Group</i>	<i>Hours per Site</i>	<i>Interviews</i>	<i>Questionnaires</i>
Zone I			
Design Group A	105	37	37
Design Group B			
CAD Group 1	142	65	31
CAD Group 2			
Zone II			
Transportation	72	38	52
Purchasing			
Supplier Quality			
Zone III			
NC Programming	50	30	16
Eight work groups in seven plants	32	29	10
Totals	401	199	146

NOTE: CAD = computer-aided design; NC = numerical control.

2. a work process map detailing the nature and steps of the work process before and after process change (developed by researchers using direct observation and one-on-one interviews with work group members; see Fetterman, 1989; Werner & Schoepfle, 1987);
3. observational data capturing work group members' actual use of the new work process and technology;
4. descriptive material on the general features of the commonization program as implemented at the work group level (developed by researchers through interviews with commonization program managers and observation of implementation activities);
5. user evaluations of the new work process and technology (from the emic, or insider point of view), developed through the procedure described by Briody and Baba (1991) in which work group members respond to open-ended questions about the benefits/advantages and costs/disadvantages of certain experiences;⁵ and
6. survey questionnaires administered on site to work group members and supervisors, with questions focusing on attitudes toward work process and technology change.

Field notes (including observation and interview data) were transcribed and stored electronically, and all such data were analyzed using formal content analysis techniques that permit the discovery of "native view" concepts and perspectives (i.e., emic coding; see Bernard, 1988). Tally 3.0 software supported the content analysis process (Pfaffenberger, 1988). Propositions and hypotheses regarding the interaction of work groups and their environments were generated from this analysis process and were validated with work group members and other stakeholders using ethnographic focus group techniques (Morgan, 1988). Before turning to a discussion of the data, we first review several key concepts that provide an intellectual framework for an ecological analysis. This review details the ways in which classical ecological concepts have been adapted for the study of internal corporate environments.

HUMAN AND CULTURAL ECOLOGY: RELEVANT CONCEPTS

The Concept of Population

The science of ecology is concerned with the relationships between living organisms and their environments. Human and cultural ecology extend this concern to include human sociocultural systems; human populations become the focus of investigation, in terms of their relationships both with the physical environment and with other elements of the human environment (e.g., other cultures).⁶ Cultural ecology, as developed by Steward (1955) and elaborated by other anthropologists in the 1960s and 1970s (see Ortner, 1984), was particularly concerned with the connection between culture-environment relations, on the one hand, and the way in which these relations influenced the interaction of elements within a sociocultural system, on the other. The internal patterning of a cultural system was viewed as the principal mechanism through which humans respond to environmental opportunities and constraints.

In this article, we focus attention on *formal work groups* within the corporation as the primary populations of interest. A work group is defined as the membership of a formal corporate subunit (e.g., department, team) that shares a common goal and a common set of work tasks and interacts regularly over relatively long periods of time (i.e., longer than 1 year). Such work groups may be viewed as subcultures when they develop distinctive and shared practices and beliefs pertaining to the conduct of work and when new members are taught these practices and beliefs as the correct way to do and think about work (e.g., see Orr, 1990). Not all work groups constitute subcultures. Only where members of a work group share an identity that is sufficiently coherent to enable them to conceive of themselves as a distinctive "us," with a unique history and a special set of ideas and practices related to the conduct of work, does a subculture exist. In MDC, formal work groups are differentiated from one another and segregated by several criteria including distinctive formal goals, a separate organizational structure, a common activity pattern, and a formal boundary. These criteria are sufficient to establish formal work groups as separate populations for purposes of ecological analysis (Hannan & Freeman, 1989).

The Concept of Environment

Environment is an ambiguous concept that may be defined in different ways from different points of view. Cultural ecologists have attempted to define the *effective environment*, including both objective (etic) and perceived (emic) conditions and characteristics of the cultural context that appear to have a bearing on group practices and beliefs (see Manners & Kaplan, 1972). An important element of environmental analysis is the identification of specific *ecological niches* that are inhabited by different populations. Niche also is a difficult concept because it can be defined only with reference to the behavior of its occupant (Hannan & Freeman, 1989). Generally speaking, a niche consists of a specific set of environmental resources that are used

and contributed by a specific population (Aldrich, 1979). In organizational ecology, several types of variables (or dimensions) have been used to define niches including resource abundance/scarcity; environmental homogeneity/heterogeneity, stability/instability, and concentration/dispersion; degree of domain consensus; and degree of turbulence.

In cultural ecology, the environment generally has meant the geographical, biological, and cultural habitat surrounding a whole sociocultural system (e.g., tribe or village). In organizational studies of ecology, on the other hand, the environment most often has meant the *external* context of an entire organizational system (e.g., the corporation's environment). Writers less frequently have characterized the *internal environment* of a complex organization, that is, the environment that exists inside a corporation yet is external to subunits within the company (for an exception, see Burgelman, 1991).

The cultural environment of any given work group has a number of components. First, there are *other work group subcultures* within the firm, including both managerial and nonmanagerial subcultures with which the focal work group interacts. Second, there are dynamic interactions among these other work groups, which together comprise the *overall culture of the corporation*. The corporate culture presents a special cultural context that must be considered in explaining a work group's behavior. Third, there are *multiple cultural contexts external to the corporation* that have an influence on it including the national, regional, industrial, ethnic or racial, and/or occupational cultures. A comprehensive analysis of a work group's cultural environment would include an examination of relationships within each of these cultural categories.

Because our study focused on work group involvement in the PDP of a major corporation, one logical approach to conceptualizing the environment would be to use the internal patterning of the PDP itself as a framework for thinking about the effective environment inside a corporation. In the PDP, new products pass through four broad phases including (a) concept origination, (b) engineering design, (c) engineering development and testing, and finally (d) manufacturing. Although MDC was attempting to *integrate* these four phases such that all phases would be considered simultaneously as the process unfolded, in reality each formal work group concentrated its efforts most intensely in one of these phases (e.g., design or manufacturing). For this reason, we conceptualize the internal environment of our work groups in terms of the PDP and its inherent stage-process structure. Two key dimensions of this environment that may be used to locate and differentiate work group niches within it are (a) the process phase in which most intensive work activities are conducted and (b) the proximity of the work group to the process itself, that is, how directly (or indirectly) the work group is involved in the key aspects of product development. Some groups clearly were central to the process (e.g., design groups that created the basic design of a part), whereas others were more peripheral (e.g., a transportation group that built and managed containers for moving parts from one location to another). The specific cultural dimensions of a PDP environmental framework include (a) the upstream and downstream work groups (horizontal direction) and managerial subcultures (vertical direction) with which the focal work group interacts, (b) the overall culture of the

corporation as it affects the PDP, and (c) cultural contexts external to the corporation including certain aspects of mainstream American culture and certain occupational cultures, that are especially influential in the PDP (e.g., the occupational culture of engineering).

Map of work group niches. The time-linear nature of the traditional PDP suggests the possibility of creating a map of focal work group niches in the PDP environment (see Figure 1). The map shows the location of each work group's primary tasks within the overall multiphase process and the group's proximity to key development tasks. Members of each work group were asked to locate their group on a two-dimensional map shown in Figure 1. The x axis represents the four phases of the product development process: direct (impact on the product), indirect (impact on the product through recommendations to other groups), support (no impact on the product itself). Each group's position on the map is thought of as its unique niche, defined both by its "address" in the ecological environment and by what it "does for a living" (i.e., the resources it uses and the contributions it makes to product development).

The Concept of Adaptation

A central concept in ecological theory is that of adaptation. The principle behind the ecologist's use of the term adaptation is that the population responds to changing environmental conditions (including changes introduced by sociocultural systems) in a way that enables the population to maintain or improve those relations with the environment that are requisite to the population's continued existence and well-being. Adaptation is viewed as a *process* rather than as an end state, thus avoiding the tautology that is created when adaptation is defined as survival in a changing environment, and survival is then offered as proof of adaptation.

Human ecology (Hawley, 1986) provides a useful addition to our thinking about adaptation by suggesting that communities of populations *collectively adapt* to environmental conditions, thus forming an interacting *ecosystem* composed of an interdependent network of populations and their environments. According to Hawley, an ecosystem is an arrangement of mutual interdependencies among units in which the group of units operates as a single whole, thereby maintaining a viable relationship with the environment. Two types of adaptive relationships among interdependent populations may be noted including (a) the *symbiotic* relationship, which involves collective adaptation by populations with different functional roles, and (b) a *commensalistic* relationship, defined as adaptation by a coalition of populations with similar roles linked in a horizontal manner. Outside the interdependent relationships, *competitive* and other types of relationships are more common.

In this article, we view the distinctive subculture of any given work group as an *adaptive response* to that group's environment, created by a pattern of interaction and interdependency among *communities or networks* of work groups in which the group is embedded. Our data suggest that distinctive subcultures form as a function of interaction patterns among work groups in such ecosystems. Once f

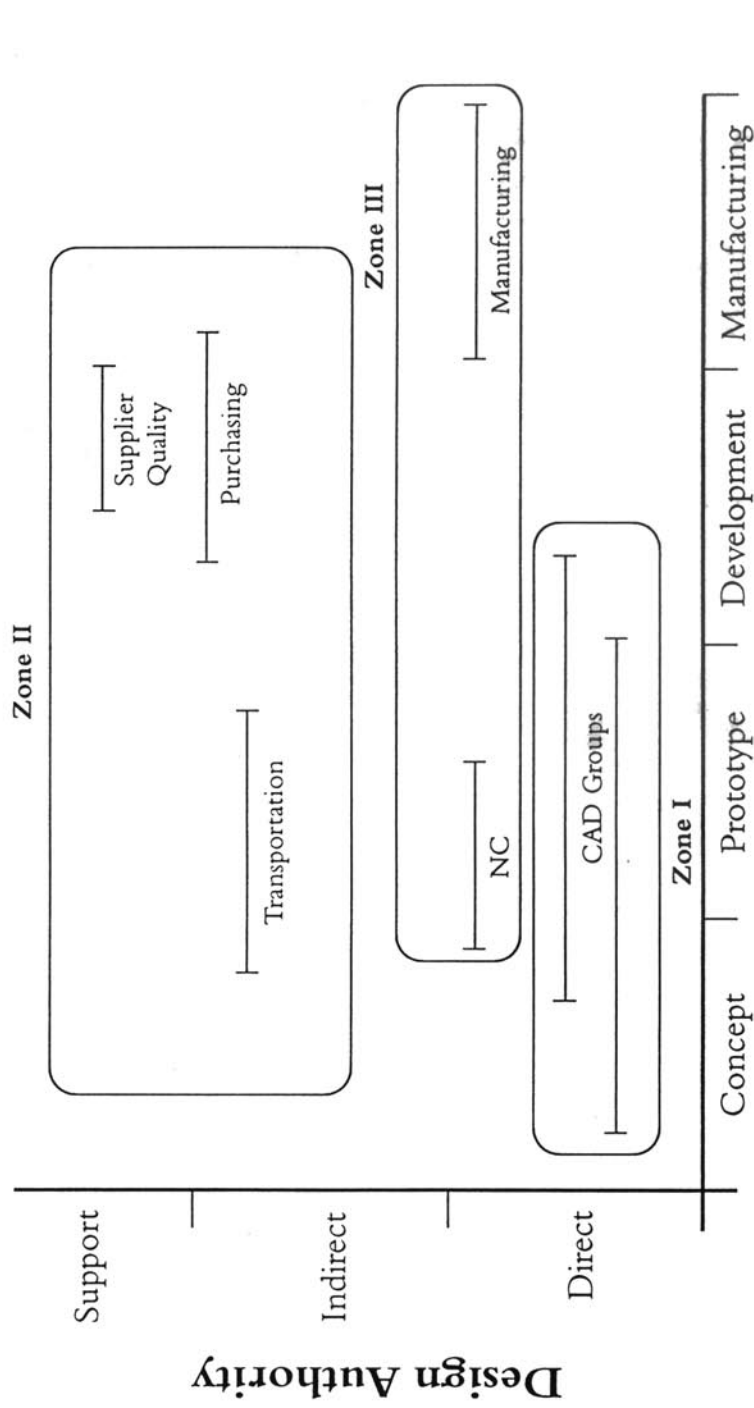


FIGURE 1: Product Development Process: Map of Work Group Niches

distinctive subculture then plays a role in maintaining ecosystem interaction patterns over time.

The Boundary Problem

A special problem in cultural ecology is the difficulty of determining the boundary between a cultural system and its environment. In the process of adaptation, environments influence cultures, and cultures in turn influence their environments, and so on in a never-ending feedback loop that makes it difficult to determine where a culture leaves off and an environment begins. The concept of an ecosystem—composed of an interdependent network of populations *and* their environments—resolves some of the conceptual difficulty around drawing a boundary by defining the population and its environment as an *integral system* (rather than viewing them as two variables, one dependent and one independent). In this system, relations between the network of populations and its environment are defined by *mutual*, rather than linear, causality. A mutual causality framework allows us to examine the processes by which these key systemic elements shape each other over time.

Using such an approach, however, does not eliminate the need for defining units of analysis (with the implication that such units must be bounded, even if mutually causal). Three types of analytic units, each with its own definitional boundary, are relevant to our analysis. First, there is the boundary between the *ecosystem* as an integral whole and whatever is external to that ecosystem. In this article, the focal ecosystem is the PDP; all groups engaged directly or indirectly in this process are considered part of the ecosystem. Second, there is the boundary between the *interdependent community of work groups* and what is outside that community. Here, a community is defined as a network of work groups within the PDP that directly sustain one another's core activity. Finally, there is a boundary separating each *work group subculture and its niche* from the network to which it belongs. This boundary is drawn around the formal membership of a work group and its core activity.

In the remainder of this article, these three ecological constructs are central to data analysis. The problem of blurred boundaries resulting from ambiguous membership was not found to be an issue in this study. In MDC, operations-level personnel were assigned to formal work groups with clearly defined memberships. The traditional, functional organization of MDC, and the relatively low degree of ethnic, racial, or gender diversity in the work groups studied, may account for the lack of such boundary problems.

The Concept of Change

Ecological change, defined as an irreversible and nonrepeatable process that involves alteration of an entire ecological system, usually results from an interaction of external forces and internal conditions (Hawley, 1986). Organizational ecologists have noted that organizations often display inertia in the face of environmental change (Hannan & Freeman, 1989). Selection appears to favor reliable performance and stability, meaning that organizations develop routines or habitual practices that are

highly resistant to change. An important debate in the literature of organizational ecology is between those who believe that organizations are basically inertial (meaning that new capabilities arise only when new types of organizations are born) and those who hold the contrary view that new organizational capabilities emerge gradually through conscious adaptation of existing organizations to environmental pressure (Hannan & Freeman, 1989).

The concept of ecological change and debates about the process by which change takes place are highly relevant to the present discussion. MDC's commonization program represented a significant *environmental shift* that challenged the existing structure and functioning of work group communities and their ecosystems. The commonization program attempted to change the nature of work group boundaries and exchanges, both by bringing some groups into close connection with other groups that traditionally had been culturally distant (e.g., design and manufacturing) and by eliminating important connections to other groups (e.g., pattern makers, who would go out of business as a result of new CAD/CAM technology). Commonization also aimed at changing the nature of available technological resources, reducing the diversity of available technologies, and forcing the channelization of work tools and methods. In our research, we found that in some ecosystems, work groups responded to this shift by vigorous efforts to maintain the status quo ante (i.e., resisting change), whereas others responded by participating actively in the process of ecological transformation (thereby transforming themselves). A key goal of the analysis in this article is to gain an understanding of the factors and forces that played a role in shaping these two divergent types of responses to environmental change.

THE CULTURAL ECOLOGY OF THE PRODUCT DEVELOPMENT PROCESS: A PRELIMINARY OVERVIEW

Early in the data analysis process, our research team discovered that work groups concentrating their efforts around the same general activities within the PDP shared a number of features that distinguished them from other groups. Three distinctive clusters of work group types were identified, with each cluster representing a different work domain or "zone" within the PDP. Zone I contained product *design* groups, Zone II was composed of groups that provided *support* to design and/or manufacturing, and Zone III was represented by several plant-based *manufacturing* engineering groups. Although the work groups in any one of these zones may have belonged to different divisions of the company, there were striking similarities within zones, and differences between zones, with respect to the nature of the work niche and the environment surrounding the work group including (a) nature and type of relationships with other work groups and (b) availability of computing resources. These zone characteristics may be viewed as key dimensions of different ecological communities. The relationships between key zone characteristics and selected ecological constructs are summarized in the following.

The nature of the work niche. The core work tasks that determine “what the group does for a living” embody much of what the group contributes to its environment and what it takes from the environment (i.e., the basic definition of a niche).

The environment: (a) Relationships with other work groups. These relationships define the network of interdependencies that structure the community. Certain groups are more closely tied to the focal work group in a mutually sustaining relationship, whereas others groups are more distant or nonsupportive.

The environment: (b) Availability of computing resources. The availability of critical forms of technology (in this case, computer resources) is a key feature of the environment and another defining characteristic of work group niches. Computer resources may be rich, with direct implications for the conduct of work activity, or they may be scarce, creating different niche conditions.

We describe, in the following, each zone with respect to these characteristics and relate these zone features to differences in work group responses to the commonization program.

Characteristics of Ecological Zones

Zone I: Design Groups

Our team studied a total of six different design groups in two major corporate divisions. Although the divisions produced very different components and were located in different cities, the six design groups had many features in common.

Nature of work niche. In this upstream zone, design groups created the detailed drawings or models that would be used to guide the engineering and manufacturing of new products. Because this creative technical work represented a core competency of the corporation (and thus was heavily protected from the competition), most of the design work was conducted in house (rather than being contracted to outside design houses).

Environment: (a) Relationships with other subunits. Design work groups were closely linked to development engineers, who in turn worked closely with high-status platform teams that directed the overall PDP. The primary attention of the design groups tended to be focused on upstream activities (i.e., concept development and design); they tended to be less interested in downstream activities (e.g., testing and manufacturing).

Environment: (b) Availability of computing resources. Corporate management viewed design technology as a competitive advantage in product development. Thus design groups were pushed to absorb emerging technological capabilities. As a result, work groups in this zone had no trouble obtaining funds for new computers. The work process was heavily computerized; all groups used CAD tools, and usually there was one computer for every user. All work group members were computer literate. We designated this zone as “technology rich.”

Zone II: Support Groups

Three different types of support groups (i.e., transportation, purchasing, and supplier quality) were studied, all located in a single division but based in different locations (two in one facility and a third located several miles away). Although these units did different kinds of work, they had several features in common.

Nature of work niche. The three groups performed various supportive functions for engineering and manufacturing (e.g., building containers to carry parts, checking supplier-created parts against design specification). These groups had limited impact on the product, and their work was not considered a core competency of the corporation.

Environment: (a) Relationships with other subunits. These groups had a dual orientation. They received design information from upstream design groups and used it to accomplish their primary task (or, as one work group member quipped, "they throw, we catch"). All of these groups also had intensive relationships with outside suppliers and often used external contract workers to support their core tasks.

Environment: (b) Availability of computing resources. Management was not convinced that support groups needed state-of-the-art computing to carry out their charge. Computer technology throughout Zone II thus was not plentiful. We characterized this zone as "technology scarce." Two consequences of scarcity were work processes that were only partially computerized and many users who were not computer literate.

Zone III: Manufacturing Groups

Our team studied seven groups of manufacturing engineers located in different plants. Even though these plants had little to do with each other (all were engaged in manufacturing different components), they displayed marked similarities.

Nature of work niche. All Zone III work groups received design information from the platform teams and used it to make parts, but the manufacturing data they created were handed off to no one (they were at "the end of the line"). The primary focus of the Zone III groups was the technical work required to keep the manufacturing plant up and running (e.g., "putting out fires" or responding to emergencies on the production line).

Environment: (a) Relationships with other subunits. Historically, manufacturing had not been a high priority for the corporation, and manufacturing often was viewed as a relatively low-status activity. As a result, plants often experienced a sense of isolation from the mainstream of corporate activities, becoming small worlds unto themselves. They developed highly divergent strategies for survival, some relying on one primary relationship with a corporate customer, others developing multiple relationships with a large number of customers, both internal and external to MDC.

TABLE 2
Patterns of Response to
the Commonization Program at MDC: User Attitudes

<i>Zone I: Design</i>	<i>Zone II: Support</i>	<i>Zone III: Manufacturing</i>
Allied CAD, 87% +	Transportation, 48% +	Plant 5, 78% +
Other CAD groups	Purchasing, 33% +	Plant 6, 67% +
Design Group A, 40% +	Supplier Quality	Plant 7, 64% +
Design Group B, 65% +	Whole site, 23% +	Plant 3, 60% +
	Inspectors, 33% +	Plant 2, 33% +
		Plant 1, 33% +
		Plant 4, 17% +

NOTE: Percentages represent proportion of positive statements out of a total number of evaluative statements made by work group members when asked open-ended questions about the advantages and disadvantages of the commonization program. (See note 5 for discussion of data analysis methodology.)

TABLE 3
Patterns of Response to the Commonization Program
at MDC: Implementation Plans

<i>Zone I: Design</i>	<i>Zone II: Support</i>	<i>Zone III: Manufacturing</i>
Mandatory	Optional	Strategic technology or nothing
Large scale	Small scale	Small scale
Production	Pilot	Pilot
Few technical difficulties	Many technical difficulties	Many technical difficulties
Entire work group	One or two "experts"	Variable

Environment: (b) Availability of computing resources. Due to its isolation and forced self-sufficiency, each plant was different from every other plant in terms of the computerization of manufacturing engineering tasks. In some plants, these tasks were heavily computerized, whereas others were virtually all manual. We referred to these self-sufficient plants as "technology lean"; they had enough computer technology to do the job (in their own terms) but insufficient budgetary resources to change technology frequently or to ensure state-of-the-art equipment.

Divergent Zone Responses to Transformational Change

The salience of an ecological model to an understanding of our data became clearer as we began to compare the responses of work groups in each of the zones to the commonization program. Tables 2 and 3 provide a summary of work group responses to the commonization program, showing both user attitudes toward commonization (measured by percentage positive/negative statements regarding advantages/disadvantages of the commonization program) and actual implementation plans and prac-

tices. Basically, work groups in Zone I were most receptive to the commonization program (40%-87% positive statements), and local management in this zone took actions that led to deployment of relatively large numbers of new workstations. Work groups in Zone II were more ambivalent (23%-48% positive), with users expressing many concerns and reservations about the commonization approach. Managers in this zone were more cautious, typically engaging in pilot tests of the new system without making a full-scale commitment to implement. Finally, Zone III work groups reacted with characteristic autonomy; some groups were quite enthusiastic, whereas others were profoundly negative (17%-78% positive). Implementation of the new program in Zone III also tended to be conservative, with pilot tests being the norm.

Differences in work group responses to the commonization program may be explained in part by differences in the nature of the ecological systems that existed in each zone. Because Zone I was technology rich, members already were familiar with CAD tools and their work process was fully computerized (a key requirement of the commonization program). Populations in this zone thus found the new CAD tools offered by the commonization program to be quite relevant to their existing work process. Designers in these groups generally were aware of the latest developments in computer evolution, and they knew the importance of new technology to their firm's competitive position. The internal orientation of design groups with respect to daily activities also meant that they were focused on informational directives coming from inside the company and not on conflicting information signals that might be coming from outside the firm (as often was the case in the other zones).

In Zone II, most work groups did not create designs on a daily basis and thus had difficulty appreciating the relevance of common CAD technologies and processes to their existing work tasks. In many cases, adoption of a common process and technology would have required considerable overhaul of their work processes, often in ways that users did not embrace. For example, in the supplier quality department, workers would be required to switch from using blueprints to obtain the information needed to validate supplier conformance with specifications to using electronic files of mathematical data that contained the same information in a very different form. This change represented a very difficult conceptual challenge for many workers whose entire careers were based on their ability to read blueprints and who were computer illiterate.

In addition, Zone II groups had a split orientation with respect to their relationships with other work groups. On the one hand, the fact that they relied on design information received from upstream design groups compelled them to give trial to the new approach (because many upstream groups in Zone I generally were adopting it and wanted their support groups to be able to receive design information through the new system). On the other hand, Zone II groups also were tied technologically to external suppliers, and this orientation provided them with information that constrained them from making a full-scale commitment to the commonization. Many external suppliers had no intention of commonizing their technologies and processes to accommodate MDC (they had other customers with whom they also needed to communicate); thus many suppliers planned to continue to use previous generations of computer tools and

processes. To maintain compatibility with these external subunits required that Zone II groups continue the use of older work practices. Finally, because Zone II was technology scarce, many employees were not computer literate and thus not prepared to adopt state-of-the-art computer design tools; only one work group had any familiarity with CAD tools whatsoever (i.e., Transportation).

Zone III presented a somewhat different picture. Work groups in this zone focused on production machinery—keeping it up and running. The use of a common product database to receive design information was definitely a secondary (or lower) priority. Further, many work groups in Zone III did not have close relationships with the corporate organization, thus they did not receive information that explained the need for change. In many cases, information they did receive from upstream was discounted because of an atmosphere of distrust that characterized relationships between the plants and corporate management. Given this difficulty, pressure from corporate management generally was met with indifference if not outright resistance. The only situation under which these work groups would accept the commonization program was when it complemented their own survival strategy. For those plants with a single corporate customer that also was adopting the new system, a positive response to the new system prevailed; if their primary customer was using it, so would they (see the high positive score of Plant 5 in Table 2). In those plants that had developed multiple customers, including a variety of external customers that were not going to adopt the new system, an expensive new computing system did not make sense (given lean resources) and therefore met resistance (see Plant 4 in Table 2).

Anomalies Within Zones

This coarse-grained overview of work group responses to the commonization program is useful in suggesting the potential value of ecological analysis to an understanding of diversity in work group responses to organizational change. The data that have been presented, however, do not illustrate the more subtle and complex aspects of work group adaptations to internal corporate environments. For example, the data do not reveal the process through which interdependent networks create and maintain work cultures. Nor does the above analysis address the anomalies that are apparent in Table 2. For example, Design Group A in Zone I clearly was not as enthusiastic about the commonization program as were other work groups in Zone I (e.g., see Design Group B), whereas Transportation in Zone II appears to be somewhat more receptive to the new approach than are other groups in that zone. To gain deeper insights into the cultural ecology of work group responses to organizational change, and to explain the anomalies noted previously, requires a more detailed examination of cultural environments and the internal cultures of individual work groups. In the following section of the article, I undertake such a fine-grained examination of two cases (the anomalous cases in Zones I and II), focusing specifically on differences in niches and interdependent communities that exist *within* zones.

ECOLOGICAL ANALYSES OF WORK GROUPS: TWO CASES

The Zone II anomaly presented by the Transportation Support Group is examined first because this case is the less complicated of the two yet provides a direct illustration of ecological concepts. The Zone I anomaly represents a more complex case, in which two closely related work groups display dissimilar reactions to the commonization program. This latter case provides an opportunity to explore the process of ecosystem transformation.

Case 1: Transportation Support Group (Zone II)

This case immediately presented an interesting contradiction. The work group members—nine people who design and manage large containers that are needed to move major components (seven of the nine had formal training in engineering)—were quite willing to adopt the new CAD technology that was part of the commonization effort, but they were unwilling to give up any of the work tools or processes they currently had in place to achieve computer-aided container design. In all, the group of nine people was using no less than seven different sets of tools and methods to achieve CAD, including three different software programs and various manual techniques. Ironically, if the work group had its way, the main effect of the commonization program would be to add one more computer system to this group's toolkit, thereby increasing the diversity of technologies and processes used by the group through a program that was supposed to reduce diversity.

Several ecological concepts, including work niches, relationships within an interdependent community of subgroups, and relations with cultural contexts external to the company, can be employed to explain this work group's subculture and its behavior with respect to the transformation program.

Niches and Community

Work niches. Zone II work niches were peripheral to the PDP. Two consequences of such peripheralization were (a) managerial policies that mandated technological scarcity and (b) a dual orientation toward upstream design engineers on the one hand and toward external suppliers on the other.

Interdependent community of work groups. To fulfill its mission in an environment of resource scarcity, the Transportation group had developed a *complex network of interdependencies* that crossed corporate boundaries and linked the work group to a large community of outside design houses (suppliers). Each design house had been carefully selected to meet the Transportation group's multiple needs including knowledge and expertise in CAD, the ability to produce high-quality designs, knowledge of the material required to make the containers, and creativity in design solutions. In addition, retired members of the Transportation group often went to work in one of these outside design houses, thereby providing work group members with supplemental retirement income and providing the suppliers with valuable links to the manufac-

turing buyer. The relationship between the work group and its design houses can be conceptualized as a *complex, symbiotic exchange network* in which asymmetrical flows of knowledge, people, and other resources move across the boundary of the corporation. Over time, the exchanges resembled *balanced reciprocity*; flows were not matched exactly in terms of dollar value because a number of intangibles were flowing in the network (informal advice, technological cooperation, future employment prospects) but were roughly equivalent in terms of overall value in the eyes of both parties.

Relationships With Other Cultural Contexts Beyond the Company

Occupational culture of engineering. Although the engineers in the Transportation group did very little engineering, they were still quite clear that they, *as engineers*, needed to be familiar with the next generation of technology. The *occupational culture of engineering* instills in its members a strong desire to keep abreast of new developments in technology, regardless of whether the technology is being used directly by the engineers (personal communication with D. Falkenburg, August 1990). The commonization program provided them with a means to "get their hands on the new technology" (which they had been unable to do previously due to restricted technology policies in their zone). Further, because some of the younger members of the group were able to use the new technology (they had college-level training in this area), they were able to discover functions for the CAD tools that provided a direct benefit to the group.

American culture as it affected the corporate culture at MDC. Middle-class national culture of the United States is characterized by *individualism* and its organizational extension, *autonomy* (Bellah, Madsen, Sullivan, Swidler, & Tipton, 1986; Cavanaugh, 1990). Autonomy in this context is the right to make independent decisions about one's own work. MDC displayed a classical *subculture of autonomy*, with divisional managers continually challenging corporate initiatives that appeared to limit their own discretion (for discussion, see Baba et al., in press). In the Transportation group's division, management had given all work groups the right to decide whether to cooperate with the commonization program, including the right to decide which aspects of the commonization program they would accept and which they would reject.

Internal Subculture of the Work Group

Adaptation to internal managerial policies, to its interdependent community, and to other cultural contexts beyond the corporation were reflected clearly in the Transportation group's subculture of work assumptions and practices. Group members emphasized that they possessed a unique set of skills that complemented those found in the outside design houses. Administrative and "people" skills were important, as was knowledge of engineering and manufacturing (to ensure that containers were properly designed and usable in the manufacturing environment). Skills in CAD were less important because these skills were provided by suppliers. The Transportation group also cultivated a collection of technologies that was compatible with the

suppliers' diverse tools and matched its own members' skill set. Suppliers often suggested certain types of design software that they felt Transportation should have in order to receive and manipulate suppliers' designs. These technologies were obtained, sometimes illicitly and/or at personal expense (in cases where the recommended software did not meet MDC standards). The work group as a whole thus maintained an eclectic assortment of people, methods, and tools that complemented the characteristics of its outside partners (i.e., *complementary isomorphism between external and internal structures*). The supervisor protected the group's internal diversity by refusing to pressure work group members to adopt new tools or methods that they did not care to learn; each person's favorite methodology was acceptable so long as that person got the job done. All work group members "did their own thing," deriving a sense of pleasure from such freedom and telling us that they "had fun" doing their jobs "any way we want to."

Analysis

The Transportation group's contradictory behavior with respect to commonization, and the Zone II anomaly (i.e., the relatively positive response of Transportation versus more negative responses by other Zone II work groups; see Table 2), now can be viewed as the logical extension of a past adaptive strategy. The commonization program represented a significant environmental shift for the Transportation group, one that potentially represented an ecological disaster for its interdependent community. Not only did this program require that MDC work groups adopt a single strategic computer system, but it also directed all external suppliers to adopt compatible computer systems as well (i.e., to enable access to MDC's design databases). If Transportation adopted a single strategic technology, it would automatically become technologically incompatible with many of its suppliers. Transportation was fearful that the "good" suppliers (those that Transportation had spent years cultivating) might decide to depart from the community altogether, being unwilling to adopt a single technological system that would make them incompatible with their other non-MDC customers. If this happened, Transportation would lose many valuable assets and be forced to work with less acceptable suppliers (who might adopt compatible technologies simply to gain access to MDC business). Other work groups in Zone II shared the Transportation group's negative reaction to commonization based on difficulties that this strategy also would cause in the management of their relationships with external suppliers (for further discussion, see Baba et al., in press).

By absorbing a new technology while simultaneously refusing to shed its old tools, Transportation both protected and enhanced its carefully balanced exchange network. Refusal to adopt commonization *protected the group's interdependent community*, which provided many benefits. Unlike other work groups in Zone II, however, Transportation also found some positive value in the new CAD tools, adoption of which provided several other benefits. First, it responded to the upstream design engineers' edict that component designs must be accessed in electronic form. Second, it satisfied the Transportation engineers' craving for state-of-the-art technology, which had long been denied as a result of their peripheral position in a resource-scarce

environment. Third, it enabled a work process innovation discovered by one of the younger CAD-literate engineers. The Transportation group's opportunistic response to commonization effectively captured and manipulated the commonization program to meet its own needs while not at all modifying the autonomous behavior that had required the need for a commonization program in the first place.

Case 2: Design Groups A and B (Zone I)

A contradiction of a different sort presented itself in Zone I. In one of MDC's large component supplier divisions (here referred to as Division 1), we found two closely related CAD groups; we call them Design Groups A and B. These groups worked together on the same basic component, with each group designing different but related parts. Previously, the two groups had been united under a single supervisor. Several years prior to our research, however, they had been split by function and assigned to separate supervisors. Nevertheless, they continued to work together, side by side in the same room. There were no significant differences between the groups in terms of gender, age distribution, ethnicity, or educational background.

Despite their close association, however, the groups displayed very different responses to MDC's commonization program. When our research team arrived at Division 1, employees at the research site were polarized around the issue of whether the division would benefit from adoption of the commonization program's new approach to CAD. Design Group A was aligned with the camp that was strongly opposed to the commonization program, whereas Design Group B had joined the camp of supporters. As we discovered, these opposing viewpoints were only a surface manifestation of a much deeper cultural division between the two groups.

Our earlier discussion already revealed that both of these design groups are located in technology-rich Zone I, meaning that both groups have computer-literate members, have no problem obtaining new computer resources, and do most of their own design work (rather than being dependent on outside suppliers). In the following, we provide further data needed for an ecological analysis, adding the concepts of work niche differences and relations with other groups inside the corporation (i.e., managerial elites). This discussion tests the prediction that ecology creates diversity across demographically similar groups.

Niches and Populations

Work niche: Design Group A. This group was responsible for creating the core component of the division, a component in which many complex subparts needed to fit together to form a coherent whole. Without this critical core component, the company's main product could not be assembled. The group's failure to finish its work on time meant that the entire production schedule could be delayed. Group A had learned to do its job very quickly; speed meant that the group (and the division) would be rewarded. Delays meant that the group could lose future work. To do its job quickly, Group A used two-dimensional (2D) CAD technology. Two-dimensional CAD is like a drafting board; the principles used are similar to drawing on paper, and a product

similar to a blueprint is the result. The computer is not necessary to create the product; paper and pencil could be used as effectively (but using the computer is faster).

Design Group B. This group designed accessory parts that were not needed as quickly as the core product; hence there was far less time pressure on this group. Unlike Group A, this group worked on parts that were not connected with one another but were connected with the core product designed by Group A and with many other components that were made by work groups within and outside the division. This group used a more advanced form of CAD technology that was characterized as 2½D (somewhere between 2D and 3D). This type of CAD creates a partially 3D mathematical model of the part that can be sent electronically to computer-controlled machines that, in turn, cut the part automatically. The role of the computer is central, both in creating the model of the part (which cannot be created by traditional drafting) and sending the model electronically to downstream groups that would make the part.

Relations With Other Work Groups: Subculture of Managerial Elites

Design Group A. The Group A supervisor was a local hero with divisional managers (and received large annual bonuses) for his consistent ability to meet tight deadlines and solve thorny design problems in seemingly impossible time frames. Division 1's history was distinguished by a *subculture of speed*, which was the division's primary claim to fame within MDC. Division 1 managers were known to "break the rules" to get a job done fast. Because Division 1 managers were in part dependent on this supervisor to uphold their organization's reputation, the Design Group A supervisor had significant influence within the division.

Design Group B. When Group B was created, it was put under the supervision of an individual who was not especially influential with Division 1 management and whose primary commitment was to the mastery of new technologies and processes. This new supervisor did not agree with Group A's work process (which he called "hacksaw and chisel design" and which he blamed for the quality problems that were plaguing the core component). This Group B supervisor initiated a process of differentiation in which Group B switched from 2D to 2½D technology and also began to develop a completely new work process focused on the construction of "perfect" math models and electronic transmission of those models to downstream work groups. Some years later, this supervisor was promoted into divisional management and given full-time responsibility for the management of new CAD/CAM technology. This meant that he spent considerable time relating to MDC's corporate technology management group, a *technology-oriented managerial elite that existed beyond the local cultural environment*. Following his promotion, the original supervisor's protégé was selected to head Group B, and the protégé maintained close contact with his mentor. The mentor provided informal guidance and support to Group B, encouraging it to

continue on the path of technology and work process evolution. Thus Group B was connected, via a mentor-protégé link, to a wider cultural environment beyond Division 1.

Interdependent Community

Design Group A. The work community formed around creation of the core product included Design Group A, the design engineers, and the pattern maker. This group engaged in intensive reciprocal interactions needed to design and prototype the core product. The community was limited in size and tightly focused on Group A's design work. All of these three work groups either were not computer literate or did not consider computers to be critical to their work product. Communication was via direct face-to-face interaction, paper exchange, and/or telephone conversations. No computer files were shared among these groups. Further, because Group A's core work consisted of parts that connected with one another, there was no compelling reason to go far beyond this community for information about other components.

Design Group B. The work community was structured as a far-flung network of internal "customers," spread across a number of diverse work groups that created designs for components with which Group B's components interfaced. Customers provided information about interfacing components and manufacturing specifications for the parts they themselves were designing, thus allowing Design Group B members to create a customized design strategy for each customer. Design Group B also connected with computer user groups and other technology experts to learn about advanced computer technology and participate in its future development.

Internal Culture of the Work Group

Design Group A. This group was organized as a traditional, functional hierarchy. The supervisor was the creative leader, and he assigned subtasks to individual designers on a functional basis. Designers were strictly controlled (e.g., not allowed to go to external meetings) and were expected to be at their workstations all day, producing as many designs as possible. Designers were rewarded based on the number of designs they produced (not on the quality of the designs). Members of the group thus perceived their role in the company to be the production of designs, and they emphasized the importance of speed in creating designs.

Design Group B. In this group, the supervisor viewed himself not as a lead designer but as a team leader, whereas the designers were empowered to act independently in seeking out customer input and making decisions about design strategies. Designers could leave their workstations to meet with customers, and the focus of the group was on customer satisfaction. Designers wanted to create "perfect" designs that had no quality defects and met their customers' needs. These designers also talked about speed, but they characterized it differently than did those in Design Group A, noting that greater speed *overall* would be achieved by creating high-quality designs that

could be cut automatically by computer-driven machines (thus saving considerable time *downstream*).

Relations With Other Cultural Contexts Beyond the Corporation

Division 1's relations with MDC. Division 1 was a captive supplier of MDC; that is, 95% of its products were transferred internally to MDC rather than being sold on the open market. For many years, MDC tolerated the fact that Division 1's products were not of the highest quality and even encouraged practices that led to poor quality (e.g., giving short deadlines that required the division to cut corners). Because Division 1 did not face direct competitive pressure from the open marketplace, it had not been forced to improve the quality of its products. As a result, an insular corporate culture—focused on speed at the cost of quality—was able to flourish and persist.

American cultural axioms of individualism and autonomy. The influence of individualism and autonomy were apparent in the behavior and beliefs of Design Group A and of Division 1 as a whole. Both of these organizational units focused narrowly on their own self-interests, neglecting the consequences of their actions for others (i.e., the consequences of poor design quality for customers). Individualism also was expressed in the power of the Group A supervisor. His influence and authority derived from the feats of individual heroism that he performed for divisional management.

Analysis

The divergent responses of Design Groups A and B (and the anomaly in Zone I) now can be explained using the principles of cultural ecology, with an emphasis on differences in niches, communities, and effective environments. First, it is important to note that although the two work groups were in the same environmental zone, they filled *different niches*, with Group A being more upstream than Group B. Its more upstream position placed Group A under a special set of environmental pressures, time constraints being the most important. Responding to intense time pressure, Group A constructed a work process that was *fast*. A commitment to top speed in turn placed several serious constraints on the group in terms of technology choice (the group did not switch to 2½D CAD when it became available) and intergroup relations (the group was insular and limited in terms of linkages with other subunits). Group B's niche, however, was more forgiving with respect to time. Its niche provided *slack time* (a crucial resource) for learning new technology and forging close relationships with a broad network of other units. Because Group B had already learned 2½D CAD, the switch to the 3D system proposed by the commonization program was less traumatic for the group.

Second, the interdependent community of each work group was a key source of diversity. Group A's community of cooperation contained no expertise in 3D CAD nor any advocates of that approach. There was no impetus or reinforcement within this community for the switch to 3D CAD. Rather, the Group A community reinforced the

idea that the best way to design the core product was the traditional way—with a drafting approach and other manual techniques. The incentives for each group in the network to maintain a traditional work process were clear. The design supervisor had no skill in 3D design, thus he feared that he would not be able to maintain his position of influence and authority under the commonization regime. The design engineers were not computer literate, and so the change represented a shift to a technology they did not understand (their comments were only 11% positive). Even though engineers generally are subculturally attuned to accept new technology, the local subculture of speed apparently overshadowed this occupational tendency. In addition, the pattern maker stood to go out of business if 3D CAD became the preferred work tool. Clearly, all of these actors had incentives to resist commonization. Group B, on the other hand, constructed a far-flung community of interaction that promoted a broader view of the organization. The group's many diverse exchange partners helped to reinforce the idea that time savings elsewhere in the organization may be more important to the corporation overall than speed in their own group. This community also provided knowledge that allowed 3D technology to be used more effectively. Probably as a result of Group B's acceptance of the transformation program, the design engineers they worked with also were more receptive (75% positive statements, even though these design engineers were *not* computer literate).

A third explanatory factor in this case involves the nature of the effective environment in which each group's niche and network were positioned. For Group A, the effective environment was dominated by a strong local corporate subculture of speed and a group of managerial elites that were closely associated with this speed-oriented system of belief and practice. In this insular environment, the local subculture of speed apparently was more compelling than was the general influence of Zone I (which typically gave rise to positive responses to commonization). The local environment was not all powerful, however, as Design Group B was able to escape its influence by connecting with a larger effective environment beyond the division. Out of these two different effective environments, two different models of design culture emerged. In the struggle over commonization, these models became *competitors*, each vying to dominate the future vision of design at Division 1. Competition represents yet another type of ecological relationship that may exist between work group subcultures in the same corporation.

The significance of ecological differences between work groups can be seen in the consequences that such differences have for corporate transformation programs. In this case, the Group A supervisor was able to convince divisional management that conversion to 3D technology would slow his group's effort and harm the division. Citing the need for speed, he successfully initiated work on a major new product using the old technology and work process, meaning that the new work system could not be implemented for several months (i.e., until the new product was completed). Thus, not only was the transformation program stalled, but a work process with well-known quality defects was allowed to produce important new products for market.

DISCUSSION

Deciphering Cultural Diversity in American Corporations

Ecological analysis of case material informs our understanding of subcultural diversity in and around American organizations. Viewing the ecosystem from the ground up, we can now examine each layer in the system—from the most local to the most global—and the relationships between these layers as sources of cultural diversity in corporations.

We began by noting the existence of different types of work niches in different zones of the PDP as the most localized source of diversity. Niche characteristics, mediated by zone differences, shape the habitual work practices that constitute the foundation of work group subcultures. The *work that the group performs* is a compelling force that orients the group to certain types of activities, other work groups, and views of the world. Our data showed that zone and niche differences were associated broadly with different patterns of work-related behavior and belief and with different responses to the same environmental stimulus. The data also suggested that there are *distinctive microhabitats* within similar environmental regions of the corporation (i.e., the same zone), giving rise to subtle niche differences that have far-reaching implications for work group subculture.

Niches and zones, however, were not sufficient to explain all of the variability in the data. A fine-grained analysis of the ecological system was necessary to explain anomalies in the zone-level data. Examining case data more microscopically, it became clear that niches are embedded within networks of interacting work groups that depend on one another to accomplish their work objectives. The characteristics of individual work groups in this community shape the nature of the community, and the community, in turn, influences the subcultures of participating work groups.

The case examples show that work groups are deliberate social actors that shape their work communities to reflect their own visions of ideal work practice and to cope with environmental constraints. Thus the internal structure of the group often was reflected in the external structure of the work community. In the case of Design Group A, for example, tightly controlled top-down interaction between the supervisor and his designers was mirrored in the network of tightly controlled external relations, all of which were mediated through direct supervisory oversight. In Design Group B, however, the designers had freedom from supervisory oversight in creating design concepts, and their internal autonomy was reflected in the broad network of relationships that each designer created independently with downstream exchange partners. In the Transportation group, internal human skills represented the reverse image of skills possessed by external supply partners, whereas technologies were a matched set. In both of these cases, the construction of an external community of interaction had important consequences for the possibility of future change because existing webs of cooperation between work groups tended to act as a stabilizing force that reinforced earlier choices.

Adding another layer to the ecosystem reveals that these work communities also form under the influence of other cultural contexts beyond the interdependent network.

The subcultures of managerial elites were found to be particularly influential. Managerial policies pertaining to the definition of core work, the approval of budgets for key resources, the use of outside suppliers, and key competitive priorities (e.g., speed or quality) all were important influences shaping work group and community subcultures. Managerial policies and practices create, in part, the internal environments in which work groups operate, thereby shaping the nature of work niches and work communities.

This latter source of diversity was made more complex by the fact that managerial policies were not monolithic, even *within* a zone. Indeed, we found that there were different groups of managers, each with its own sets of behaviors and beliefs, and that these managerial subcultures provided different types of environmental contexts within which work practices could develop (for a more detailed example of conflict between managerial subcultures, see Briody & Baba, 1991). The local managers of a division, for example, may display practices and beliefs that are antithetical to those of distant corporate managers or technological leaders (as in Case 2). Work groups, depending on which managerial subculture they related to most closely, may experience different kinds of environmental stimuli and be rewarded for different kinds of action.

A related source of cultural diversity stemmed from the tendency of work groups to interact with different groups of managerial elites in different ways. Some work groups appeared to align themselves with local management, becoming co-builders of a shared tradition (e.g., Design Group A). In such cases, the work group became part of the fabric of its own environment. Other work groups, however, seemed to form in opposition to local managerial groups, allying themselves by choice with other (perhaps more distant) power structures that would sponsor their contrary vision (e.g., Design Group B). We also saw a third strategy in which the work group basically accepted managerial policy but worked within policy constraints to create its own world of independent action, thereby establishing the grounds for future resistance to distant policy directives (e.g., Transportation). Work groups thus may *choose their effective environments* and, with this choice, also select options in work group subculture and ecosystem structure.

The discussion thus far suggests a complex interplay between culture and environment, operating at several levels simultaneously. The characteristics of the work niche, work group communities, managerial subcultures, and—very importantly—work group choices among alternative effective environments interact to create a diverse array of subcultures within the U.S. corporation. Each subculture emerges through the interaction of a different set of ecological forces, framed within the context of American culture generally but developing unique expressions of that culture through its interactions with other subcultures and its own choices.

An individual may be influenced simultaneously by several different cultural contexts that are themselves interrelated. Thus an engineer in the Transportation group is concurrently under the influence of American national culture, the occupational culture of engineering, and corporate culture of MDC. The local subculture “on the ground” (i.e., the subculture of Transportation and its interdependent work community) has a complex relationship with these larger cultures. It is at once an integral part

of them (i.e., a local instance of each tradition, drawing on each for frames of meaning and action) while at the same time representing an adaptive response to them (i.e., a pragmatic maneuvering that pursues opportunities and copes with constraints, allowing the Transportation engineer to do his job in a satisfying and productive way). That different local contexts determine the relative degree of influence that a given cultural context will have on an individual is demonstrated by comparing Cases 1 and 2. In the first case the occupational culture of engineering was influential to the point of contributing to an anomaly in the data, whereas in the second case this influence was overshadowed by a more potent form of corporate culture (i.e., the subculture of speed in Division 1). Thus it does not seem possible to predict a priori which type of cultural formation will hold the greatest influence in any given situation; the outcome is dependent on a unique combination of forces in each case. What is clear is the fact of mutual causality; once a local subculture emerges, it has a feedback loop to the environment, perhaps changing that environment in significant ways (as discussed in the following section).

An ecological approach to cultural diversity draws on and incorporates many of the concepts offered by several other models of cultural complexity discussed in the introduction to this article. The notion of subcultures nested within a framework of the national culture is useful provided that the national frame is viewed not as deterministic but as possibilistic and probabilistic. American culture provides many possibilities for variety among subcultures. Although some tendencies of American culture are more likely to appear in corporate contexts than are others (e.g., individualism over egalitarianism, technocentrism over humanism), the less likely tendencies cannot be ruled out. Concepts of power and hierarchy are indispensable, given the influential role played by managerial elites. Despite their influence, however, elites are not completely in control of the corporate culture, and work groups may create countercultures (and opportunistic subcultures) that evade or frustrate managerial influence. In addition, interdependent networks may display important nonhierarchical properties such as balanced reciprocity (Transportation) and teamwork (Design Group B). Finally, with respect to the shifting web of orientations perspective, it is clear that individuals and groups are capable of shifting their orientation from one community of interaction to another and that such shifts may have profound implications for the subcultures involved (Design Group B). Our research also suggests, however, that some of these shifts represent conscious *choices* among clearly distinctive or even contradictory alternatives, where easy or swift switching back and forth between orientations may not be possible (i.e., a commitment must be made to one orientation or the other, as in the case of the two approaches to design in Division 1). Thus, although choice is possible, once chosen, work group subcultures and their ecosystems may have both a significant and an enduring influence on future practices and paradigms of their members.

Ecosystem Change

A closer examination of the process by which Design Group B transformed itself provides insights into the process of ecosystem change over time. Instead of remaining

inside a closed and insular community, Design Group B *chose* to develop a wide network of exchange relations with many other work groups, both upstream and downstream. Especially significant was the nature of its exchange relations with downstream customers. To satisfy these customers, designers in Group B were willing to expend extra time and effort to create "perfect" designs, even though the Division 1 reward system was still oriented toward speed and quantity rather than quality. In effect, Design Group B was offering what appeared to be *balanced reciprocity* to its customers; it gave them extra service consistently and received from customers critical information that allowed the group to achieve its vision of an ideal work system (empowerment and pride derived from the creation of "perfect," high-quality products). This shift from *negative reciprocity* (where downstream customers were given defective parts to enable upstream heroes to perform feats of unbelievable speed) to more *balanced reciprocity* represents an important transformation in the nature of the work group's subculture—in the habitual practices and beliefs surrounding the daily conduct of work—and it also is an essential ingredient of the transformation necessary to make MDC more competitive internationally. This change was enabled by the fact that Design Group B was connected *vertically* to a cosmopolitan context (i.e., the subculture of technology leaders in MDC via the mentor-protégé link), where the value and significance of its actions were recognized and praised (if not rewarded directly or immediately).

Choices also have a cultural context. In Design Group B, for example, the renegade vision of "perfect" mathematical models was first articulated by a new young supervisor who had less investment in the local divisional culture. In some ways, he was quite typical of American managers, who are fascinated with technology as the solution for all manner of industrial problems (Baba et al., in press). He sold his technological vision to local management on the basis of speed—not speed for his group, but speed for divisional groups downstream; computer-controlled machines would be able to cut perfect parts very rapidly using mathematical models rather than 2D drawings. Because the niche of this work group provided slack time, the young supervisor was able to demonstrate the value of his vision without risking the entire speed culture of the division. Given the abundant resources for computing typically found in Zone I, this supervisor also was able to finance his vision with new 2½D technology. Although external technological and economic change may have been the ultimate source of choice and diversity in this case, that external change still had to be translated into the language of the local culture before any difference was experienced inside. The translation was provided by an individual who demonstrated leadership and ingenuity within a generally conservative cultural context, confirming the idea that *individual leadership* is an important factor in the process of culture change (Kotter & Heskett, 1992; Schein, 1985).

The transformation of Design Group B's ecosystem thus involved three critical elements: (a) a resource-rich work niche (sufficient slack time and access to new computing equipment), (b) a visionary leader acting as an internal catalyst for change, and (c) a means of connection to a broader, more cosmopolitan context that was itself exposed to larger environmental pressures for change (i.e., international competition). These factors enabled Design Group B to break away from the insular ecological

community in which Design Group A was entrenched and to form a new community and a new niche for itself, both of which allowed the group to enact its vision of ideal work practice.

CONCLUSION: MANAGING CHANGE WITHIN COMPLEX ECOSYSTEMS

The cultural ecology perspective predicts that diversity across work group subcultures will exceed that which would be expected based on demographic differences alone. Case study data presented in this article confirm that prediction. Although demographically equivalent along several major dimensions, work groups may indeed display radically different patterns of behavior and belief—based on their situation within an ecological system—with significant implications for organizational change.

Data presented here also suggest that work group subcultures are learning organizations that will adapt when the environment sends adequate stimuli. In our view, the problem of local inertia documented in the case studies stems not so much from “resistance to change” as it does from a lack of adequate knowledge and practice regarding effective change management at the local level. Often, managers fail to appreciate the enormous cultural diversity that exists among work groups in U.S. organizations. It is not possible to manage change effectively by treating all work groups alike, whether this means “ramming change down their throats” or sending them all to the same training program.

Rather than assuming that all groups will have a similar response to change and that a single method of implementing change will be equally effective in all groups, management practices should be informed by a knowledge of the corporation’s internal ecology. Such knowledge could be instrumental in shaping customized approaches to change that would stimulate work groups to participate more constructively in corporate efforts to adapt to changing conditions outside the firm. Three suggestions for the management of ecological diversity within the corporation are offered in the following.

Global versus local change. Work groups learn to cope with *local* conditions, as local is defined by them (i.e., *their* effective environment, in an emic sense). Such groups probably are not very effective in coping with changes in global conditions—those that affect the company as a whole—if they are not exposed to the same environmental stimuli that the company as a whole is experiencing. The internal environment of the company must be altered to enable internal groups to experience external conditions. There are many ways to do this (e.g., benchmarking the competition, putting work groups in direct contact with their customers, having internal groups compete directly with external groups, providing access to current financial information). Which measures are appropriate will depend on the nature of the work group and its local environment as well as on the nature of the global environmental shift.

Formal versus natural boundaries. Change programs involving new technology deployment initiatives often are designed, budgeted, and delivered according to the formal organizational division of labor. Often, little or no attention is given to the fact that actual work practices often do not recognize formal boundaries; horizontal relationships link communities of cooperating work groups across divisions and to other firms. When change programs proceed without regard for such natural communities and no provision is made to maintain or replace existing relationships that are likely to be damaged or destroyed by the change program, there is bound to be resistance. The change program should not simply take care of "our guys (and gals)," as work groups naturally form productive relationships with "other guys (and gals)." Change initiatives should begin with a map of existing work communities and should plan to include as many and as much of these as possible. Such an approach would do much to further efforts aimed at corporate *integration* because integration means the linking together of diverse work groups that span formal organizational divisions.

Functionality versus negotiated significance of technology. Management often assumes that work groups evaluate new processes and technologies solely on the basis of utility. If the new tools are truly capable of doing the job, many managers tell us, the work group will accept them. It is certainly true that if the new tools cannot do the job, work groups will resist them mightily. However, there often is more to a work group's acceptance of technology than a functional evaluation. Technology does not always play the obvious role dictated by its physical presence; often, its role is negotiated by an interacting network of exchange partners. For example, in Case 1, technology was not a way to get the job done so much as it was a means to fulfill the requirements of a professional identity and to communicate with and maintain relationships with suppliers. The impact that a new technology will have on a group cannot be understood by knowing only the physical features of the technology. It is also necessary to understand the symbolic and negotiated dimensions of the technology that are imparted by the ecological system in which the work group operates. Once management understands the meaning and significance of technology within a particular ecosystem (and such meanings will vary across groups), the correct approach for introducing change will be more readily apparent.

NOTES

1. Subcultures may be defined as subsets of some larger cultural whole that share certain features with that whole while simultaneously expressing their own distinctive patterns of belief and behavior based on special historical experiences and/or identities that diverge from the cultural mainstream.

2. Organizational and management scholars in this country seldom have recognized the role of American culture in shaping the internal cultures of the corporation. This failure may result from a culture-bound "blind spot" related to the American managerial assumption of free will (Adler & Jelinek, 1986).

3. Although managerial elites are powerful, they are not fully in control of the overall culture of the organization as other nonmanagerial subcultures may arise in response to managerial initiatives and may thwart or defy managerial directives (e.g., labor movements or other countercultures; see Martin & Siehl,

1983). In the final analysis, the overarching culture of the corporation is one made not solely by elites but by the interaction of all of the subcultures that exist within it.

4. CAD/CAM refers to computer-aided design and computer-aided manufacturing technologies. These tools systems are used to create mathematically based designs of new products that can be stored in a common database and accessed by all functions and units participating in product development. Because these tools enable math-based designs to control the machines that create new parts, high-quality products can be created at lower cost and in less time than are normally required for a complete product development cycle.

5. Responses to questions about the advantages/disadvantages of a new work process and technology were coded to permit quantification of user views; that is, we coded and counted numbers and percentages of statements about advantages and disadvantages of commonization in each work group. Advantages were counted as positive statements, disadvantages as negative statements. This enabled us to develop a quantitative framework for comparison of work group responses to the planned change (i.e., percentage positive/negative statements).

6. Human ecology was developed by sociologists during the first quarter of this century to bring some intellectual order to the seemingly chaotic growth of urban areas in the United States (Hawley, 1986). Spatial relations among urban social groups were the primary focus of analysis during this period. More recently, sociologists have applied concepts from population ecology at the macro level to understand processes of adaptation and change (or lack thereof) in populations of formal organizations (Hannan & Freeman, 1989).

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