15 ORGANIZATIONAL SPECIATION

Bill McKelvey, University of California, Los Angeles

1. INTRODUCTION

Organizational systematics has been defined as the science of diversity (McKelvey, 1978a). It includes three component subjects of inquiry: (a) Taxonomy, the development of a theory of differences (speciation) among organizational forms, together with a theory of classification; (b) Evolution, the tracing out of the historical development of different lineages of organizational forms; and (c) Classification, the identification and assignment of organizational forms to formally recognized classes. A move away from grand theories, treating organizations as one homogeneous group of phenomena, toward middle range theories (Merton, 1957) requires not only vertical differentiation, such as Parsons' (1956) institutional, managerial, and technical levels, but also horizontal distinction among kinds of organizations. However, successful accomplishment of the latter distinction awaits the development of organizational systematics.

This paper pursues the "natural selection" line of inquiry taken recently by Campbell (1969), Weick (1969), Hannen and Freeman (1977), and Aldrich (1978, 1979) by looking more closely at the shifts in theories of causality and classification implied by natural selection theory. The main intent is to propose a conceptual framework and theory of the organizational speciation process,
thereby elaborating the taxonomic subcomponent of organizational systematics. Such a theory is needed to fully understand: (1) how environmental forces actually produce differences in organizational form, (2) how a given form remains stable over successive generations of organizational members in the face of subsequent environmental changes and the appearance of new forms, (3) how a group of organizations remains similar in form but different from other groups, and (4) how adaptative changes in form take place in the long term.

Organizational speciation is that process which results in the creation of different organizational forms, the latter defined as follows:

D1. Form: the appearance, condition, and nature of an organization and its subunits as well as the configuration, interrelationship, and manner of coordinating its subunits (McKelvey, 1978a).

It is important to note that the inquiry will focus on the creation of a form, which is embodied in the several members of an organizational specie or grouping, not on the life or death of a particular organization as a legal entity. A specific definition of an organizational specie appears later in the paper.

2. CAUSALITY AND THEORIES OF CLASSIFICATION

The development of organizational taxonomy requires the selection of a theory of classification and within the latter the identification of a specie concept, which is at the root of organizational differences. The choice of a theory of classification in turn depends upon one's approach toward causality. A useful framework with which to view causation is that supplied by Schwab (1960) after a review of over 4000 studies in the physical, biological, and behavioral sciences. He termed them "principles of enquiry." Briefly, they are as follows:

1. Reductive Principle. Scientists search for the cause of an entity's behavior by lowering the level of analysis to the study of its constituent parts.
2. Rational Principle. Explanation of an entity's behavior is pursued by raising the level of analysis higher to the larger system or environment in which it is embedded.
3. Holistic Principle. An object is viewed as a multileveled system of interdependencies, many of which contain two-way causal flows. The focus is on the pattern of relations among the parts themselves and their relation with the whole.
4. Antiprinciple. Scientists avoid accepting and being guided by any preconceived theories or hypotheses and try to "let the facts decide." Assumptions about causality are avoided as guides to inquiry.
5. *Primitive Principle.* Common sense notions are used to guide inquiry, including whatever views of causality are implicit in them.

Not surprisingly, theories of classification are rooted in different principles of enquiry. Over the past two centuries biologists have tried out several theories of classification with varying success (Mayr, 1969: 65-77). For our purposes the most important are:

1. **Essentialism.** All objects are treated as totally analyzable entities that may be defined in terms of a fundamental reality or essence giving rise to properties that are inevitable consequences of the essential definition. Whether taking biological organisms or organizations, essentialists attempt to trace all observable attributes back to a few essential characteristics. All existing typologies of organizations, such as those by Etzioni (1961), Blau and Scott (1962), Parsons (1956), Katz and Kahn (1966), Perrow (1967), and Thompson (1967), among others, are based on the identification of a few essential attributes.

2. **Empiricism.** This view holds that there are naturally occurring groupings of objects and that if investigators carry out enough empirical studies, the groupings will eventually be discovered. They do not posit theories about how or why the groupings occur. Instead, they form groupings strictly on the basis of similarity. Some examples of this approach to organizational classification, using numerical taxonomic methods, are studies by Haas et al. (1966), Pugh et al. (1968, 1969), Goronzy (1969), and Pinto and Pinder (1972). Methodological comments are given by McKevel (1975) and Warriner (1977a).

3. **Evolutionism.** Adherents of this theory not only try to classify the objects in question but also attempt to explain their origin and subsequent differences by looking to natural selection processes which result in the survival of some forms but not others. Environmental variation, selection processes that create species, and retention mechanisms that preserve species once they are created, are the main elements of evolutionary theory. The result is not only a classification of presently existing entities but also a development of lineages tracing the entities' descent from common ancestors. The best example of such a theory is the biological classification scheme now in wide use. The evolutionary approach has not been used in classifying organizations. But a recent development is a paper by McKevel (1978b) that discussed the evolution of organizational forms in ancient Mesopotamia.

Table 1 shows the relation between theories of classification and principles of enquiry. Ignoring the primitive principle on the assumption that the field has
Table 1. Theories of Classification Related to Principles of Enquiry

<table>
<thead>
<tr>
<th>Theories</th>
<th>Principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essentialism</td>
<td>Reductive</td>
</tr>
<tr>
<td>Evolutionism</td>
<td>Rational</td>
</tr>
<tr>
<td>Empiricism</td>
<td>Holistic</td>
</tr>
<tr>
<td></td>
<td>Antiprinciple</td>
</tr>
<tr>
<td></td>
<td>Primitive</td>
</tr>
</tbody>
</table>

progressed beyond that, the only principle that has been left out of existing theories of classification is holism. Though it, in the form of systems theory, has been on the rise in organization theory, it has not yet led to a paradigm that has fostered theoretical propositions and subsequent empirical inquiry on a wide scale.¹

Since organizations, like biological organisms, are not totally analyzable entities, organizational systematicists probably ought to dismiss essentialism and its implicit reductive principle as their biological counterparts have already done. Though there may not be as many different kinds of organizations as there are biological organisms, organizations may be more complex in that more taxonomic characters may be needed to adequately describe their total behavior. As Burns (1967), Hall et al. (1967), and McKelvey (1978a) have noted, the simple essentialist typologies have proved inadequate in face of the richness of total organizational behavior, leading to their rejection by researchers needing a workable classification for use in identifying meaningful subpopulations of organizations for empirical study.

In biology, systematicists have tended to adhere either to evolutionism (Mayr, 1969) or to empiricism (Sneath and Sokal, 1973), with each largely rejecting the opposing theory. McKelvey (1978a) has argued for an approach combining both. Thus evolutionary theory would be used a priori to suggest possible classes which are then tested out by the more objective, broader based, numerical taxonomic methods. As noted before, without a solid a priori theory the empirical methods run into difficulties. And without empirical testing there is no check on biased interpretations of evolutionary development due to poor and occasionally unavailable historical data. In short, each theory benefits the other.

3. THE RATIONAL PRINCIPLE AND THE EVOLUTION OF ORGANIZATIONAL FORM

The missing link in the combined evolutionary-empiricist approach advocated by McKelvey is the lack of an evolutionary theory of organizational classification,
and ultimately an evolutionary theory of organizational speciation. The combination of the rational principle of inquiry and evolutionism has not yet been widely accepted in the study of organizational differences. But there are three streams of thought suggesting that a full-fledged environmentally responsive evolutionary approach is close at hand: the natural selection, contingency, and resource-dependency theories.

**Natural Selection.** Campbell (1969) noted a reawakening of interest in evolutionary theory in social science. Drawing on the theory of natural selection in biology, he identified what appear to be the necessary and sufficient conditions of sociocultural evolution. They are as follows:

3. A mechanism for the preservation, duplication, or propagation of the positively selected variants (the rigid duplication process of the chromosome gene system in plants and animals, memory in learning) (Campbell, 1969: 73).

Campbell’s broadly defined interest in the evolution of all kinds of sociocultural units has been applied more recently to the process, as opposed to the outcome, of evolution in organizations, by Weick in his book on the process of organizing (1969). The natural selection model as applied to organizations received a preliminary review by Aldrich and Pfeffer (1976) and a more extended treatment is found in Aldrich (1979). The natural selection model has recently been applied by Hannen and Freeman (1977) to explain organizational differences through use of the biological population ecology model.

**Contingency Theory—The Technology Hypothesis.** This approach was best described by Perrow (1967) as the following chain of events:

1. Because of the environments organizations choose or are forced to operate in, their goals, outputs, and inputs are specialized and differentiated.
2. These attributes create certain problems in the workplace and organizations develop appropriate technologies to solve them.
3. These technologies in turn create problems that require specialized managerial systems and organizational structures for their solution (not a quote).

Following the work of Lawrence and Lorsch (1967) this view came to be labelled "contingency theory." Over the years there has developed strong empirical support for the central ideas that organizational technology and structure are contingent on the kind of environment prevailing (Woodward, 1958; Burns and Stalker, 1961; Chandler, 1962; Udy, 1964; Duncan, 1971; Negandhi and Reiman, 1972; Child and Mansfield, 1972; Galbraith, 1973; Khandwalla, 1974; Lorsch and Morse, 1974; and Child, 1974, 1975; among others).

*Resource-Dependency Theory – The Power Hypothesis.* The chain of events based on power relations is as follows:

1. The environment provides many of the constraints, uncertainties, and contingencies because of the necessity for transacting with the environment.
2. These contingencies affect the distribution of power and influence within organizations, providing some subunits with more power and others with less.
3. Power is used in determining organizational social structures, particularly to the extent that there is uncertainty and the decisions concern critical issues (Aldrich and Pfeffer, 1976: 89).

The theoretical and empirical work in support of this approach has recently been exhaustively reviewed by Aldrich and Pfeffer (1976) and Pfeffer (1977), so need not be discussed here.

Without entering into a lengthy discussion, let it be noted that the natural selection model does not require acceptance of a view of environmental determinism in which managers are denied choice, as is implied by Hannen and Freeman (1977). Instead, the environment may be seen as a set of objective constraints, which managers may or may not correctly discern or enact (using Weick’s (1969) term) and chose to respond to. Thus managers are never denied the option of not adapting to the prevailing environment. The fact that a manager chooses not to respond or does so poorly does not undermine the long-run viability of the form of an organizational population or specie best suited for its niche anymore than the choice of a rabbit to jump in front of a truck undermines the long-run viability of its specie.
4. CONSTRAINTS FOR A THEORY OF ORGANIZATIONAL SPECIATION

The central element in a theory of organizational speciation is the concept of an organizational specie. The development of such a concept proceeds within a set of constraints posed by a model of what an ideal classification might look like and by the model of natural selection presented earlier. There are four conditions a specie concept must satisfy to become the foundation of an effective evolutionary classification:

1. The concept should lead to observation of sharp discontinuities among the organizational forms being classified. The sharper these demarcations are, the easier to develop a classification scheme. Without observed discontinuities, classification becomes arbitrary.

2. It should result in high levels of homogeneity within classes in addition to sharp demarcations between them. Without homogeneous classes a classification loses its value as a means of identifying subpopulations of organizations for empirical investigation and as a means of codifying knowledge about their total behavior.

3. The specie concept should result in groupings that are stable over a period of time long enough to make the effort of classifying the groupings worthwhile.

4. Since an evolutionary approach is advocated here, the specie concept should explain how the mechanism assuring stability in the short run, which satisfies condition 3, also operates to allow evolutionary changes in the long run.

The constraints imposed by natural selection theory stem directly from the three essential processes: variation, selection, and retention. Taking a cue from the way in which the biological specie concept (Mayr, 1969) handles these constraints, an organizational specie concept probably should have analogs to:

1. A Generational Mechanism. In biological organisms the intercommunicating gene pool, helped along by occasional mutations, is the root process assuring variations. Because the total number of gene combinations available within a specie is very much greater than the combinations held by a single member of a specie the result is, except in exceedingly rare instances, that each member is somewhat different, and with mutations, quite different. Coupled with isolating mechanisms (discussed shortly), the gene pool also is the means by which the specie form is passed on
from generation to generation. Thus, the intercommunicating gene pool is responsible both for assuring stability within the specie in the short run (because some gene combinations are more likely) and for allowing long-run evolution due to less likely gene combinations and mutant forms occurring that are beneficial to survival.

2. *An Ecological Mechanism.* Among biological organisms the Darwin-Wallace theory of the survival of the fittest explains why some variations persist while others die out. As a result of conditions imposed on the members of the specie by their niche, some members, and the gene combinations they hold, survive, mate, and otherwise pass on their particular combinations. Over a period of time the most successful combinations come to characterize the specie.

3. *Isolating Mechanisms.* In most biological organisms, reproductive isolation is the principal means by which a limited set of gene combinations comes to be passed along from generation to generation. Without isolating mechanisms a specie would not persist even if it were created in the first place. Even though it mingles with other organisms it is prevented from interbreeding with them. Thus species, once formed, remain separate.

The biological specie concept is not perfect in its handling of all possibilities of biological speciation, though it does handle the mainstream of sexually reproducing organisms. Ross (1974) concluded that rather than argue whether or not the main specie concept handled all situations, it would be preferable to have additional specie concepts to handle special situations. Such will undoubtedly be the case for organizational specie concepts as well.

5. **A CORE TECHNOLOGY SPECIE CONCEPT DEFINED**

Following Monod (1971), Hannan and Freeman (1977) argue for identification of an organizational blueprint analogous to the genetic code of biological species. Such a blueprint would “consist of rules and procedures for obtaining and acting upon inputs in order to produce an organizational product or response” (Hannan and Freeman, 1977: 935). After the contingency theorists in general and Perrow (1967) in particular, the view taken here is that what will shortly be defined as an organization’s core technology constitutes the relevant body of knowledge, skills, rules, and procedures for obtaining and converting inputs into outputs.

Definitions of key concepts are collected in this section along with brief examples. An explanation of how the concepts combine to form a viable organizational specie concept is given in the following section.
ORGANIZATIONAL SPECIATION

D2. *Organizational species:* polythetic, technology-sharing populations of organizations isolated from each other because their tech-pools are not easily learned or transmitted.

D3. *Tech-pool:* a population of mutually compatible technological elements that may be combined variously to form a particular core technology.

D4. *Polythetic group:* one where: (a) each member possesses many properties, \( p \), of a set of properties, \( P \); (b) each \( p \) in \( P \) is possessed by many members; and (c) no \( p \) in \( P \) is possessed by all members (after Beckner, cited in Sneath and Sokal, 1973: 21). In a monothetic group all members possess the same set of properties.

The specie concept is based on two key concepts drawn from biological taxonomy, polythetic groups and the intercommunicating gene pool. Biologists have long since given up on the idea of forming a classification around monothetic groups—the phenomena are too varied to allow this. Instead, they have found the notion of polythetic grouping fully satisfactory. Since organizations are also highly varied, it is suggested that organizational systematicists will want to adopt the polythetic group concept.³

Though there is always risk in adopting analogs from another science, it will be argued that the tech-pool concept solves similar conceptual problems in dealing with organizational stability and adaptation. As outlined in the following section, the concept of the intercommunicating tech-pool solves a number of problems related to conceptualizing and explaining how organizational species remain stable across generations in the short term and adapt in the long term. Furthermore, it will be argued that technological elements, via manager and employee choices, intercommunicate and combine very much like genes do to form the technological base of individual organizations.

In thinking about technology it is important to distinguish between the subset of technical and managerial elements used by managers in a particular organization and the broader pool of technological elements from which they are drawn. This pool, containing all known elements of a technology, is defined as the tech-pool. Thus, the tech-pool of founding consists of all skill and knowledge elements pertinent to operating the technical and managerial aspects of a foundry organization. A particular foundry would not have within its grasp all elements of the broad tech-pool, though each foundry would have many elements of the tech-pool. And, each element of the tech-pool would be present in many foundries. Thus, the members of an organizational specie comprise a polythetic group sharing many elements of their tech-pool. The relation between the tech-pool and the organizations that are its members is depicted in Figure 1.
The technological base of organizations is defined as follows:

D5: **Core technology:** the knowledge and skills used in the primary task workplace and the direct management of that workplace.

D6: **Primary task:** comprises the set of activities that bear directly on the conversion inputs into those outputs critical to an organization's survival (Miller and Rice, 1967):
   (a) there is only one primary task per specie;
   (b) it is possible for an organization as a legal entity to have several primary tasks (a conglomerate, for example);
   (c) peripheral service or staff units in larger organizations are not elements of the primary task; however, they may be seen as having their own primary tasks.

D7: **Workplace management task:** comprises the set of activities that bear directly on carrying out boundary transactions between the workplace unit and other organizational subunits or entities comprising the organization's niche.

Space precludes full development of the pros and cons of the primary task concept. In most organizations it is the production, marketing, or financing function, singly or in combination. Thus, the primary task of a foundry is pouring molten metal into molds; the primary task in an elementary school is education, not serving hot lunches. In BIC Pens, Ltd. the primary task is marketing. In
Procter and Gamble, Inc., it is a synergistic combination of production and marketing. In a university it is a synergistic combination of research and teaching; in RAND Corp. it is research; in a small college it is teaching. In large conglomerate or vertically integrated organizations there may be several primary tasks and associated forms. The divisions each operate one or more primary tasks such as ship building, entertainment, mining, construction, and so on, and the corporate headquarters organization is yet another form of organization with a different primary task, usually financial control.

The workplace-management task pertains to the managerial activities directly concerned with assuring the effective design and operation of the hardware or technical system of the workplace. Managers try to protect the technical core from uncertainty or to design it to be more flexible. They try to control the activities to foster goal attainment. They try to differentiate the activities to correspond with a heterogeneous environment and to take advantage of specialized skills. They attempt to integrate all the activities into a unified whole. Generally, these activities seem to fall into three broad categories: measuring effectiveness; mitigating environmental contingencies such as threat, change, heterogeneity, and uncertainty; and coordinating interdependencies (McKelvey, 1977). Note that the core technology concept is not a hardware-oriented concept at all, but in fact is much more broadly concerned with many aspects of managerial information processing and organizational behavior knowledge and skills as well.

6. EVALUATION IN TERMS OF THE CONSTRAINTS

To be viable, the core technology specie concept, coupled with the tech-pool concept, should include generational, ecological, and isolating mechanisms.

Generational Mechanisms. It is customary to think of a biological specie, an animal or plant, as a physical object. Instead, think of a specie as a set of highly probable gene combinations that are passed through time by being held temporarily in the body of a plant or animal. An organizational form may be thought of in the same way—it is a set of highly probable combinations of technological elements that: (a) are passed around to the several organizational members of the specie and (b) are passed on in time by the employees of the organizations. Each organizational member, and each employee within that member, knows only a subset of the total tech-pool. Thus, there is a unique combination of elements within each organization. Since each organization possesses many of the elements, its version of the form implicit in the tech-pool varies somewhat from the form of the tech-pool embodied in another organizational member of the specie. This is a source of variations in organizational form due to each
organization's choice (via its employees) to use a certain unique subset of the tech-pool.

As does its biological counterpart, the tech-pool also offers a way of conceptualizing short-term stability and long-term evolutionary change. The short-term stability of an organizational specie obtains because all members of the specie draw from the same tech-pool of successful, and therefore highly probable, combinations of technological elements. Organizations tend to keep on using elements that are effective. They reward employees for learning the elements of the tech-pool that work. They hire from other members of the specie employees who are known to have mastered needed technological elements. As long as there are individual and organizational rewards for mastering the elements of the tech-pool, the tendency will be toward stable combinations of elements closely reflecting, but not identical to the composition of the tech-pool.

Long-term evolutionary change in the form of incessant, usually small changes (they may or may not be improvements) is also covered by the tech-pool specie concept. During the course of doing his or her job an employee may discover a new way of doing something. This is a variation. If it is successful it probably will be spread around the organization (though there are numerous case studies showing that certain kinds of incentive systems mitigate against this, at least in the short term—strike another note for stability) and eventually to other organizations making up the specie. It is also possible that a new employee, though being taught by an old master about to retire or leave, brings in a new way or soon discovers one. This is a variation that eventually, if successful, may be passed on into the tech-pool. Another possibility is that a new employee fails to learn from the truly skilled old master and so the organization loses part of its grasp on the tech-pool. This variation, if it happens often enough, may lead to the failure of the organization or it may lead to the discovery of other successful variations that replace the old elements and eventually take their place in the tech-pool.

Ecological Mechanisms. To be useful the core technology concept must offer a way of conceptualizing how environmental forces operate to select some variations and dampen down others. Khandwalla's (1977) study offers ample evidence that niche attributes such as hostility, turbulence, heterogeneity, uncertainty, and restrictiveness affect organizations. In terms of the core technology concept, technological elements are seen to be differentially effective in the face of these and other niche attributes. Those elements that are effective tend to persist while those that are not disappear, at least in effective organizations in the long term.

Isolating Mechanisms. Isolating mechanisms serve to keep a specie differentiated from other species. There seem to be several mechanisms that play this role in
keeping one tech-pool from merging with another over fairly long periods of time. Organizations, for example aerospace companies, tend to hire employees who know certain parts of the “aerospace tech-pool.” They tend not to hire miners, nurses, teachers, or airline pilots, and so forth, who have knowledge of technological elements from different tech-pools. In this way, the aerospace companies remain isolated from other tech-pools. Even though an organization might hire a member from a totally different tech-pool (such as a business school hiring a business person as dean) the “strange” member knows only a small portion of the tech-pool from which he or she came. Since the tech-pool is typically widely diffused among many people it is very difficult, if not impossible, for an organization to quickly change from one tech-pool to another simply by hiring people. Organizations also tend to try to retain people who they see are valuable tech-pool holders. Often the elements of a tech-pool are held by artisans; learning a craft takes a long apprenticeship or an on-the-job training program—these increase the difficulty of an organization quickly picking up a different tech-pool. Many tech-pools are held by professional people such as professors, engineers, and scientists. Because the training is long and often difficult, the job of learning even a part of the tech-pool of an organization such as an aerospace company is very difficult. Furthermore, employees holding part of a tech-pool tend to mix with other people holding part of the same tech-pool—they attend the same professional conferences and so forth. Warriner (1977b) noted that accreditation agencies, federal regulatory agencies, professional associations, and the like, also acted as isolating mechanisms.

One of the advantages of drawing heavily on the biological specie concept as a metaphor is that the various mechanisms it entails also work to satisfy the conditions imposed by an ideal classification model. The isolating mechanisms work to assure homogeneity within classes and sharp demarcations between them. The tech-pool notion, which interrelates with the generational and ecological mechanisms is the device that allows the core-technology concept to handle the problem of short-term stability and long-term evolutionary change. In conclusion, it seems reasonable to go forward with the view that the core technology concept is a viable specie concept. Preliminary acceptance of this concept does not preclude the development of alternative specie concepts, however. It is far too soon to assume that the core technology concept, or any other soon to be presented, will be the concept gaining eventual broad acceptance.

7. A MODEL OF THE ORGANIZATIONAL SPECIATION PROCESS

The proposed model attempts to represent the process by which organizational forms come to be different and remain that way. It is offered below in outline
form. It is patterned after a model of the biological speciation process suggested by Ross (1974: 80-84).

Stage 1. Relevant technological elements are present in isolated pockets. In the case of American railroads, the relevant technological elements had been accumulated by the British locomotive builders, and American mining tramway operations, steamship operations, foundries, small steam engine builders, overland stage lines, and canal operations. Also included here would be what Stinchcombe (1965) labelled the organizational capacity of a society. Additional societal precursors to the creation of new organizations have been suggested by Aldrich (1978).

Stage 2. An invention or discovery or a change in environmental circumstances prompts the mixing of previously unmixed technological elements. In the case of the railroads, the success of the Erie Canal, coupled with a war with England, which dried up federal canal building funds, and the hilly region west of Baltimore and Charleston, prompted people to turn their interest toward railroads and the steam locomotive. It does not seem that a new tech-pool and organizational form result simply from the invention of a new technological element such as the steam locomotive, airplane, assembly line, computer, or linear programming, and so forth. Instead, once a new element is recognized there is a slow mixing of previously unmixed elements. In some cases the new technological element is added on to a previous mix, such as assembly lines in automobile organizations, and hence there is an evolution within an organizational form rather than actual creation of a new form.

Stage 3. During the period the new technological mix has an advantage, there is the gradual development of a tech-pool of unique character. Thus, during the first 50 years or so of the railroads, there was the crystallization of a tech-pool uniquely associated with difficulties in running railroads across vast stretches of land and in operating heavy equipment. During this time the tech-pool becomes more "ingrown" and increasingly insensitive to other outside developments. The personnel holding technological elements come increasingly from other organizations using the same tech-pool, as do new developments in technology.

Stage 4. The new core technology evolves to the point where elements from other tech-pools prove inferior, or are clearly not applicable. In biology this stage is analogous to the point in speciation where two species may mate but produce inferior or sterile offspring. At this stage, people "in the business" would usually feel little to be gained by bringing in outsiders or ideas from other businesses, and there would be a tendency to reject things "not invented here." Insiders would feel outsiders do not understand how things need to be done, and so forth. Business schools at this stage might bring in businesspersons as deans but the message would be "keep your hands off the running of faculty and academic affairs." ("But it would be fine if you would go outside and raise money for us!"
Stage 5. The separation of the tech-pool is reinforced by the development of isolating mechanisms. Training in the core technology would be time-consuming and expensive. The technology would be complex enough to preclude an organization picking it up easily by having existing employees learn it or by hiring small numbers of new employees. Federal regulations, professional associations and the like also would have emerged. In the railroad business problems with unions, the ICC regulations, customer preferences, not to mention the problems of making efficient use of expensive equipment, would accumulate to make it difficult for outsiders to come in and master the core technology, and it would be equally difficult for another organization with a different core technology to easily become effective in the railroad business. One of the anecdotes associated with the failure of the new rapid transit line in the San Francisco Bay area (BART) was that all their enthusiasm for new technology they never got around to hiring someone who could “run a railroad.” BART was developed in the space-age, using much of its tech-pool. They forgot how important the railroad tech-pool was.

CONCLUSION

After reviewing notions of causality implicit in several theories of classification, an argument was made in support of an evolutionary approach to thinking about how differences among organizations are created. A further argument was made that effective classification of organizations cannot proceed until a workable specie concept is developed. Pursuant to this, the core technology concept, together with the tech-pool concept, were presented. The paper ended with a brief outline of major stages in the organizational speciation process.

The ideas presented in this paper are not meant to end discussion on organizational speciation but rather to begin it. There are several logical next steps. One is to pursue the development of specie concepts alternative to the core technology notion. There needs to be fuller consideration of the argument made here and elsewhere (McKelvey 1978a) that numerical methods will remain in the doldrums until viable a priori theories of organizational differences are accepted. The evolution of organizational forms, as opposed to management thought, is a largely untapped subject. Finally, the development of tighter, more empirically grounded, middle range theories tied to different species of organizations needs to be pursued. These might include theories of organization design, change, motivation and leadership, and planning and control systems, to name but a few. Until such theories are focused and compartmentalized, except at the most abstract levels, it seems likely that organization science will have little solid impact on practical management.
NOTES

1. For further critical review of systems theory see Melcher (1975).
2. See Hannan and Freeman (1977) for a discussion of niche theory.
3. Decision rules bearing on the classification of organizations into polythetic groups are the subject of classification method, not dealt with in this paper.
4. Shetty and Perry (1976) found that chief executives brought into an organization from outside performed at a lower level than those already inside.

REFERENCES


—. Organizational Systematics. Graduate School of Management, UCLA, 1977.


Pinto, Patrick R., and Pinder, Craig C. A cluster-analytic approach to the study of organizations. *Organizational Behavior and Human Performance*, 1972, 8, 408-422.


——. Personal Communication, 1977b.
