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PUBLIC ADMINISTRATIVE BEHAVIOR AND COMPLEXITY: A PRELIMINARY MODEL WITH APPLICATIONS

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THE NEED FOR A MIDDLE-RANGE THEORY

Students of public administration and government have long sought a useful theory of public administrative behavior.[1] Ironically, efforts devoted to developing such a theory over the past half century have generated increasing pessimism about the possibilities that such a framework might emerge. Reading various retrospective essays on the state of the theoretical enterprise in public administration (Waldo 1948/1984 and 1980; Bailey, 1968; Caiden, 1971, esp. chapter 10; Denhardt, 1990), one comes away with a sense that the field remains frustrated by an intellectual crisis (Ostrom, 1974) tied directly to what Dwight Waldo called a "crisis of identity" more than twenty-five years ago (Waldo, 1968, pp. 3-11; also see Stillman, 1991).

Responses to these frustrations have ranged from attempts to construct a new paradigm for public administration (Ostrom, 1974) to acceptance of the "great diversity of theoretical perspectives" resulting from the many "wicked" problems facing public administration (Harmon and Mayer, 1986). Between those extremes stand a variety of attempts to develop broadly applicable theories of public administration. Some have sought a broadly defined theoretical "framework" within which a useful empirical theory can develop (Wamsley and Zald, 1973). A few have sought to develop a comprehensive perspective with normative, as well as explanatory, powers[2] [e.g., Ostrom's (1974) "democratic administration" paradigm; Wamsley, et al.'s (1990) "agency" perspective]. Still others have developed less global approaches (see Perry, 1991, pp. 6-13) with roots in Robert Merton's call for a "middle-range" theory-building strategy.

Merton proffered the "middle-range theory" in the 1950s as a response to those seeking a theoretical approach "intermediate to the minor working hypotheses evolved in abundance during day-to-day routines of research, and the all-inclusive speculations comprising a master conceptual scheme" (Merton 1968, pp. 39-72). Although not consciously adopted as a theory-building strategy in public administration, middle-range theory approaches have been used regularly by analysts of bureaucratic behavior such as Herbert Kaufman,

Aaron Wildavsky, James Q. Wilson and others.[3] Only recently have the attributes of this approach been made explicit (Lane, 1990).[4]

Often perceived as "too soft" by methodological hard liners and theoretically insufficient by those enamored by the search for grand theories, middle-range theories have proven intuitively attractive for many students of public administrative behavior who believe they reflect more than merely convenient "second best" alternatives to other approaches. The complex and dynamic character of American public administration begs for an open-ended and flexible approach. The ambiguous subject matter of American public administrative behavior itself has both set the parameters and shaped the search for the appropriate standards of study and theory construction (Stillman, 1991). The result has been a clustering of public administration research around the middle-range.

One obvious cost of relying on the implicit emergence of middle-range theories has been the lack of a coherent theoretical framework upon which a synthesis might be developed or within which extant and future research can be advanced.[5] A middle-range theory synthesis is needed that will facilitate further research and reflection rather than summarize studies of the past (see Perry 1991; Dubnick and Romzek, 1993).

It would be self defeating, of course, to expect or even seek a synthesis that explicitly or implicitly assumed the tone or nature of a grand theory. Yet it would be equally wrong to ignore the potential of deriving from extant research a paradigmatic framework that would enhance and advance our understanding of public administrative behavior. Thus, if a potential "least common denominator" (LCD) can be found within existing research, it could prove useful as a foundation for the desired middle-range theory synthesis.

The notion of "adaptation" is an strong candidate for that LCD position. With no notable exception, agency-environmental relations has played a strong -- if not pivotal -- role in the classic studies of American public administrative behavior. In almost all cases, the adaptive nature of those relations has been highlighted. And with few exceptions (Kaufman, 1985/1991; Wood and Waterman, 1993), no effort has been made to explicitly articulate a middle-range theory reflecting the salience of adaptation in the study and practice of American public administration.

In this paper we assume the challenge of constructing such a theory of the middle range and demonstrating its applicability to three major issues facing the field: Are public agencies manageable? Is the public provision of services replaceable? Is American public administration reformable? We start with an overview of the choices among various adaptation approaches that can be applied. We then offer an elaboration of an adaptation model -- a conceptual infrastructure -- that integrates what we have learned from existing middle-range theory research with some recent developments in the study of dynamical and complex systems. At that point we return to those major issue to both test and demonstrate the potential utility of this middle-range approach.

THE ADAPTATION OPTIONS

Adaptation-based perspectives have been applied to a wide range of social behavior. At one extreme, the use of adaptation has been limited to noting that individuals adjust to social pressures in different ways,[6] while at the other extreme it has been used to understand or explain change and development of entire societies.[7]

The notion of adaptation is found throughout the literature on social behavior. Yet, while adaptation plays a critical role in organized human behavior, there have been few efforts to construct an explicitly adaptation-centered theory of behavior. In most instances, adaptation has been regarded as an important and useful conceptual mechanism that enhances the power of other theories. This has been most evident in the fields of genetics and evolutionary biology, but the concept of adaptation plays equally significant roles in a wide range of fields from economics and strategic management to game theory and artificial intelligence. Only recently has adaptation itself become the focus of theory-building efforts (see Holland, 1992).

As noted previously, some notion of adaptation can be found throughout the study of public administrative behavior.[8] As in other intellectual arenas where adaptation has been used, the particular view of adaptation applied in analyzing public administration has varied from study to study, oftentimes betraying an author's implicit assumptions about the ontological nature of his or her subject matter. In public administration, those ontological assumptions represent two choices made about public administrative behavior:

- Is the behavior being considered *individual* or *collective*? That is, is our attention focused on the behavior of individual public administration actors, or are we concerned with the behavior of collective entities where the composite whole is greater -- or at least distinct from -- the sum of its individual parts?
- And of equal import, is the subject of our attention perceived as *structured* (i.e., responding according to a set repertoire of reactions) or *reflective* (i.e., representing a "thoughtful" process that is capable of generating new and innovative responses each time)?[9]

Anthony Downs' Inside Bureaucracy (1967) is a classic example of the individual/structured focus wherein he establishes his bureaucratic behavior model based an individual rational actor who is assumed to react in a consistent way to varying situations. Downs' bureaucrat responds to different situations as a utility maximizer, relying on a set of tactics shaped by what he or she defines as the utility to be maximized. Thus, "climbers" in Downs' model rely on "promotion, aggrandizement and jumping" as they respond, while "conservers" rely on a different set of responses (Downs, 1967, chapter IX).

In contrast, Herbert Kaufman's study of forest rangers (1967) and John J. DiIulio's of corrections officers (1987) reflect the assumption of a individual/reflective focus wherein individual level administrators are regarded as constantly engaged in transforming their repertoire of potential responses to adjust to varying and changing conditions.

Frederic A. Bergerson's study (1980) of relations among the military services uses a collective/reflective lens on the subject of public administrative behavior by stressing the behavioral adjustments made by

organizational entities to the challenges of a changing environment. Compare this to the collective/structured view used in R. Douglas Arnold's study of congressional-bureaucratic relations (1979), where agency-level choices were assumed to be made on the basis of a limited set of options for responding to legislative influence.

How do these ontological foci relate to adaptation perspectives? The distinction between structured and reflective approaches, for example, is mirrored in a controversy among evolutionary biologists that even predates publication of Darwin's On the Origin of Species. Put simply, there is a major division in the field of evolutionary biology[10] between those who adhere to a "traditional" Darwinian natural selection model for adaptation and those who argue that the adapting organism plays a dynamic and creative role in the process. For the traditionalists, natural selection is *the* creative force in adaptation and evolution. The object of the natural selection is a genetic structure that is randomly impacted by the process, but that structure cannot and does not direct or energize the adaptation process. Its options are limited by what its genetically encoded instructions allow. In contrast stand those who believe in a more positive role for the adapting organism through some inner directing order or self-organization (e.g., see Wesson, 1991). It is evident that this division among biologists corresponds to the ontological distinction made between those who perceive public administrative behavior as structured or engaged in reflection. Obviously, the use of a traditional model of adaptation will favor a more structured view of public administrative behavior, while the "positive adaptation" model is more complementary to the reflective perspective.

Similarly, a related controversy among evolutionary biologists focuses on the question of whether the species or individual organism is the *primary adaptive unit* in the theory of evolution. Since the primary ontological focus of evolution biologists is on species, there is no disagreement about what is evolving. Where the argument occurs, however, is whether the process of evolutionary adaptation is occurring primarily at the individual organism or species levels. A focus on adaptation at the level of individual organisms tends to stress the continuity and gradualness of evolution, while species-level adaptation -- in combination with the findings of paleontologists -- has promoted views that emphasize "punctuated equilibrium" and other views of radical evolutionary change.[11]

The association of adaptive models to ontological foci is summarized in Figure 1. Two of the models (genetic and selective adaptation) derive from the models of evolutionary biology, while the remaining two (cultural and choice adaptation) emerge from the social sciences.

Genetic adaptation is associated with the view that behavior is adapted at the individual level according to a structured or programmed repertoire of behaviors. Here, as the label implies, adaptation is guided by the behavioral blueprint found in the "genes" or some similar mechanism. It is easy to recognize this model as closely resembling the Taylorist ideal where worker judgment is replaced by "scientifically" determined rules and practices (Taylor, 1967). Among students of public administrative behavior, those adopting formal theory approaches clearly rely on this model of adaptation to

help them understanding that behavior (e.g., Orzechowski, 1977). Empirical studies of actual public administrative behavior, however, do not provide support for the adoption of this adaptation model. This may be due, in part, to automation of those public service jobs that might be susceptible to such a model. But decades of studies (e.g., Blau, 1955/1963; Kagan, 1978) have also shown that efforts to constrain individual behavior through rules and other structures do not -- and cannot -- eliminate the human factor in the adaptive process. Thus, this model is of limited value in the effort to conduct empirical studies of public administrative behavior.

In contrast to the genetic model, *selective adaptation* characterizes studies of behavior in public administrative collectives that are also regarded as bundled strategic choices, i.e. structured. Here adaptive behavior is subject to "selection" by forces in the environment. Organizations, public (Kaufman, 1985/1991, pp. 134-136) or private (Nelson and Winter, 1982), develop various standard procedures, agency strategies, and other structural mechanisms for dealing with problems in the hope that these will make the desired difference. According to this model, however, these structures by and of themselves mean little in the face of environmental forces that ultimately determine which shall be adopted and which shall be ignored -- which will succeed and which will fail.

Two relatively recent examples where selective adaptation models have been applied explicitly to public administrative behavior should be noted. Herbert Kaufman's (1976) effort to study the "immortality" of government organizations eventually led to his discourse on the central role of chance in determining organizational survival (Kaufman, 1985/1991). While noting that he does not intend to equate the biological and organizational worlds, Kaufman borrows heavily from the theory of natural selection as he focuses on the survival of collective entities. Focusing on the death, birth and survival of public agencies, Kaufman is quite explicit in his assumption that the efforts these organizations make to respond to their "perilous" environments in any rational or structured sense (and they do make such efforts) are not likely to make an immediate difference, although they might have long-term implications (Kaufman, 1985/1991, pp. 49-51).

Another explicit application of selective adaptation to the study of public administrative behavior is provided by Wood and Waterman (1993) who set out to develop "a model of political-bureaucratic adaptation" that highlights "the specific mechanisms through which political institutions operate and their relative importance" (Wood and Waterman, 1993, p. 498). Using evidence from EPA programs, Wood and Waterman posit a variety of alternative sources of pressure for agency-level adaptation, but they limit the type of responses to those that were "instantaneous..., delayed, gradual, and distributed through time in a probabilistic fashion" (Wood and Waterman, 1993, p. 500). Thus, their adaptation model complements an ontological focus on public administrative behavior as that of a collective (almost "billiard ball"-like) entity with highly structured response repertoires.

What the genetic and selection adaptation models have in common is a perspective that minimizes the value of autonomous public administrative behavior in determining its role or place in the machinations of government.

In both adaptation models, the behaving entity is regarded as either passive or as the media through which determining forces operate. This is not the case with the remaining two models.

Cultural adaptation represents a collective-level model relating how behavior actively contributes to its own form and substance. Cultures, in this model, constitute a range of socially (i.e., collectively) constructed scenarios which define the parameters of appropriate and acceptable behavior. Building on the work of anthropologist Mary Douglas, Thompson, Ellis and Wildavsky (1990) provide a "cultural theory" dealing with both the stability of alternative "ways of life" (cultures) and how these change (i.e., adapt) to anomalies and "surprises" in the environment.[12] In the face of constant and inevitable challenges, the behaviors of individuals shift within the cultural parameters of their collective entity (Thompson, Ellis and Wildavsky, 1990, chapters 4-5). Adaptation under this model is limited by parameters set by the cultural context, but not as restricted as the more structured context of genetic or selective adaptation.

In the literature of public administration, there is perhaps no better example of this adaptation model than Selznick's TVA And The Grass Roots (1949). The Tennessee Valley Authority's consciously adopted "grass-roots doctrine" eventually emerges as a "protective ideology" within which it made operational and policy decisions. For all intents and purposes, it acted as a defining cultural context that determined how the agency adapted to its local environment. In more recent years, Mashaw's Bureaucratic Justice (1983) reflects a equally powerful application of this view of adaptive public administrative behavior. The culture of the Social Security Administration's (S.S.A.) disability claims division was characterized by a bureaucratic justice model that Mashaw analyzes in detail. As with Selznick's T.V.A., the S.S.A. response to challenges and changes were shaped within the cultural context provided by that model.

Finally, *choice adaptation* characterizes the work of those who focus on public administrative behavior as individual and reflective. For examples of this orientation we turn to the work of Herbert Simon (1957) and Charles Lindblom (1990). Despite being associated with the advocacy of rationality, Simon's view of adaptation is rooted in the notion that human behaviors -- i.e., decisions or choices -- are central to efforts of adjustment (adaptation) to "irrational and nonrational" situations. "The area of rationality," he argues, "is the area of adaptability to . . . nonrational elements" (Simon, 1957, p. 241). Adaptation, in short, is manifest in attempts to be rational in the face of significant impediments to rationality. Lindblom takes this notion further by focusing on the centrality of "probing" behavior and inquiry in individual efforts to deal with problems through processes he characterizes at one point as "never-ending inconclusiveness" (Lindblom, 1990, p. 216). In both instances, the efforts are bound to come up short. For Simon, the result will be less than optimal decisions; for Lindblom, at some point a choice must be imposed, typically by the state. What is important about both views, however, is their lack of attachment to some structured goal or set strategic repertoire. Simon sees the adaptive decision-making process as a dynamic one in which options and ideas

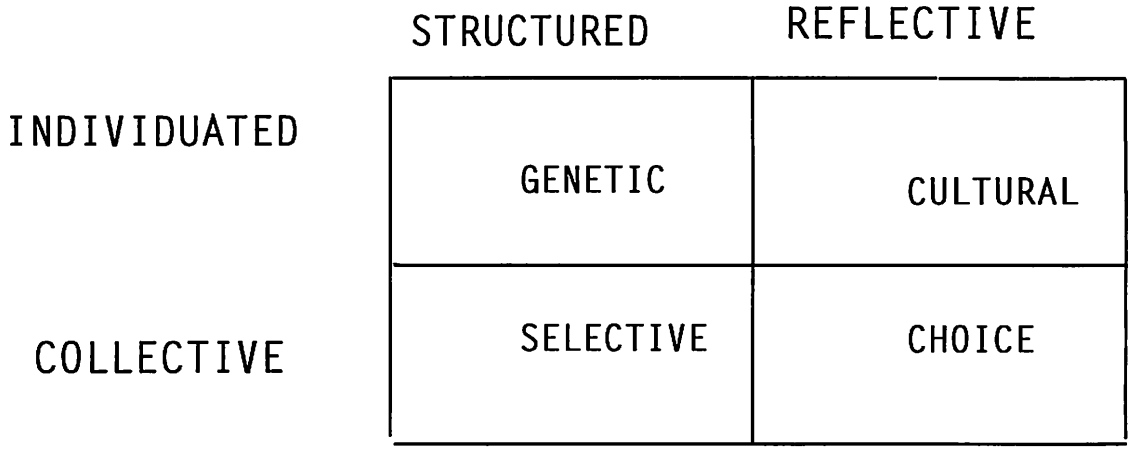

FIGURE 1: ADAPTATION MODELS

proliferate (Simon, 1983, pp. 770-772), while Lindblom sees probing as a creative act through which individuals reflexively make choices about how to behave (Lindblom, 1990, pp. 21-24).

Any middle-range theory based on adaptation will come from among these four adaptation models, and to select among them means adopting a particular ontological focus. If our purpose in constructing a middle-range theory approach is to provide a foundation for further research on public administrative behavior, the decision to select one ontological path over another is critical in determining the shape and direction of the enterprise. With that in mind, in the next section we elaborate a conceptual infrastructure for our middle-range theory within the dynamic context provided by the choice adaptation model. We believe that decision is justified by both the past and potential fruitfulness of studies that focus on individual and reflective public administrative behavior. As will be evident in the elaboration that follows, this choice in no manner intended to devalue alternative approaches. In fact, we find it necessary and beneficial to borrow from them, and we do so without concern. In the pursuit of a middle-range theory, all doors remain open.

A CONCEPTUAL INFRASTRUCTURE

Among a disparate but growing group of scientists,[13] adaptation is more than merely a condition achieved by biological organisms or a facilitating process within the Darwinian theory of evolution. According to John H. Holland (1992), "adaptation is a fundamental process, appearing in a variety of guises but subject to unified study" (p. 2). It is a process inherent in a wide range of natural and artificial phenomena where one can observe that "an initially unorganized system acquires increasing self-control in complex environments" (p. 3). Thus, Holland contends, a unified approach (i.e., theory) to adaptation is as relevant to the study of economics, production control engineering, and physiological psychology as it is to genetics (pp. 2-5). We contend that such a unified approach toward adaptation is applicable to the study of public administrative behavior, and can provide a fertile conceptual foundation for our efforts at middle-range theory building.

Holland's work on complex adaptive systems rests on a set of seven questions common to all of them[14]:

1. To what parts of its environment is the organism (system, organization) adapting?
2. What structures are undergoing adaptation?
3. How does the environment act upon the adapting organism (system, organization)?
4. What part of the history of its interaction with the environment does the organism (system, organization) retain?
5. What are the mechanisms of adaptation?
6. What limits are there to the adaptive process?
7. How are different (hypotheses about) adaptive processes to be compared? (Holland, 1992, p. 2)

Building on these queries, Holland developed a unified approach to adaptation. Borrowing from his model, we will attempt to show how a simplified version of

the unified adaptation approach can provide an infrastructure for a middle-range theory of public administrative behavior.

1. To what parts of its environment is the organism (system, organization) adapting? Holland begins by seeking an definition of the *environment* (ε) within which the adapting entity operates. Students of public administration have paid a great deal of attention to the political, institutional and legal environments of public sector activity, and in recent years have been increasingly attentive to economic and fiscal factors. However, few have given the more general environment of public administration the attention advocated by John Gaus who argued more than fifty years ago for a more "ecological" perspective on public administration. Public administration, he argued, is built "quite literally from the ground up, from the elements of place -- soils, climate, location, for example -- to the people who live there -- their numbers and ages and knowledge and ways of physical and social technology by which from the place and in relationships with one another, they get their living" (Gaus, 1947, p. 1).[15]

For present purposes we need to acknowledge both the wide range of environmental factors relevant to public administrative behavior as well as the salience of certain parts of those surroundings. To do this we developed a simple model of the general environment of public administration (see Dubnick and Romzek, 1991, chapter 4).[16] Building on Gaus' comments, an eight dimensional "ecological model" was developed to help categorize potentially relevant parts of the public administrative environment. As illustrated in Figure 2, it covers a wide range of different environmental features: physical, technological, demographic, cultural, economic, governmental, policy making, and personal. Of course, not everything within each of these environmental arenas is public administration-relevant (*pa*), and so we narrow our attention to those elements in each arena that can be characterized as *pa*, allowing us to focus on a subset of the general environment,

$\circ\ E \subset \varepsilon$, where $\{E{:}pa\}$.

For notation purposes, we will designate this the public administration relevant environment, Epa.

Within the context of our middle-range construct, however, this more focused designation still leaves much to be desired. More significant than the potentially relevant environment are those parts of the public administration ecology (Epa) highlighted for attention[17] at a given point in time and space ($t\sigma$). In other words, the situation ($Epa_{t\sigma}$). Conceptually, what distinguishes a situation from both the general environment or the public administration relevant environment is that the situation involves objects that are meaningful for the individual public administrator at the point of activity (Parsons and Shils, 1951, p. 56).

Empirically, situations may emerge as the most meaningful features of the public administrative environment. This is especially true under

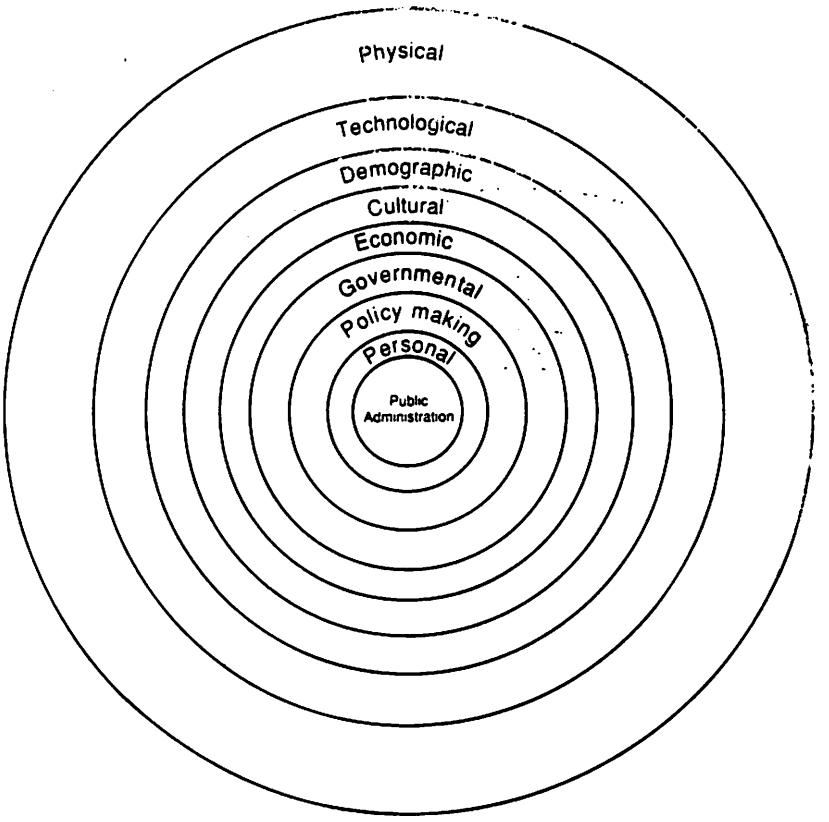

FIGURE 2: THE PUBLIC ADMINISTRATION ENVIRONMENT

(From Dubnick and Romzek, 1991, p. 94)

conditions of ambiguity and conflict (Wilson, 1989, p. 36) -- conditions all too common in the real world of public administrative behavior. In other words, there are times when situations become more than merely contexts for action. They can, argues James Q. Wilson (1989, pp. 36-44), generate their own dynamic imperatives (see discussion of expectations below).[18]

2. What structures are undergoing adaptation? The salient components -- or "grist" -- of an adaptation model are the *structures* (α) which are central to the process as the subject of adaptation mechanisms. The nature of these structures vary according to the subject matter. In genetics they are chromosomes, in game theory they are strategies, and in artificial intelligence they are programs (Holland, 1992, p. 4). In the study of public administrative behavior, the equivalent structural units are termed enactments (α_{en}) (see Weick, 1979, pp. 130-131).

As described by Karl Weick, an enactment is a form of social action[19] taken by individuals that "brackets" parts of the actor's surroundings for closer attention. According to Parsons and his colleagues, social actions are human behaviors "oriented to the attainment of ends in situations, by means of the normatively regulated expenditure of energy" (Parsons, et al., 1951, p. 53). Thus, to be called a social action, a behavior must be goal oriented ("attainment of ends"), relevant to the context of the behavior ("situations"), and based on some intelligence or logic ("normatively regulated").[20] Within that conceptual context, an enactment is a social action through which individuals engage and "make sense" of their environments and particular situations (Weick, 1979, pp. 130-131).

Thus conceived, enactment structures perform a number of functions. First and foremost in our model, enactments define the experience of the social actor by determining what parts of the environment are relevant, i.e., which shall he or she be attentive to. Thus, from Weick's perspective, situations are a function of enactments,

- $Epa_{t\sigma} = f(\alpha_e)$

since the latter determines what is relevant. At the same time, an enactment defines what is to be excluded or ignored from the purview,

- $\sim Epa_{t\sigma} = f(\alpha_e)$

Importantly, an enactment can also function as a means for dealing with the environment -- from service as a navigation tool or map to guide us through our everyday lives, to use as a model upon which strategies can be designed and implemented (see Weick, 1979, chapter 6).

Lest this view seems too extreme, the adaptation model provides an equally significant role (although not a dominant one) for the environment (see below). Part of any situation's influence over enactments is rooted in the fact that there are too many possible enactments, each with different situation-handling capacities. Holland notes that, even within modest adaptive systems, the number of possible structures is "enormous" (Holland, 1992, p. 16). Logically, one can easily argue that the same holds true for

enactments in our model. Hypothetically, under completely random conditions, any specific subset of enactment structures (A_{en}, where $A_{en} \in \alpha_{en}$) might emerge vis-à-vis any given situation. But under adaptive conditions, those subsets do not exist as random possibilities. Instead, they exist as subsets distinguishable from one another by their respective abilities to "perform" under different conditions, i.e., situations.

Performance (μ) thus plays a central role in any adaptation scheme, for it helps to differentiate among alternative structures and highlight those structures that are likely to be used in a specific adaptation process. In genetics, performance is defined in terms of "fitness" (which chromosomes provide the best potential fit) while in game theory it takes the form of "payoff" (which strategy is most likely to generate the greater payoff) (Holland, 1992, p. 5).

Unfortunately for our purposes, any attempt to designate a single or even dominant performance standard for all public administrative behavior would be impossible -- or at least the height of hubris if not foolishness. There are any number of candidates. For instance, we might focus on some highly desirable performance standard such as efficiency (μefy), effectiveness (μefc), equity (μequ), responsiveness (μres) or any number of other potential candidates (μxxx) (see Fried, 1976). Or we might seek out some less than optimal solution, such as Simon's satisficing (μsat); that is, taking actions "that almost everyone in a society will tolerate, and that even many people will even like, provided we aren't perfectionists who demand an optimum" (Simon, 1983, p. 85).[21]

The performance standard of greatest utility in the adaptation of public administrative behavior is -- and will probably remain -- an empirical question that must be answered each time we consider an instance of public administrative behavior. Put notationally,

- $\mu xxx = f(Epa_{t\sigma})$

Given the dependence of the situation on enactment structures [$Epa_{t\sigma} = f(\alpha_e)$], we can begin to appreciate the extent to which public administrative behavior is tied to its cultural and social context.

- $\mu xxx = f[Epa_{t\sigma} = f(\alpha_e)]$, or
- $\mu xxx = f(\alpha_e)$

The logical result of this formulation is that enactment structures selected through the adaptation of public administrative behavior will tend to be reinforcing. This conclusion complements a wide range of theories about human culture and individual psychology. Where the enactment structures create situations in which equity is a central concern, then an equity performance

standard is likely to dominate, and enactment structures will be distinguished according to the extent to which they favor or promote equity; similarly, where responsiveness is a salient factor in a situation, one is likely to find μres as the basis for differentiating among various enactment structures.

One can foresee problems with such a model if performance standards were not stable over time, for it would be difficult to assess (and therefore make distinctions among) various enactment structures. That is, in fact, one of the central problems facing public administrative behavior in the United States, for there are typically a number of alternative performance standards contending for priority in any given situation. Periods of major administrative reform in the United States occur when a particular performance standard becomes so dominant that it becomes the basis for differentiating and selecting among alternative behavior choices. Within an agency, major changes can be brought about if a specific performance standard is given priority, e.g. efficiency, equity. In most cases, however, such dominance is rare, resulting in the application of a less than optimal standard such as satisficing.

For present purposes, we are left with the general proposition that at any point in time and space, what distinguishes a particular set of enactment structures from all other enactment structures is a function of the application of a currently dominant performance standard to the universe of all possible enactment structures, or:

$$\circ A_{en} = f(\alpha_{en} \times \mu x x x_{t\sigma})^{22}$$

3. How does the environment act upon the adapting organism (system, organization)? At the heart of the adaptation model is the question of the linkage between environmental and structural forces. Among biologists and other evolution theorists, this is the area of greatest controversy. How influential is the genetic (structural) factor in evolution and adaptation, and how influential is the environment? Rather than engage these issues, we focus our attention on describing two dimensions in the linkages between the situations and enactment structures which characterize public administrative behavior -- the media through which they pass (i.e., signals) and their content (i.e., expectations).

The signals. In Holland's formal model of adaptation, the issue of how the environment acts upon the target structures is an important one, and his treatment of this issue provides some insight into the way natural scientists view the underlying dynamics of the adaptation process itself. It is a perspective reflecting the intellectual history of biological evolutionary theory.

Among biologists, the relationship between organisms and their environments historically has been approached in three ways (Levins and Lewontin, 1985, pp. 51-58). Pre-Darwinian biologists perceived the relationship as symbiotic and harmonious. The environment was regarded as a resource (or pool of resources) to be drawn upon, and that was exactly what organisms did. In this view, the various structures of organisms (e.g., the giraffe's long neck, the snout of the anteater) were adaptations to the

available resource base. The traditional Darwinian model challenged that view, however, by noting just how hostile and limiting the environment was to all life forms. Life itself was stressful and brutish, and only the "fit" survive. More recently, biologists have regarded the environment in more passive terms -- as a potential source of information, with organisms as the users of the signals being generated. This third perspective is reflected in Holland's model (1992, p. 22). For him, environmental signals are derived rather than merely received. Effectively complementing Weick's view of enactment, Holland's model regards structures as the independent and sole active agent in the generic adaptation process.

We assume a somewhat contrary position regarding the role of environmental factors in the adaptation process. As conceptualized in our model, we find all three views of the environment to be relevant. The relationship between situations and enactment structures ($Epa_{t\sigma} \leftrightarrow \alpha_e$) can take a wide range of forms based on the stimuli or *signals* (S) emanating from the general environment,

- $S = f(\varepsilon)$[23]

Perceived as an active feature in the relationship, an environment can generate facilitating, resource-laden signals (S_R), or it can spawn limitations and constraints (S_C). Viewed more passively, the signals can be understood as available information (S_I) which might be used by the enacting structures based on their capacity to do so. We will assume that any particular situation is capable of generating some specific combination of all three types of signals at any given time and place:

- $S_{t\sigma}: S_R,\ S_C,\ S_I = f(Epa_{t\sigma})$

How do these signals impact on the enactment structures? There are two responses, one simple and unqualified, the other requiring qualification. The simple response can be summarize by the statement,

- $(S_{t\sigma} = f(Epa_{t\sigma})) \rightarrow \alpha_e$

reflecting what might seem as obvious conclusion -- that signals are the media through which situations facilitate, constrain, and otherwise inform enactment structures. Were we to leave the elaboration at this point, the conclusion would be that situational signals stand as independent forces in the adaptation process and should be factored into our model accordingly. A required and complicating qualification comes in the previously noted role played by enactment structures in determining the situations that generate the signals, that is,

- $Epa_{t\sigma} = f(\alpha_e)$

The complication boils down to this: while accepting the independent role of some situational signals in the adaptation process, we must also accept the significant role that enactment structures play in determining which signals will be heard and which will be ignored.

The logical difficulties implied in this modified adaptation model do not plague Holland's more generic adaptation model, for he accepts the concept of a passive, information-based environment. But it was a problem faced by Nelson and Winter (1982) in their application of an evolutionary theory model to economic change. They found environmental factors to be more active and relevant to the economic change process than the biological model they were using would allow. The problem was grounded in the treatment of all parts of the environment as exogenous variables in the evolutionary process. Thus, in economics one cannot rely strictly on the behavior of the firm to understand the process of economic change and growth. One must factor in the active influence of some environmental factors, such as market prices and the various forces and structures that shape them (Nelson and Winter, 1982, pp. 157-162).

Similarly, any useful model of the adaptive world of public administrative behavior must go beyond the structural determinism inherent in Holland's model and characteristic of the Weickian theory of "enactments." We accomplish this by assuming a somewhat active (i.e., independent) role for the environment in the form of facilitating and constraining signals. At the same time, we maintain the assumption that enactment structures play a significant -- perhaps determining -- role in deciding what signals will be heard.

Having noted that, it is the powerful influence of the enactment structure in the relationship that has the most significant implications for our study of public administrative behavior. As conceptualized here, **enactment structures are incapable of standing as mere objects in the adaptation process.** They are actively involved in shaping whatever impact the environment has on them. Thus, from this perspective, **public administrative behavior cannot help but be responsible behavior.**

But responsible for what? Having noted that the environment provides signals for the situation to respond to, we must now address the issue of what those signals contain. For this we turn to the concept of expectations.

Expectations as content. In the study of communications, much has been made of difference between signals sent and messages received. The evidence and examples of this fact run the range from the mundane to the tragic:[24]

> Headquarters to brigade: "On no occasion must hamlets be burned down."
> Brigade to battalion: "Do not burn down any hamlets unless you are absolutely convinced that Vietcong are in them."
> Battalion to company commander: "If you think there are any Vietcong in the hamlet, burn it down."
> Company commander to troops: "Burn down that hamlet."

The content of the signals emanating or drawn from the environment are subject to the same influences, and thus must be treated as distinct from the media. The distinction can be so great, that the notation I will be used to designate the content of the signals and distinguish them from the signals per se.[25] To

be more specific, we focus attention on certain types of message content which is central to public administrative behavior, expectations ($Iexp$).

As we have indicated elsewhere, students of public administrative behavior have not made far-reaching use of the concept of expectations despite its central place in the study of governmental and social action during the post-World War Two era (Dubnick and Romzek, 1993).[26] Among those post-war analyses, the most useful version of the expectations concept is found in the work of Talcott Parsons and others relating to the development of a "general theory of action." Individual actions, they note, are reactions to situations and how an individual orients toward it. Each situation orientation has two dimensions -- one of choice, through which the actor perceives the alternatives available to deal with the situation; and one of "expectancy", through which the actor develops "an orientation to the future state of the situation as well as to the present" (Parsons, et al., 1951, p. 68). What is distinctive about these expectancy orientations is that they were simultaneously cognitive and cathectic. That is, the orientation includes not only the actor's ability to cognitively discriminate among different expectations about the situation, but also his or her ability to attach some sense of value or significance ("a readiness to receive gratification and avoid deprivation") to the expectation (Parsons, et al., 1951, p. 68). Thus, in this construct we have a direct association between expectations and action. For present purposes, that association takes the form of expectations (themselves derivable from enactment structures) acting upon structures, i.e., enactments,

- $Iexp \leftrightarrow \alpha_e$

The significance of expectations in this model is related to the complex context they provide for adaptive structures. Recent advances in the study of complex systems (Pagels, 1988; Waldrop, 1992; Lewin, 1992) have drawn attention to their "dynamic" quality. Conceptually, students of complex systems place their subject matter between the two extremes of order and chaos. Orderly systems, although potentially quite complicated in design (e.g., computer chips or other uniformly design and produced systems), are static by nature. That is, the variability of and relationship among component parts of the system are minimal and quite predictable. In chaotic systems, in contrast, that variability and those relationships are unpredictable, resulting in a constant state of turbulence (see Gleick, 1987). The variability and relationship among the component parts of complex systems, however, is dynamic rather than either static or turbulent. The component parts of complex systems, in brief, are capable of relating to each other and dealing with their surroundings.

As complex systems, humans and human groups manifest this dynamic capability through consciously designed and implemented activities. More fascinating for students of complexity, however, are examples of spontaneous dynamic responses.

> Thus, people trying to satisfy their material needs unconsciously organize themselves into an economy through myriad individual acts

> of buying and selling; it happens without anyone being in charge or consciously planning it. The genes in a developing embryo organize themselves in one way to make a liver cell and in another way to make a muscle cell. Flying birds adapt to the actions of their neighbors, unconsciously organizing themselves into a flock. Organisms constantly adapt to each other through evolution, thereby organizing themselves into an exquisitely tuned ecosystem. Atoms search for a minimum energy state by forming chemical bonds with each other, thereby organizing themselves into structures known as molecules. In every case, groups of agents seeking mutual accommodation and self-consistency somehow manage to transcend themselves, acquiring collective properties such as life, thought, and purpose that they might never have possessed individually (Waldrop, 1992, p. 11).[27]

The expectations environment of public administrative behavior is characterized by such spontaneous dynamic complexity.

We get some hint as to the nature of that complexity by considering the characteristics of relevant expectations. As we elaborate elsewhere (Dubnick and Romzek, 1993, pp. 55-66), any given set of interacting expectations has a variety of characteristics (see Table 1) $\{Iexp_{c1,c2,c3,\ldots c12}\}$. Six of the features highlighted in Table 1 -- number (c1), scope (c2), depth (c3), diversity (c4), intensity (c5), and tractability (c6) -- are "external characteristics" of an expectations set, i.e. they reflect how that set relates to the behavior of the social actor. The remaining six characteristics -- translucence (c7), structure (c8), complementarity (c9), temporality (c10), consistency (c11), and interrelatedness (c12) -- are "internal" features of the expectations set itself. It is important to note that each characteristic acts as a variable dimension of any given set of expectations. The result is a complex expectations environment for public administrative behavior which is capable of generating dynamic pressure on the social actor.

Collectively, we term these expectations variables the problematic environment ($Eprob$) and they reflect a key feature of our model by creating and energizing the problems to which those actions orient. The very existence of multiple, diverse, and often conflicting (i.e., complex) expectations makes such "stimulating" problems almost inevitable.

To more fully appreciate how this occurs, consider the different types of problematic situations that might emerge due to the existence of complex expectation sets. For present purposes, we will limit our attention to two features of any set of expectations, one external (diversity, $Iexp_{c4}$) and one internal (complementarity, $Iexp_{c9}$). Assuming the perspective of the social actor, we can construct a two-by-two scheme reflecting the variable impacts of expectation-set diversity and complementarity. Diversity within a set of expectations can result in varying degrees of ambiguity (low to high) in the overall meaning or directions derivable from that set. That is, in some instances the diverse demands being made by the multiple expectations will be

Table 1: CHARACTERISTICS OF EXPECTATIONS

EXTERNAL --

C1. Number

The quantity of expectations in a set influencing an administrator or agency.

C2. Scope

The quantitative range of behaviors addressed by the expectations.

C3. Depth

Degree of specificity of behaviors covered by the expectations.

C4. Diversity

The qualitative range of behaviors addressed by the expectations.

C5. Intensity

The degree of cathectic, i.e. emotional, attachment to an expectation or set of expectations.

C6. Tractability

The extent to which the expectation or set or expectations can be handled, managed, etc.

INTERNAL--

C7. Translucence

The clarity of meaning in the expectations.

C8. Structure

The arrangement of component parts of a set of expectations reflected in priority order.

C9. Complementarity

The level of agreement among component parts of a set of expectations.

C10. Temporality

The time factor associated with specific expectations reflecting variations in perceptions about when an expected state of affairs should be reached.

C11. Consistency

The stability and invariability of a set of expectations over time and space dimensions.

C12. Interrelatedness

The degree of interdependence among the component parts of a set of expectations.

clear (low ambiguity), while in other circumstances the message will seem unclear (high ambiguity). Between those two extremes, of course, is a wide variation in ambiguity. Similarly, varying degrees of complementarity within a set of expectations translate into perceived levels of conflict (low to high). At one extreme (high conflict), two or more expectations within a set may provide contradictory instructions to the actor; at the other extreme (low conflict), the messages may be noncontradictory. Again, a wide range of degrees of conflict stand between the two poles.

Combining just these two dimensions, four types of problematic situations arise[28] (see Figure 3). In situations where expectations are low in ambiguity but high in conflict, you have a state of "dissonance" in which any action will require the actor to commit to a particular subset of expectations while taking a stand against alternative subsets. This kind of circumstance occurs when administrators are assigned the task of formally adjudicating disputes arising under policies they are authorized to implement. Formally, administrative law judges in a variety of government agencies adjudicate disputes under conditions of dissonance (e.g., Warren, 1988, esp. chapter 7).

In situations where there are low levels of conflict but high levels of ambiguity, public administrators must deal with conditions of "fuzziness." No one would argue with the mandate that police officers "keep the peace" in a community, but few would be able to claim to know exactly what that mandate means. Under such conditions a good deal of discretion is left to the individual police officer to adapt his or her actions to particular street-level situations (e.g., Lipsky, 1980).

A third type of problematic situation arises where there are high levels of both ambiguity and conflict. Under such conditions a state of "confusion" dominates, creating a highly volatile situation where taking an uncontroversial action will be difficult if not impossible. In addition to inherent conflicts among expressed expectations, there is little agreement regarding the nature of what is expected from any possible solution that the actor might generate. As Herbert Kaufman (1977) has so brilliantly argued, the pervasive call for eliminating government "red tape" often leaves public officials flailing about while accomplishing little. The fact that one person's red tape is another person's essential service or protection is at the heart of the problem. A procedure safeguarding the rights of prisoners or the privacy of homeowners might be seen as wasteful to those seeking swifter justice or zoning restrictions on the construction of a heliport on the next door neighbor's estate. For the public administrator, involvement in such situations may prove traumatic.

Finally, even a seemingly ideal situation -- where there is a low level of conflict and low ambiguity regarding expectations -- can prove problematic under a variety of circumstances. Under such favorable circumstances, the situation remains "vulnerable." For one thing, it might be impossible to meet even clearly defined and widely accepted expectations in the long term. The U.S. Army Corps of Engineers, for example, has an unambiguous congressional mandate to keep the Mississippi River from changing its course and spilling into the Atchafalaya River. Despite such a clear and unchallenged mandate,

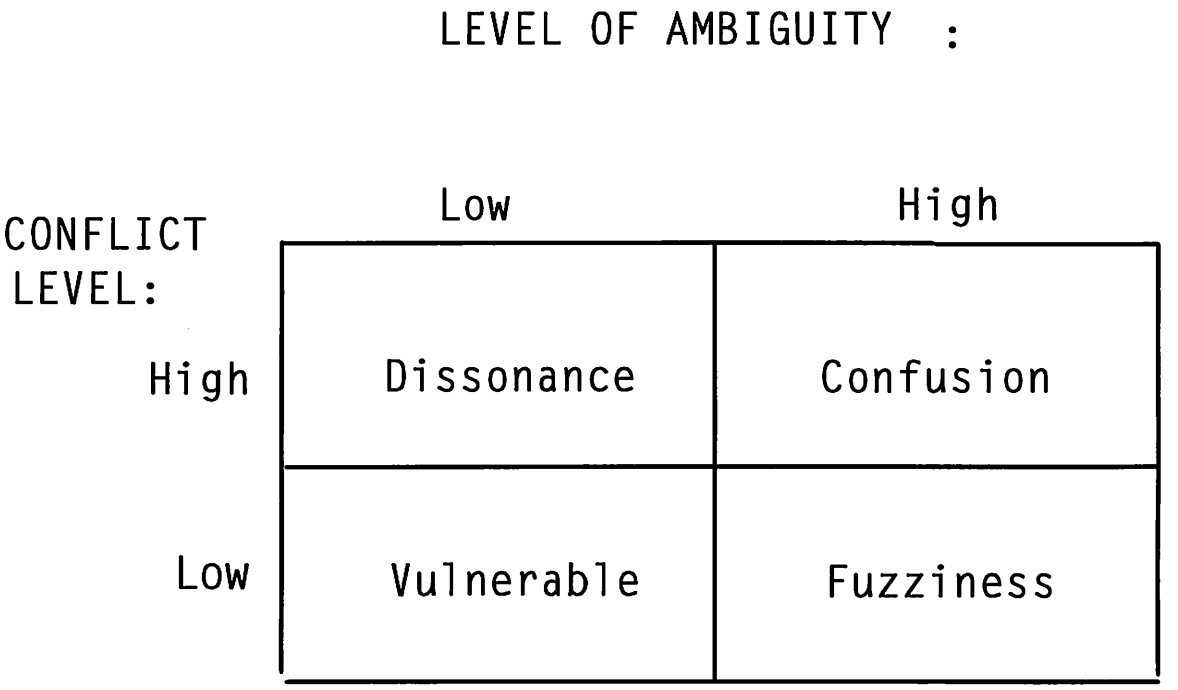

FIGURE 3: PROBLEMATIC SITUATIONS

members of the Corps know that in the long term the mighty Mississippi will do as it pleases (McPhee, 1989).[29] And where meeting expectations under such circumstances do not prove impossible (e.g., NASA's mandate to land an American on the moon by 1970), the pressures to maintain the consensus and supportive environment can prove no less intense and potentially costly in the long term[30] (see Lambright, 1990). And then there is the time factor: today's nonconflictual and clearly articulated expectation can quickly deteriorate tomorrow. The much studied swine-flu affair of 1976-77 provides an excellent case study of what takes place when an overly optimistic, perhaps even cocky, attitude began to prevail among public health officials to whom politicians and the general public deferred in issues of possible epidemics and immunization. Administrators at the Centers for Disease Control and HEW were unprepared for the humiliation when the epidemic failed to appear and critics began to get media attention (see Neustadt and Fineberg, 1982 and Silverstein, 1981).

Given these four contexts, the adaptation of public administrative behavior will reflect efforts to respond or adjust to those parts of its environment which are problematic. Two important points emerge from this analysis. First, the fact that this discussion of problematic environments was based on just two features of a set of expectations (diversity and complementarity) should give pause to those who underestimate the complexity of the public administrative task environment. Second, and most important, is implication that public administrative behavior is driven (i.e., motivated) by an urge to solve problems. (The model addresses the question of motivation through its focus on the "mechanisms of adaptation"; see below.)

4. What part of the history of its interaction with the environment does the organism (system, organization) retain? In addition to the role played by the environment in shaping adaptive structures, the adapting entity possesses an internal capacity to retain information on past behavior. Adaptation implies the existence of some learning or memory function in the adapting entity. In Holland's model, this is factored into the framework as a structure (or portion of a structure) retained by an adaptive plan, which he designates as $\mathcal{M}$. The basis for retention, supposedly, is the usefulness of retained structure in the adaptation process. When applied to human behavior, we must stress that the decision to retain a structure is likely to be based on "perceived" rather than actual utility. In any case, the presence of this memory means that for any set of structures there is the possibility of additional input based in part on past experience, or

$$\circ\ \alpha_{\tau\sigma} = \alpha_{\tau\sigma-1} + \mathcal{M}$$

The field is filled with discussions related to the retention or learning function in public administrative behavior, although often the approach to the subject is more implied than explicit. In Weberian bureaucracy models, for example, retention is implied in both the rational design of organizational roles and rules and the expectation that individuals filling bureaucratic positions will learn and adhere to those roles and rules. The "bureaucratic politics" model, which dominated the study of public

administration in political science over the past two decades, has a learning or memory component implied in the ongoing assessment and strategic maneuvering bargaining required of each "player" in the process (Allison, 1971, esp. chapter 5). More formal models of public administrative behavior -- particularly game theory and principal-agent theory -- also have a learning or memory component implied (Bendor, 1990). The learning or memory functions have not, however, emerged as a central concern in any of these models.[31]

[There are a variety of learning or memory functions implied in the adaptive model of public administrative behavior. As we see below, learning occurs at all three levels of enactment structure selection -- individual, organizational, and institutional. There exists a vast literature on the subject of learning for each. At the individual level, scholarly debate rages over the subject, especially in regard to the "objectivity" of knowing (e.g., Lakoff, 1987). At the organizational level, organizational learning (Argyris and Schön, 1978) and "learning organizations" (Senge, 1990) have attracted increasing attention in recent years. The new institutionalism has also focused attention on learning -- both how institutions do it (e.g., March and Olsen, 1989, esp. chapter 4) and their role shaping how learning takes place (Douglas, 1986).]

The issue here relates to *what* part of previous enactment structures is retained in the adaptation process. Despite its natural and psychological limits,[32] the human capacity to learn and retain is so great that it would be absurd to consider all that is subject to retention in the adaptation process. For present purposes we focus on four foundations for social action among those things that are retained: preferences, norms, practices, and "cause maps".

Retained *preferences*, $\mathcal{M}prf$, represent the values applied to various goals and means in enactment structures. John Dewey (1939/1966, pp. 30-31) discusses this process as the adjustment of "desires and interests" through experiential learning. More significant is the observation of March and others that preferences are as much the results of behavior as they are its determinants (see March and Olsen, 1988, p. 340). What is retained, in short, is the valuation of ends and means that seem to be associated with an instance of successful public administrative behavior.

Similarly, *norms* ($\mathcal{M}nrm$) that have been effective are retained. By norms, we mean those rules of conduct that mandate, permit, and/or empower social action (Raz, 1990). Where values and preferences establish priorities for actions, norms provide the reasons or justifications to act. In their most institutionalized form they are manifest in the law, but they also play key roles at the individual and organizational levels where they take forms such as personal promises and obligations or rules and regulations.

Relatedly, many standard or customary *practices* ($\mathcal{M}pct$) are subject to retention as well. Whether in the form of habits (Bourdieu, 1990), customs, or "rules of thumb" (see Raz, 1990, pp. 59-62), practical behavior plays a central role in the actions of individuals and organizations, especially in lieu of alternatives. That is, in the absence of explicit

preferences or norms, behavior will follow standard practices that are so ingrained that they are hardly thought about. Equally important, however, as a medium for behavior practices tend to be relatively conservative, often reinforcing previous behavior. Nevertheless, even practices are subject to change in the adaptation process as they confront increasingly challenging environments.

Lastly, the adaptation process also retains changes in what Weick (1979) terms the *cause map* ($\mathcal{M}map$). Cause maps are closely related to enactments, and in fact reflect an actor's interpretation of the reality created by enactment structures. Thus, when an actor retains a cause map, he or she is retaining a "template" that is intended to make sense of what has occurred (Weick, 1979, p. 131).[33]

In notation form, what we have is a designation of the adaptive memory function as:

$$\circ\ \mathcal{M}pa:\ \mathcal{M}prf, \mathcal{M}nrm, \mathcal{M}pct, \mathcal{M}map$$

with the resulting propositions:

$$\alpha pa_{\tau\sigma} = \alpha pa_{\tau\sigma-1} + \mathcal{M}pa$$

4. What are the mechanisms of adaptation? To this point we have established the conditions surrounding the adaptive process which characterizes public administrative behavior in our model. We have posited the existence of a public administration relevant environment that manifests itself as contextual situations for public administrative behavior (Epa_{ts}). We have also developed a conceptualization of the adaptive enactment structures through which that behavior manifests itself (α_e). Finally, we have elaborated constructs that allow us to focus attention on the way the environment and retention processes impact on enactment structures through signals (S_{ts}: S_R, S_C, S_I), complex sets of expectations ($Iexp$), and a memory function. What remains is to describe and discuss those mechanisms which actually carry out the adaptation process.

In Holland's adaptation framework, the mechanisms for adaptation are termed *operators* (Ω). Mutations and recombinations serve as operators within the field of genetics; in the field of artificial intelligence and game theory, "learning" and "optimal strategy" rules perform the operator functions respectively. Each acts as a "basic set of structural modifiers" in their respective fields (Holland, 1992, p. 3).

A note on the sources of operators: While operators play a significant role in generic adaptation theory, the question of why they emerge is not addressed at the general level. In traditional Darwinian terms, mutations seem to occur randomly -- almost accidentally. Clearly the same cannot be said of operators used in artificial intelligence or game theory. Thus, the source of operators seems to be an issue specific to the arena of adaptation being studied.

In the case of public administrative behavior, the sources of operators can be located in the motivations that energize actions. Having said this, we face a problem. Given the treatment of motivation among social scientists, we face the danger of opening an intellectual "can of worms" that might distract us from our theory construction efforts. At the same time, because of the important role played by assumptions about what motivates public administrative behavior, it would be counterproductive not to address the issue.

For present purposes, we need to stress the diversity of motivators for action. Elster (1993) writes in terms of three substantive sources of motivations: advantage (self-interest), passions, and social norms.[34] Turner (1988, pp. 57-69) provides a more elaborate synthesis of various motivational theories, distinguishing between less conscious needs (needs for a sense of group inclusion, a sense of trust, and a sense of ontological security), more conscious needs (needs for symbolic/material gratification[35], sustaining self-conception, and a sense of "facticity" that confirms one's place in the world), and the more general motivation to avoid a diffuse sense of anxiety.

Keeping in mind the reality of multiple motivational sources, we will settle here for the general notion that public administrative behavior may be driven by the need to reduce or minimize anxiety. In contrast to Freudian and other psychoanalytic views, the sense of anxiety used here is rooted in the general conditions posed by the complex environment of expectations facing public administrators. Thus, anxiety as used here is not only associated with some unconscious or subconscious fear or discomfort rooted in an individual's personal life, but also with feelings generated by the conscious assessment and awareness of dilemmas and uncertainties created by the many problematic situations constantly challenging public administrators.

Operators and adaptive plans: In our model, the enactment structures of public administrative behavior are subject to at least four types of anxiety-reducing operators, each representing an adaptive mechanism developed for a distinctive type of situation (see Figure 4). In situations where the emphasis is on explicit goal-oriented individual actions, the idea of <u>decision premises</u> (Ωdec) comes closest to the operator role. The concept is attributable to Herbert Simon's early work which defined such premises as "the criteria or guides" used by public administrators "in narrowing down the multitude of possibilities to the single actuality" (Simon, Smithburg and Thompson, 1950, p. 59; also see Simon, 1957).[36]

In situations where the individual is more focused on his or her own health and survival than on explicit goals (a more Freudian view of anxiety), the operators at work would be closer to Janis and Mann's (1977) <u>coping strategies</u> (Ωcop). In their research, Janis and Mann found five patterns of behavior that emerged under stressful decision-making conditions. In their terms, these included "unconflicted inertia" (do nothing), "unconflicted change" (unreflexive reacting), "defensive avoidance" (conscious indifference), "hypervigilance" (over reactive, panic), and "vigilance" ("careful search and appraisal") (pp. 52-64).

The relevant operators take different forms where the situation places emphasis on collective-level action. When goal orientation is not the major consideration, some mechanism similar to consensually validated grammar (Ωgrm) emerges. Derived from the work of Harry Stack Sullivan, this concept is adopted by Karl Weick (1979, p. 3) to reflect the "rules and conventions" agreed upon by people at a "common-sense" level which allows them to assemble "interlocked behaviors" into collective actions. On a more explicitly[37] goal-oriented level, Weick (1979, p. 113) discusses assembly rules (Ωasm) which provide the shared "procedures, instructions, or guides" used to mobilize individual actions into larger efforts.

For our model, separately and together these four comprise the mechanisms through which adaptation occurs:

- Ωpa: Ωdec, Ωcop, Ωgrm, Ωasm

Given the complex nature of the situations facing public administrators, and depending on the level of anxiety involved, it is possible for all four operators to be at work simultaneously at any point in time and space:

- $\Omega pa_{t\sigma} \leftrightarrow A_{en}$

How does a particular set of operators emerge in the adaptation process? At any point in time, there is a "mixture of operators" that are controlled by some set of factors -- what Holland terms an *adaptive plan* (τ) (Holland, 1992, p. 3). In Holland's view,[38] this plan acts as a set of instructions with the potential for progressively improving the choice and performance of structures vis-à-vis their situations. Furthermore, there are many potential adaptive plans present in the adaptation relationship environment. On the one hand, this general set of plans ($\Im$) reflects what is adaptively feasible within the realm of public administration behavior. On the other hand, it represents the limits of the adaptive process at any point in time and space. We will return to this point below.

There are various ways a given plan can come to the fore. Logically, the plan can emerge randomly. If we were to assume the existence of some conscious force in the adaptation process, one can consider the other extreme -- e.g., a systematic strategy for selecting the optimal plan. In between there is room to consider qualified random processes. Holland, for example, discusses a random process qualified by the probability distribution ($\wp$) of a particular plan within the total population at a given time and place, or

- τ: $(S_{t\sigma} \times I) \times \alpha_{t\sigma} \rightarrow \wp(\alpha) \rightarrow \alpha_{t\sigma+1}$

Still another possibility is to consider the plan as part of a learning (information processing) process. Under this scenario, the plan's instructions amount to a successive selection of operators from among those available, where the selection is influenced by the information obtained and

retained (in part through a memory function, $\mathcal{M}$) from the environment. Put in notation form,

$$\circ\ \tau\colon\ (S_{t\sigma}\ X\ I)\ X\ (\alpha_{t\sigma}\ X\ \mathcal{M}) \rightarrow \Omega \rightarrow \alpha_{t\sigma+1}$$

In our model of public administrative behavior, an adaptive plan (τpa) involves a particular set of anxiety-reducing structural means for achieving satisficing solutions to the dilemmas and challenges of problematic environments. To use Holland's words, the adaptive plan uses a mixture of operators "to produce structures which perform 'well' [are satisficing] . . . in the environment confronting it. 'Adaptations' to the environment are persistent properties of the sequence of structures generated by the adaptive plan" (Holland, 1992, p. 4). The possibility of a particular plan emerging in the realm of public administrative, however, is much less likely to result from chance than in most other adaptation systems, and more likely to be the result of a selection process with at least some degree of structure.

Public administrative behavior, in short, is not understandable as random behavior, or even the result of some qualified random process (e.g., natural selection). Public administrative behavior (B) -- in this regard, the selection of particular sets of enactment structures relative to situations -- is instead assumed to be a function of choices made at three interrelated levels of public administrative activity: individual (pa_{ind}), organizational (pa_{org}), and institutional (pa_{ist}), or

$$\circ\ \mathrm{B} = f(pa_{ind},\ pa_{org},\ pa_{ist})$$

At the individual level, a growing body of evidence has demonstrated that public administrators develop a variety of means for dealing with the ambiguities and uncertainties of their problematic environments (e.g., Lipsky, 1980; Wilson, 1989). While this is hardly surprising, what is astonishing is that so little is known about the mechanisms and strategies individual's use. Most of the empirical research on individuals in public administration has focused on what motivates people (Rainey, 1991, chapter 6), and only a few have followed the lead of Barnard (1938) and Simon (1957) in attempting to understand how public administrators actually behave, i.e., how they deal with expectations. Among those who pursued that issue, most attention has been given to efforts that stress calculative behavior within rational choice frameworks (see March, 1988, pp. 271-274).

Relying on more generic literature, we can think of individual adaptation plans (ξ) in terms of a wide range of selection mechanisms. Most can categorized into four types: cognitive, cultural, calculative, and systemic.

Cognitive psychologists have elaborated a number of models outlining the mechanisms and procedures individuals use to deal with problematic situations, particularly those involving the need to make decisions under conditions of stress. The work of Herbert Simon in this area is seminal (Simon, 1957), as is Amitai Etzioni's work on mixed scanning (1967), and Irving Janis and Leon

Mann's on "hot cognitive processes" (1977). The emphasis in these approaches is on the individual as a distinctive information-processing entity. Janis and Mann, for example, offer a model of decision making under conditions of conflict that posits three defensive mechanisms (procrastination, shifting responsibility, and "bolstering") in addition to the ultimate choice of committing to a specific choice. The cognitive selection (ξcog) accomplished through these mechanisms is closely linked to the information and feedback the individual receives during the decision-making process (Janis and Mann, 1977, chapter 4).

In contrast to the cognitive approach, cultural psychologists such as Jerome Bruner (1990) and sociologists like Erving Goffman (1986) emphasize a "framing" approach, wherein the individual defines his or her situation in terms relevant to the social or cultural context of the action (ξcul). The resulting action plans as thus shape by those developed within those contexts.

Calculative selection (ξcal) is directly related to the rational-choice school of decision making. In what is now regarded as its most naive (non-empirical) form, this selection process involves making choices on the basis of clear objectives, complete knowledge of alternatives and their consequences, and the ability to calculate the best alternative from among the options (see Dror, 1968, pp. 132-141 for one elaboration). In its more empirically-relevant forms (March, 1988, p. 272), the calculative model has been modified to take into account limited information (limited rationality), social and cultural constraints (contextual rationality), the presence of other calculating individuals (game rationality), and the impact of procedures and symbols (process rationality). What all these variations have in common is the underlying assumption that selection is accomplished through the conscious use of calculative means.

Finally, the systemic selection approach (ξsys) (March, 1988, pp. 273-274) substitutes established and accepted behavioral precepts (i.e., strategies) for calculation.[39] Thus, selection can be made through a strategy based on learning through experience -- over a period of relative stability, individuals learn to select that enactment structure most suitable for the assumed continued stability (learning strategies). Alternatively, individuals can adopt strategies informed by the need to survive or grow (survival strategies). Finally, selection can be based on styles developed within certain roles. For example, Downs' (1967, Chapter IX) utility-maximizing rational actors vary in their approach to choices. Downs' "climber," as an example, relies on mechanisms stressing "promotion," "aggrandizement," and "jumping," while his "conservers" will seek those that minimize risk, avoid change, and maximize convenience. Maccoby (1976) and other students of leadership also link individual selection mechanisms to the "style" or goals of the subject. For Maccoby, the mechanisms of choice will depend on whether the leader styles himself or herself a "jungle fighter," "craftsman," "gamesman," and so forth.

Two points need to be stressed about these alternative models. First, despite significant differences, what these four approaches to selection (cognitive, cultural, calculative, and systemic) have in common is an active role for the individual actor in the selection process. Implicitly, at least, they all accept the fact that individual actions (i.e., selections) are based on the "reflexive monitoring of conduct" (Giddens, 1979, p. 56). This, in turn, implies that the selection process has meaning for those involved in it. Any choice of enactment structure -- whether accomplished cognitively or culturally or calculatively or systemically -- is therefore an "accountable" action. By this we do not mean "accountable" in the narrow legal, financial, or even political senses; rather, such selections are accountable in that they "make sense" to those who do the selecting. That is, individual actors are able to "give accounts" for their selections (Giddens, 1979, pp. 56-57).[40]

A second point to be stressed is that particular adaptive plans emerging from individual-level activity (τpa_{ind}) can be -- and we assume will be -- a composite function of selection processes driven by all four approaches. That is:

$$\circ\ \tau pa_{ind} = f(\xi cog,\ \xi cul,\ \xi cal,\ \xi sys)$$

Given such a composite arrangement, we assume that any permutation of these four factors is a possible individual-level action plan at any point in time and space. Thus, rather than considering merely four types of selection processes, we are actually considering twenty-four types[41] at the individual level.

Logically, it is the possibility of so many individual approaches to the selection of enactment structures that leads to efforts to narrow and focus individual choices through organization-level mechanisms. Ideally, organizations are purposive by nature and function, and from a collective perspective they can be regarded as rationally-defined manifestations of adaptive plans (see Thompson, 1967, Part One).[42] However, from the perspective of our model, organizations are something quite different. They are, in the words of Karl Weick, "superimposed structures" invented by people to provide some conceptual order on the "flows of experience" that constitute the reality of organized efforts (Weick, 1979, p. 11). More to Weick's liking is the term "organizing," which represents "a *consensually validated grammar* [among individuals] *for reducing equivocality by means of sensible interlocked behaviors.* To organize is to assemble ongoing interdependent actions into sensible sequences that generate sensible outcomes" (Weick, 1979, p. 3; emphasis in original).

For Weick, the fundamental building block of actions at the level of organizations are found in "collective structures."[43] Collective structures first emerge when two or more people finds themselves dealing in mutually beneficial ways with their individual problems. These individuals find they share a common interest in the means for solving a problem.

> ...[P]eople converge first on issues of means rather than on issues of ends. Individuals come together because each wants to perform *some* act and needs the other person to do certain things

> in order to make performance possible. People do not have to agree on goals to act collectively. They can pursue quite different ends for quite different reasons. All they ask of one another at these initial stages is the contribution of their action. Why that person consents to make the contribution or why that contribution is needed is secondary to the fact that the contribution is made. Partners in a collective structure share space, time, and energy, but they need not share visions, aspirations, or intentions. That sharing comes much later, if it ever comes at all (Weick, 1979, pp. 90-91).

For Weick, the emergence of adaptive plans in an organizing context (τpa_{org}) is a process with roots in the formation of organizations themselves. Organizing, according to Weick, occurs through a process of "natural selection." Put simply, some "ecological change" generates a response in the form of an enactment structure with the hope of reducing the equivocation (i.e., anxiety) stirred by the ecological change. Successful selections are then retained for use again as "enacted environments" which can be mobilized by further ecological changes, with the process recirculating again and again as the organizing process continues (Weick, 1979, chapter 5).[44]

While Weick's summary of this natural selection process is helpful in our understanding of how organization-level adaptive plans emerge,[45] overtime the plans themselves have become manifest in the formal and informal structures and strategies that we normally associate with organizations. Mintzberg's (1979) comprehensive summary of alternate organization structures can thus be regarded as alternative adaptive plans for dealing with different problematic environments. Similarly, Etzioni's (1975) elaboration of organizational compliance strategies can also be seen as a typology of alternative adaptation plans.

Given the vast array of organizational forms and strategies that have emerged from the natural selection process, what are the organizational selection mechanisms used in the adaptation process? James D. Thompson (1967, pp. 134-135) provides a framework that we can use for classifying the various types of organizational selection mechanisms (Ψ). The type of selection mechanism put to use is likely to depend on the degree to which organization decision makers are certain about both the underlying causes of a problematic situation and the desirability of what might result from the selection of an enactment structure.

Where there is certainty about causation and the desirability of a possible outcome, the organization will rely on computational or programmed selection processes (Ψpro). Where certainty remains high on outcome desirability, but there is uncertainty regarding causation, a judgmental selection process (Ψjud) will be used. A compromise selection process (Ψcom) is relevant where there is uncertainty regarding outcome desirability, but certainty about causation. Finally, selection processes

relevant to situations where there is uncertainty regarding both factors is termed by Thompson as inspirational (Ψins).

As with individual-level selection, the actual plan to emerge from an organizational selection process[46] is likely to be a composite of all four types:

- $\tau pa_{org} = f(\Psi pro,\ \Psi jud,\ \Psi com,\ \Psi ins)$

And as with individual-level selection process, we assume that this composite function results into twenty-four possible selection arrangements, each reflecting a combination of the four selection approaches.

The complexity of public administrative behavior should be increasingly obvious at this point, for while organizational selection processes are important unto themselves in the development of adaptive plans -- and thus in the overall adaptation process underlying our model -- it is critical to remember that our primary concern is with the behavior of individual actors, i.e. public administrators. Our assumption remains that organization-level selection processes exist as a means for narrowing and focusing individual-level choices. Thus, the organizational processes must be regarded as a context for individual choice, resulting in the proposition:

- $(\tau pa_{org} \Rightarrow \tau pa_{ind}) = f[(\Psi pro,\ \Psi jud,\ \Psi com,\ \Psi ins) \Rightarrow (\xi cog,\ \xi cul,\ \xi cal,\ \xi sys)]$

Within this context, the number of possible selection mechanisms increases exponentially, for each of the twenty-four organization-level options is itself logically capable of using twenty-four individual-level selection mechanisms (i.e., 24^2 or 576 formal possibilities). Thus, *it is one of the paradoxes of public administrative behavior that efforts to deal with increasingly demanding problematic situations through organizational means that narrow and focus choices has the consequence of making the overall situation more complex.*

On a superficial level, selection processes at the institutional level can thus be regarded as means for dealing with the challenge of selecting the most appropriate organization-level mechanisms for adapting public administrative behavior. From that perspective, institutional-level selection can be regarded as merely a "megaorganizational" process. Were that the case, it would be sufficient to regard institutions as little more than societal "rules of the game" that can be designed and assessed from time to time according to functional or instrumental standards.[47] Such a perspective would be incorrect, for institution-level selection mechanisms represent more than instrumental processes.

The relationship between institutional context and public administrative behavior has been a concern of scholars since at least the emergence of the field in the last half of the 19th century. For many, the central issues in public administration have been those of "locus" -- that is, *where* public administrative behavior occurs (Golembiewski, 1977). In some instances, the issue was a normative one, reflecting a concern for the proper place of public

administration within a constitutional democracy (e.g., Rohr, 1990). At other times the concern has been empirical, reflecting an interest in how institutional contexts impact upon bureaucratic behavior (e.g., Gawthrop, 1969). In these and other analyses, however, the focus was on formal and legal institutions.

More recently, a new institutional perspective has emerged that goes beyond the more formalistic definitions and creates the opportunity to enhance our understanding of adaptive public administrative behavior (see March and Olsen, 1989). Besides abandoning the limiting confines of formalism, most advocates of this new institutionalism also avoid adopting a collectivist approach which regards institutions as having an existence independent of its component parts.[48] Instead, they regard institutions as firmly rooted in the day-to-day routines and conventions of individual actors (DiMaggio and Powell, 1991; also see Giddens, 1979 and Bourdieu, 1990).

Although there is no widely agreed upon conceptualization of an institution (DiMaggio and Powell, 1991, pp. 2-11), the idea is typically associated with routines, rules, conventions, "normatively appropriate behavior," and similar phenomena (see March and Olsen, 1989, pp. 21-22). To be regarded as institutional, a set of behaviors or actions must become routinized and widely known. Thus, institutions are not merely "background" structures, but acknowledgeable features of daily life. "Every competent member of every society knows a great deal about the institutions of that society," contends Giddens (1979, p. 71); "such knowledge is not *incidental* to the operation of society, but is necessarily involved in it."

In this sense, institutions reflect more than just instrumental means for action. For any society, institutions provide the "core system" of meaning, belief, interpretation, and status (March and Olsen, 1989, p. 112). In this sense, institutions are cultural rather than merely social in nature (Douglas, 1986; Thompson, Ellis and Wildavsky, 1990).

As sources of adaptive plans, institutions play a powerful role in both reflecting and shaping public administrative behavior. Institutions reflect behavior because they are derived from recurring social actions and practices within the public administration community.[49] They shape administrative behavior through their impact on both organizational and individual choices. Their influence on the selection of enactment structures is a powerful one, relying on neither rational calculation or contractual obligation.

> Institutional routines are followed even when it is not obviously in the narrow self-interest of the person responsible to do so. Even in extreme situations like war, or in concentration camps, individuals seem to act on the basis of rules of appropriateness rather than rational consequential calculation. . . . The conformity to rules can be viewed as contractual, an implicit agreement to act appropriately in return for being treated appropriately, and to some extent there certainly is such a "contract." But socialization into a set of rules and acceptance of their appropriateness is ordinarily not a case of willfully entering into an explicit contract. Rules . . . are learned as catechisms of expectations. They are constructed and

> elaborated through an exploration of the nature of things, of self-conceptions, and of institutional and personal images (March and Olsen, 1989, pp. 22-23).

The fundamental mechanism through which institutional adaptive plans (τpa_{ins}) influence public administrative behavior are <u>accountability systems</u> (Φ). One of the important characteristics distinguishing these selection mechanisms from those previously discussed is that they are comprised of sets of expectations,

- $\Phi = f(I_{exp})$

As we have detailed in earlier work (Romzek and Dubnick, 1987; Dubnick and Romzek, 1991, chapter 3; Dubnick and Romzek, 1992), accountability systems reflect four distinct, yet equally legitimate, sets of **institutionalized expectations**. It is their institutional status that render these expectation sets quite different from others.

The first of these -- legal accountability systems (Φleg) -- stresses the need for public administrative behavior to live up to its legal and contractual obligations. Accordingly, it calls for the use of legal and adjudicatory means to deal with problematic environments. Political accountability systems (Φpol), in contrast, emphasize responsiveness and greater reliance on political strategies. Organizational and hierarchical means are associated with bureaucratic accountability (Φorg). Finally, professional accountability systems (Φprf), select enactment structures stressing deference to the expertise of public administrators.

As with individual and organizational level selection mechanisms, the particular adaptive plan emerging from institutional process will likely be a composite of all four mechanisms:

- $\tau pa_{ist} = f(\Phi leg,\ \Phi pol,\ \Phi org,\ \Phi prf)$

And once again, the composite nature of this function creates twenty-four permutations, each standing as a logical alternative.

How do these institutional mechanisms relate to individual and organization-level adaptive plans? Contextually, institutional plans form a relatively stable context within which organizational plans can operate, and thus indirectly provide the setting for individual adaptive plan development. This nesting creates the general context of public administrative behavior. Thus,

- $B = f(\tau pa_{ind},\ \tau pa_{org},\ \tau pa_{ist}) = f[(\Phi leg,\ \Phi pol,\ \Phi org,\ \Phi prf) \Rightarrow (\Psi pro,\ \Psi jud,\ \Psi com,\ \Psi ins) \Rightarrow (\xi cog,\ \xi cul,\ \xi cal,\ \xi sys)]$

Again, as we have generated more mechanisms to narrow and focus public administrative behavior, we have also increased the complexity of the situation facing public administrators. For each of the twenty-four institutional permutations there exist twenty-four organization-level permutations, and for each of those twenty-four individual-level possibilities. Thus, we are faced with a potential 24^3, or 13,824 logical choices for public administrative behavior adaptation to a given situation. How useful is this elaborate arraying of adaptation selection mechanisms to our understanding of public administrative behavior? The answer is found in the next two questions raised by Holland's generic adaptation model.

6. What limits are there to the adaptive process? The limits of the generic adaptive process described in Holland's model are defined by the variable set of all possible adaptive plans, or $\mathfrak{I}$. Put simply, when considered in total, adaptive plans -- through their capacity to instruct the various operators -- define the domain of all structural activity that can occur in the adaptive process (Holland, 1992, p. 25).[50] In our model we designate the "limits" variable as $\mathfrak{I}pa$, and equate it with all logically possible enactment structures covered by the public administrative equation for $\mathbf{B}$ noted above.

The usefulness of this point emerges when we apply the analytic tools from two areas of study: dynamical systems and the science of complexity. Through these applications we can gain some insight into the spatial, dynamic, and parametric limits of the adaptation process.

Spatial limits: Dynamical systems is an area of study that has intrigued mathematicians for at least 200 years. It is based on the idea that we can predict the future state of even complex dynamic systems if we know three facts: (1) the space on which the dynamic motion is to occur, called the *manifold*; (2) the initial starting point within that manifold space; and (3) the rule that informs the movement or selection process within the manifold limits, called the *vector field*.. In short, given a particular starting point within the space -- called the *initial point* -- we can make predictions of where that point will be in the system at any future point if we possess detailed knowledge of both the manifold and the vector field. Of course, errors in predictions emerge if we are uninformed or misinformed about any of three conditions: the initial point, the layout of the manifold, or the vector rule (see Casti, 1990, pp. 53-76).

Under our formalistic adaptation model it is possible to create a manifold of all possible states of public administrative behavior. As noted above, each of the three functional levels of $\mathbf{B}$ (τpa_{ind}, τpa_{org}, τpa_{ist}) manifests a range of selection mechanism which we can view as points, or states, on a manifold of public administrative behavior. Given the calculated permutations, the manifold of public administrative behavior contains 13,824 distinct states. And so, at any given point in time and space, public administrative behavior can be described by locating it at a specific location in this vast manifold reflecting the structural product (i.e., enactments) of

a state reflecting some specific combination of individual, organizational, and institutional operators. Put differently, at any point in time and space we can locate public administrative behavior through coordinates representing the conjunction of all three dimensions of our model.

How does this picture of the spatial limits of adaptation help us understand public administrative behavior? First and most obviously, it puts in perspective a complex subject that is often treated much too simply. Stereotyping bureaucratic behavior or applying reductionist assumptions that narrow the behavioral option of public administrative actors loses credibility in the face of this model.

Equally important, it helps us understand the complex nature of behavioral change in public administration. Consider, for example, the different consequences of different types of change. The concept of initial point can be applied at this juncture to any distinct set of coordinates representing a given set of enactment structures, or $(A_{en})_{ts}$. Vector rules are reflected in the specific instructions contained in a given adaptive plan, (τpa_{ts}). These instructions can range from making no moves within the manifold, to making minor movements from the starting coordinates, to making radical movements among the vast array of thousands of structural choices.

Now consider two types of shifts within the manifold space. For example, at an initial time and place, the state of public administrative behavior may be an enacted choice representing coordinates Φpol_n, Ψcom_n, and ξcul_n, where *n* represents some specific composite state on the manifold of public administrative behavior; or

- $A_{en} = f(\Phi pol_n \Rightarrow \Psi com_n \Rightarrow \xi cul_n)$

Dissatisfaction may arise with the individual conduct in this behavioral structure, and the person involved may be replaced with someone who more closely approaches the situation more cognitively, e.g., ξcog_n, thus creating a movement represented as

- $A_{en} = f(\Phi pol_n \Rightarrow \Psi com_n \Rightarrow \xi cog_n)$

Such a coordinate change might have significant consequences if the individual being replaced performed at an exceptional or critical level, but it is less likely to create turmoil than an institution-level change. Alternatively, consider the call for a radical shift away from the highly politicized situation of Φpol_n. An operative adaptive plan may call for radical reforms at the institutional level that depoliticizes administrative behavior and establishes a mandate for highly legalistic behavior based on professional standards; thus

- $A_{en} = f(\Phi leg_n,\ \Psi com_n,\ \text{and}\ \xi cul_n)$

Under such circumstances, it is less likely that the status of organizational and individual level behavior will remain unchanged for long, although it is logically possible.

Dynamic limits: Even greater insight is generated by this model if we apply some of the lessons of the recently emerging sciences of complexity (e.g., Pagels, 1989, esp. chapter 4; Waldrop, 1992; Lewin, 1992; Casti, 1990). From the perspective of complexity, the dynamics of adaptation are found somewhere between the realm of static order and turbulent chaos, with complexity filling the vast range between (see discussion above). The dynamics of complexity involves vector fields that apply to manifold spaces comprised of diverse and interactive elements. Unlike the orderly world where adaptation is completed and therefore static, complexity is a world of ongoing adaptivity; unlike the chaotic world where adaptation is not possible due to constant turbulence, the complex world is drawn toward adaptation. Complexity, in short, characterizes the world of adaptive public administrative behavior.

Students of complexity have taken note of the wide range of dynamics that occurs between order and chaos. Special attention has been paid four distinct patterns, each associated with the idea that there exist "basins of attraction" within all complex manifold spaces (Pagels, 1989, chapter 4). These basins are "local" areas within complex environments toward and within which adaptation moves.[51] The first type of basin involves a process of "fixed point attraction" where adaptation moves toward a single (equilibrium) position within the manifold space. In a second basin, adaptation involves "limit-cycle attraction" wherein vector field movement creates a closed loop pattern. They are "limited" because, although not following an orderly pattern of adaptation, they do operate within a range of oscillating movement around a fixed point without converging on it (Pagels, 1989, pp. 77-78; Kauffman, 1993, pp. 177-178).

In contrast, in an "antilimit (or quasi-periodic) attraction" basin, adaptation movements are cyclical, but they diverge from the limited range of a oscillating closed loop. There is, in short, less orderliness than in the limit-cycle basin (Pagels, 1989, p. 78; Kauffman, p. 178), but there remains a tendency of adaptation toward a local area of points. Finally, in a "strange attraction" basin the cyclical nature of adaptive movements is gone as the vector field constantly shifts the adapting entity away from its initial location, never to return because the basin of attraction is itself moving within the manifold space (Pagels, 1989, pp. 78-79; Kauffman, 1993, pp. 178-179).[52]

As applied to public administrative behavior, it is possible to imagine the existence of these types of complex patterns of behavior and more: from behavior focused on ending a project at a fixed point (e.g., sending property tax bills to all home and business owners in a community by a given date), to behavior following a limited cycle pattern (operating a mass transit system on a daily and set schedule), to anti-limited cycle behavior (working through an annual budget cycle), and even behavior oriented to deal with near chaotic events (the activities of organizations such as the Federal Emergency Management Agency as it responds to disasters). Despite the wide range of

possibilities implied in this model, it is not difficult to imagine forms of public administrative behavior that can fill every niche.

Parametric limits: A central factor determining which type of dynamic will prevail is found in another concept from the science of complexity -- *parameter space* (see Kauffman, 1993, pp. 179-181; also Casti, 1990, pp. 65-68). A parameter space includes a subset (or "ensemble") of manifold states that fall within boundaries established by a set of environmental conditions. In the physical world, the parameter space for a falling object is determined by such things as gravitation force, air resistance, etc. In the world of public administrative behavior, parameter space (Πpa) is a function of the public administration-relevant environment,

- $\Pi pa = f(Epa)$

The environment acts on the parameter space in three ways: by determining the (1) location, (2) size, and (3) stability of the ensemble of manifold states within which public administrative behavior is taking place. In this sense, parameter space is important because it provides a link between the spatial limits of an ensemble of manifold states and the stability of the basins of attraction.

The location parameter is significant in providing a context for the adapting behavior. Different locations may be associated with ensembles of different textural quality. Due to the wide acceptance of public sector professionalism in community X, for instance, the basin of attraction surrounding that part of the manifold space (and associated ensemble) characterized by Φprf is more likely to be relatively "smooth" from the perspective of an incoming professional city manager. In contrast, a highly professional manager would find the terrain more "rugged" and difficult to deal with in communities (locations) where political accountability (Φpol) is stressed.

The size parameter is important for the range of freedom it offers to adaptive behavior. A large ensemble area is better able to tolerate a greater range of adaptive change than a smaller area, so long as the changes do not challenge the boundary parameters. Most important, however, is the stability parameter: a constantly shifting (unstable) parameter space creates significant challenges for adaptive behavior, while a stable parameter space is less challenging.

Parameter spaces characterized by "smooth," large, and stable ensembles are obviously going to be more conducive to gradual adaptation, and we are likely to see a fixed point or limit-cycle dynamic patterns emerge under such conditions. In stark contrast, those parameter spaces involving rugged, small, and unstable ensembles will be characterized by adaptive patterns more closely resembling anti-limit or "strange" attraction dynamics. Between these two extremes, of course, reside the wide range of situations that probably characterize most conditions under which public administrative behavior adapts.

Behavior within limits: In this section we have considered the limits to public administrative behavior. It should be stressed that this was a logical, rather than empirical, exercise. Our intent has not been to claim for this elaborate mapping exercise more than we have -- that it lays out the logical possibilities of public administrative behavior within the limits of our adaptation model.

The framework's lack of empirical utility, however, does not detract from its value in helping us pursue the middle-range construct we seek. Having noted the possibilities for public administrative behavior, we can now turn our attention to discovering and understanding where and why the actual behavior fits into this overall scheme.

7. How are different (hypotheses about) adaptive processes to be compared? For Holland, the comparison among different adaptive processes should be based on an assumed standard, and in his case that was the standard of relative "efficiency." As used in Holland's model, efficiency has three components: performance, robustness, and timeliness. First, efficiency relates to what extent the adaptive processes (or plans) being compared accomplished the performance objective, μ.[53] Second, efficiency is a matter of robustness -- or how well the adaptive plans perform over the range of environments ($E \subset \varepsilon$). And third, efficiency is a matter of time: comparisons of the time taken by each adaptive process to achieve its performance objective. For Holland, all adaptive processes might perform robustly "eventually," but it is the efficient ones that do so within a "reasonable time span" (Holland, 1992, pp. 16-18).

Is efficiency a basis for comparison among adaptive plans for public administrative behavior? Certainly, the term efficiency has an all too familiar ring to it as a performance standard in the field of public administration, but its legitimacy as either a performance standard or basis of comparison is low except among the most technocratic observers. But in contrast to the traditional view of efficiency used in the field of public administration, Holland's distinctive use of the term make help reestablish it as a useful criterion.

Consider, for example, the reliance on performance. In our model, performance was explicitly related to Simon's standards of "satisficing" (μ_{sat}) rather than the traditional association with economic measures such as the minimal use of resources or cost-effectiveness. In addition, the inclusion of robustness and timeliness integrates both spatial and temporal factors that are often ignored in the traditional views of efficiency.

From the perspective of the modest objectives of this paper, the undertaking of such comparisons based on a modified view of efficiency will have to wait. A prior order of business is to establish the utility of the overall model, and then to develop the capability of operationally describing the variables needed for such comparisons. Thus, while satisficing has proven more conceptually appropriate to the assessment of public administrative behavior performance, its operationalization will prove an extremely difficult task. So will the efforts to operationalize the concept of "situations"

($E_{pa_{t\sigma}}$) needed to assess robustness or the definition of "reasonableness" in relation to time. Despite these hurdles, the potential for making greater use of the adaptation model seems promising.

APPLICATIONS

We now turn to three general issues in the field of public administration to see what insights might be gained from applications of this adaptation model. The three issues underlie much of the discussion that has occurred in the field for several decades.

First, are public agencies manageable? That is, can their performance be consciously directed or improved? Or, when all is said and done, does public agency performance reflect the centrifugal and centripetal forces that impact it on a daily basis?

Second, is the public provision of services replaceable? Here is the question of "privatization" that has become so important in recent years, but has its roots in debates regarding the role of government in American society. The issue here is whether public sector service provision is merely an alternative to private sector provision, or whether it is the only option given the distinctive nature of the services or situation involved.

Third, is public administration reformable? That is, is it possible to effectively and successfully change the institutions of public administration? On the one hand, the history of public administrative reform efforts -- from the Progressive Era to the current period of "reinventing" and "revitalizing" -- reflects an optimistic view of the potential for reform. One the other hand, the historical record has made other observers less sanguine.

Manageability: Despite it pervasive presence in all sectors of contemporary American life, management is a relatively modern technology. As recently as 1840, ownership and management functions as we know them today were synonymous, and the idea of middle management was unheard of in the United States and relatively rare abroad (Chandler, 1977; also Chandler and Daems, 1980). Yet one hundred years later Americans found themselves facing a world of organizations dominated by the roles and functions of management at every level (Burnham, 1960; Scott and Hart, 1979).

The idea that public agencies should and could be managed is a product of the Progressive Era and reached its ideological plateau in the 1930s (Waldo, 1984; Scott, 1992). Public agency management experience, however, has led to considerable qualification of the optimistic outlook for effective management. At minimum, advocates and practitioners of public sector management have had to admit that managing public agencies is "different" if not more difficult (see Rainey, 1991, chapter 1; also Bower, 1983). Some observers have gone further, posing the idea that public management is vacuous (Hood and Jackson, 1991), may (under some circumstances) be "impossible" (Wilson, 1989, chapter 7; Hargrove and Glidewell, 1990), and even counterproductive (Thompson, 1969, chapter V).

Studies in the middle range can be cited to support any of these less sanguine contentions, but for present purposes let us consider the contention that public agencies are manageable The U.S. Forest Service of Kaufman's The

Forest Ranger (1967) was manageable, as were some of the prisons studied by DiIulio in his Governing Prisons (1987). The key to both were managers who engaged the situations faced by their respective agencies, and in that lesson we find the value of our adaptive model of public administrative behavior.

Public agencies can be managed to the extent that managers accept and adjust to the adaptive nature of public administrative behavior. Indifference to or ignorance of the signals and expectations emanating from the agency's environment; lack of awareness or appreciation of the role enactment structures play in defining situations; a lack of understanding of existing situations and the limits of adaptive change -- these are the factors that produce poor or counterproductive management.[54]

A most widely publicized case of poor agency management in recent years has been the U.S. Postal Service. Historically, concern for the management of the postal delivery system has deep roots (Crenson, 1975), and socially it has long been the symbolic example for the ever popular subject of government "waste, fraud, and abuse." Over (at least) the last three decades, however, there have been explicit efforts to do something about the operations of U.S. postal delivery services, and the adaptation model can help us understand how that effort has develop over time.

The adaptation model focuses attention on the fact that public administrative behavior must be considered a function of three interrelated levels of social activity: the institutional, the organizational, and the individual. Traditionally, management issues are most closely associated with individual level activity and the need to modify individual behavior through organizational means (see Dubnick and Romzek, 1991, chapter 11). Only recently have we made the explicit link between institutions and individual behavior (Powell and DiMaggio, 1991). Implicitly, however, the assumption of such a link has been around much longer, and it had no clearer expression than the efforts to improve the performance of certain government agencies by modifying their institutional context. This seemed the underlying logic behind the transformation of American postal delivery from a cabinet department function to a "public enterprise" function (as the U.S. Postal Service) in 1971. By transforming the agency from a "political" to a "corporate" entity, the logic held, we would provide a different set of incentives that would ultimately lead to greater efficiency.

Such an institutional change could, under our model, have a significant and immediate impact on the operations of a public service if it was simultaneously accompanied by changes at the organizational and individual level. Assuming the institutional change was not intended as a merely symbolic gesture (and there is not evidence to indicate it was so intended), it is clear that changes at the organizational and individual levels were planned but neither fiscally or logistically feasible in the early 1970s. Nevertheless, the institutional shift created a problematic situation that was bound to cause managerial difficulties in both the short and long terms unless changes were made.

According to our model, the management of the U.S. Post Office -- for all its inefficiencies -- was relatively well adapted to the situation in which it operated in the 1960s when the institutional reform of 1971 occurred.

The institutional shift in 1971 was also adapted to, at least on a symbolic level, as signs and logos changed to reflect the new identity for the USPS. Organizationally, however, the process of change was constrained and would happen slowly at best. Lack of the resources needed for change and political pressures to maintain existing commitments, services, and service centers meant managerial policies and practices at the local and regional would be changing more slowly. Thus, while institution-level expectations radically shifted, changes in organizational expectations were imperceptible at first. When they did occur during the late 1970s and into the 1980s, they met resistance that anyone familiar with the dynamics of change could have predicted, particularly at the individual level which had adapted to the existing and ongoing organizational context. If anything, individuals had started to adapt to a seemingly permanent state of ambiguity and anxiety rather than toward some vision based on clear expectations.

The managerial problems that emerged in the USPS during the late 1970s and throughout the 1980s are widely known and documented. The discontent among postal union employees manifested itself in job actions and grievances; the media had a field day with certain management practices it found in some postal facilities (Judis, 1988); and the number of violent incidents involving postal employees began to draw attention to what was happening in the USPS. To explain these managerial problems, our model would focus attention on the interconnectedness of the adaptive factors that shape public administrative behavior. We believe that the managerial problems of the USPS are attributable to the adaptation process, and (more prescriptively) that such problems could have been avoided had the USPS been managed adaptively. It is a case that needs more thorough investigation if we are to enhance our understanding of the management of public agencies.

Replaceability: Until recently, the issue of privatization has typically been approached as a contentious subject, promoted and attacked in ideological terms (e.g., Savas, 1987; contrast with Goodsell, 1985; also see Donahue, 1989). The fundamental question raised by this controversy, however, is found to be more empirically interesting than originally realized. Kettl's overview of the literature (1993) reflects the fact that privatization, in one form or another, is found throughout government, It is not a matter of *whether* government should privatize, but *why*, *where* and *how* it does so. Why it has occurred is not related to the adoption of some ideological position on the nature of government, but instead is rooted in pragmatic responses of a public sector under the stress of increasing demands and resource limitations. Where it occurs is mainly in the area of social services, and how it occurs is primarily within the context of what Kettl terms a "mixed service network" rather than in a "competitive market" environment.

The adaptation model presented here can add considerably to our understanding of the reality of privatization that Kettl offers. First, it can help us make sense of the general issue by providing a framework for distinguishing between the various types of privatization, Privatization, generally defined, can occur as all three levels of public administrative activity. It can be done at the individual level alone, where a government agency contracts out with a consultant or some other individual in order to

obtain the particular cognitive or calculative talents of that person for a limited time or at minimal costs. At the organizational level, government can obtain the services of a group of persons by putting contracts out for bid that cover particular functions (e.g., trash collection, drug abuse counseling, ambulance services) and/or geographic areas. Finally, at the institutional level the government can privatize by removing itself from the provision of the services in question and/or greatly modifying the rules under which others can provide the services.

Most of what Kettl describes in his analysis occurred at the organizational level. His view of why it happened is related to the changing environment of the state and local public sector over the past two decades which can best be summarized as situations of increasing "fiscal stress" (Levine, 1980). Increasing demands and greater resource constraints led to more innovative and flexible responses, including the contracting out solutions. These adaptations occurred locally in both geographic and functional terms. That is, "privatization" emerged as an enactment structure at various times and places depending on situational factors for each specific jurisdiction. Similarly, it tended to emerge in those functional service areas where the situations (i.e., expectations) were most problematic. And in most cases, privatization developed locally (and quietly) in a form that complemented the ongoing operations of public service networks, as opposed to the creation of a local public sector market or the radical transformation of local institutions.

The lesson drawn from this superficial application of the adaptation model is that **the public sector provision of services has been pragmatically replaceable under and within localized conditions.** Through the lens of the adaptation model, in other words, we can see how the dynamics of public administrative behavior generated innovative changes that otherwise seem out of character.

Reformability: Government reform is a time-honored process in the United States. This has been particularly true in regard to the creation and change of public agencies (Seidman and Gilmour, 1986). Common to these efforts is an underlying attempt to change the institutional context of public administrative behavior. In that sense, the issue of reform is directly relevant to our model.

In recent years we have been witnessing the emergence of a major new reform movement both in the United States and abroad (Caiden, 1991). In the U.S. this movement has manifest itself most recently in the issuance of the Report of the National Performance Review (Gore, 1993), chaired by Vice President Gore.

Can government be reformed? As raised here, we are focusing on an institution-level issue where changes are recommended calling for the transformation of the accountability systems and "rules of the game" under which public administrative behavior operates. Although specific reform proposals may seem to have relatively limited objectives and institutional impacts (e.g., allowing public sector collective bargaining, eliminating an anachronistic civil service system), they often have secondary and unintended consequences that literally extend throughout the entire system of government.

If there is a "debate" here, it is not between pro-reformers and anti-reformers, but rather between those advocating immediate and significant change versus those who support a more cautious and evolutionary approach. In its latest manifestation, this has emerged as a debate between the advocates of "reinventing" and "reengineering" government (Osborne and Gaebler, 1992; Barzelay, 1992) and those who call for "deregulating" or "revitalizing" the public service (Wilson, 1989; Thompson, 1993; DiIulio, forthcoming). In the tradition of the Progressive and New Deal reform eras, the advocates of reinventing government call for the rapid implementation of a new paradigm in government, while the deregulators and revitalizers believe in the desired changes (i.e., "debureaucratizing" government; see Dubnick, forthcoming) but would hedge their bets through a more cautious program of reform (DiIulio, Garvey, and Kettl, 1993).[55]

On this issue, the adaptation model's focus on the complexity and limits of public administration behavior could prove insightful. From the study of complex systems comes the lesson that such systems can be very sensitive to even small changes. From the history of American civil service reform comes confirmation of the issue itself as well as evidence to indicate the appropriateness of the adaptation perspective.

American reform of its civil service is a story of how proposals for significant institutional reform has fared. Relying on Leonard White's survey of the changes that occurred during the 19th century (1954, chapter 16-19; 1958, chapters 13-16), we see the initial point in the reform effort being the public service system that evolved between 1789 and 1829. Although not legislated, it was, for all intents and purposes, a career service system characterized by de facto tenure in office and informal standards of competence. "Forty years of substantially steady practice prior to 1829 had established a tradition of permanence and stability in the public service of the federal government" (White, 1954, p. 300). Overtime, a movement favoring greater democratization through a system of rotation gained political strength, and eventually got hold of the political reins of government under Andrew Jackson. To that point (in 1829), however, the traditional system had not been modified in any substantial form, and so when Jackson implemented his rotation in office approach, the result was a seemingly radical transformation of the system -- in our terms, a major shift within the manifold space.

The turmoil that followed is well known to any student of American history. What is less known is that the reforms, while substantial, were not complete. The traditional system remained in place for many parts of the federal government, thus creating a dual personnel system that itself adapted to the initial shock of 1829 and the quadrennial tremors that accompanied presidential elections (White, 1954, esp. chapter 18). Thus, when efforts to reform the existing system first emerged in the 1850s, it was not aimed merely at eliminating the Jacksonian patronage system but also modifying the non-patronage system as well. Thus, when in 1852 the U.S. Senate asked department secretaries to consider using competitive examination for entry level positions, Secretary of State Daniel Webster (who was opposed to the spoils system) refused to cooperate out of a desire to protect his long-tenured (career service).

The story of the major civil service reform actions of the early progressive era is quite different. As noted, by 1850 there were already pressures for reform, and there was even legislative action along those lines passed in 1853. By the late 1860s and early 1870s, reforms were designed and implemented within the federal government through executive rules -- President Grant had even established a civil service commission to promulgate such reforms. The passage of the Pendleton Act was not, therefore, equivalent in nature or impact on the federal civil service to the election of Andrew Jackson. The reform efforts had built up within the government for more than thirty years, and the institutional shift represented by the Pendleton Act was less radical than many history books imply. As is well known, even the Act itself reflected a more cautious approach to reform, impacting only 10 percent of the federal service of the time. In addition, the Act was passed just as the federal public service was entering a massive expansion -- thus giving the reforms more "space" within which to adapt.

Similar lessons emerge from the most recent attempt at a major reform of the federal public service system i.e., those embodied in the 1978 Civil Service Reform Act (CSRA). CSRA mandated several changes in institutional arrangements of the federal public service, among them the creation of the Senior Executive Service (SES). SES was intended to provide the federal government with a cadre of high-level, experienced managers whose terms of employment allowed for flexible assignment -- an approach contrary to the existing system that had evolved from the original Pendleton Act. Unlike pre-CSRA supergraders who had rank-in-position only, SES members could be deployed as needed throughout the federal service to further the programmatic goals of the president and top agency officials.

Current research reveals a SES that has not lived up to its potential as a government-wide, strategic human resource pool (Sanders, forthcoming). The situation reflects once again the attempt to impose an institutional change without providing for the organizational and individual level adaptation implied by the model. In this sense, the creation of the SES was more like the reforms during the Jacksonian era than those represented by the Pendleton Act. Despite the fact that SES and similar reforms had been widely discussed and hotly debated for years prior to the passage of CSRA, the lack of prior experience with such flexibility made the actual implementation efforts a "shock" to the federal personnel system. Essentially, organization and individual level actions could not keep pace with the relatively radical shift at the institutional level. Some would argue that adaptation was in process under the Carter presidency when the incoming Reagan Administration provided another shock to the personnel system through their efforts to use the SES as a vehicle for reshaping (i.e., politicizing) the federal service in their own image (Levine, 1985). But even without the Reagan factor, SES reforms would have proven difficult. Federal agencies never really adjusted their vision to those implied in SES. Federal agencies seem to still maintain impermeable boundaries, as the movement of SESers between agencies remains insignificant.[56] In short, agencies still view employees from outside their boundaries with suspicion and are reluctant to welcome transfers in. Our

model suggests that overtime they might adapt to this aspect of SES as (and if) there is more experience.

Superficially, at least, the application of the adaptation framework does give us some insight into the process and impacts of different reforms, and they imply support for the points made by DiIulio, Garvey, and Kettl (1993) in their cautionary warning that reformers consider the institutional limits and consequences of what they advocate. According to the model, reform is more likely to succeed if the changes are undertaken within the existing "parametric limits" of public administrative behavior, and if the conditions within those limits are conducive to the advocated reforms. Attempts to radically transform public administrative behavior will certainly bring about change, but the change might be toward more chaos rather than any intended outcome. Shifting within the "parameter space," however, is more likely to bring about desired changes, although there is no guarantee. What the adaptation model tells us is that each attempt at change means a shift in the manifold space of public administrative behavior, thus creating a new situation (i.e., set of expectations) for the public administrator to deal with. Under the right conditions and with sufficient forethought these can be anticipated and appropriate strategies for change developed with the intent of achieving desired reform.

How do the reforms advocated in the National Performance Review (NPR) measure up to this advice? Actually, pretty well if the example of the changes advocated for the Government Printing Office (GPO) is any indication. GPO currently holds a near monopoly over printing services in the federal government, and where it doesn't actually print a government document it is able to collect a six to nine percent fee for processing orders for private printing (Gore, 1993, p. 56). The NPR proposal for dealing with this is relatively modest. While abolishing GPO's monopoly over printing services, the NPR would create a competitive situation wherein GPO could compete with private and "in-house" printing services for a major portion of the federal government's needs. While challenging the GPO, this approach would not seem to stretch the parameters of that agency's operations.

At the individual level, GPO employees will find their work performance subject to a new standard: comparison of the costs, timeliness, and quality with which they can complete a given printing job relative to the performance of their competitors. While this may require some adjustment on the part of individual employees, as well as some changes in the organization of GPO operations, the required changes are far from those that would have been mandated by more radical solutions, e.g. elimination of GPO in favor of either complete privatization or in-house printing. At the same time, these are reforms that go beyond the merely superficial type that resulted in the significant managerial problems in the Postal Service (see above).

Some conclusions: The adaptation model developed here suggests a basically conservative view of reform: that reform probably has to be evolutionary to be successful. A similar lesson is implied in the areas of improving management and privatization -- change, if it is not to be chaotic,[57] must be accomplished within the context and an awareness of the complex adaptive phenomena comprising public administrative behavior.

General proposals for reform at both the institutional and managerial levels are mostly efforts to simplify and to make public administrative behavior less complicated and more straightforward. Typically they involve schemes related to reorganizations or the adoption of the latest "fad" (e.g., ZBB, TQM). Ironically, such efforts have generally increased the complexity of public administrative behavior, with the result now even small changes have the potential of leading to chaos. A more effective approach would assume that complexity from the outset and rely on explicitly contingent approaches to change. There are different levels of adaptation in public administrative behavior, each related to the other in specific and constantly changing situations. All adaptation plans, in other words, are aimed at moving and changing targets. For the manager to succeed, he or she must learn to deal with -- effectively manage -- the constantly shifting world of public administrative behavior. The fact that such behavior is adaptive provides both a conceptual and strategic foundation for those managerial efforts. Similarly, for reformers to succeed, they must understand that adaptation is a fundamental force which can prove to be either an obstacle or tool in the reform endeavor.

[1] The term "public administrative" is truly awkward, but it is used here to avoid the adverse analytic implications of commonplace alternatives. For obvious reasons, we avoid any claims to contributing to the development of a theory of "bureaucratic" behavior. Although we, like all Americans, frequently use the label "bureaucracy" as a synonym for public administration, both the negative associations and technical ambiguities of that label are sufficient grounds to favor a more specific term. Other potential designations -- e.g., "agency" or "public sector" behavior -- generate their own ambiguities, and may divert attention from our focus.

[2] See Kronenberg, 1971 for a discussion of the need for an empirical theory that has moral as well as scientific authority.

[3] For example, see Kaufman, 1967; various publications generated by "the Oakland Project," such as Pressman and Wildavsky, 1973 and Levy, Meltsner, Wildavsky, 1974; Wilson, 1973; Derthick, 1979 and 1990; and Hargrove and Glidewell, 1990.

[4] Focusing on a body of political science research similar to these examples, Ruth Lane articulates a relevant derivative of the middle-range approach she terms "concrete theory" which has five defining characteristics: (1) "a focus on actual decision makers"; (2) "an expanded self-interest axiom" that goes beyond the narrow assumptions of **homo economicus**; (3) "close attention to the environment"; (4) "a strong logical quality" stressing the "explanatory quality" of the theory; and (5) "an overriding concern with specificity" that avoids making grandiose claims for the theoretical generalizations being applied to individual cases (Lane, 1990, p. 928).

[5] Two major exceptions seem to prove the point. In 1969, Emmette Redford's Democracy and the Administrative State played a pivotal role in pulling together various lessons of a vast literature that had developed on the role of bureaucracy in a America's pluralistic democracy. Twenty year's later, James Q. Wilson's Bureaucracy (1989) performed a similar service for the volumes of studies generated by his students over two decades. In both instances, however, the synthesis amounted to little more than summary statements drawing normative conclusions rather than establishing a framework within which a future agenda of research could be developed.

[6] For example, see Merton, 1968, pp. 193-211, where he notes five "modes of individual adaptation": conformity, innovation, ritualism, retreatism, and rebellion.

[7] For example, see Parsons, 1966; for a critique, see Giddens, 1984, chapter 5, especially pp. 233-236.

[8] In a very important sense, the contemporary relevance of adaptation was established in Herbert Simon's revolutionary insights into administrative behavior in general, i.e., "human behavior in organizations is *intendedly* rational, but only *limitedly* so" (Simon, 1957, pp. xxiii-xxiv). While seeking the optimal results promised by rationality, organized endeavors settle for what is obtainable within the confines of circumstances. They *adapt* rather than optimize (see Simon, 1983, pp. 39-42).

[9] Here we are taking significant liberties with Giddens' (1979, 1984) concept of "structuration" by focusing on its reflective dimension. This is done more for stylistic reasons, in order to avoid confusion that might result from the use of structured/structurated. However, conceptually the idea connoted by the term "reflective" is intended to be identical to Giddens' "structuration."

[10] This division of Darwinism into two major schools of thought is an oversimplification. See Mayr, 1991; also Gould, 1977.

[11] Interestingly, this fundamental distinction is regarded as relatively trivial among those representing both perspectives. Compare Dawkins, 1989, pp. 86-87 and Mayr, 1991, pp. 79-82.

[12] It is a framework that Wildavsky has applied to a variety topics, from the formation of political preferences (1987) to the role of political leadership (1989), approaches to budgeting (1988), and the nature of public sector responsibility (19__).

[13] For a readable introduction to this group and their work at the Sante Fe Institute, see Waldrop, 1992. Also see Lewin, 1992.

[14] For purposes of this presentation we have changed the original order of the questions listed by Holland.

[15] An exception is found in the work of Fred Riggs (1961, 1964).

[16] Compare to Wamsley and Zald, 1973.

[17] See the discussion on enactment structures that follows below.

[18] While situational factors are important, they have rarely been explicitly applied in the systematic analysis of public administrative behavior. For a possible exception, see Hargrove and Glidewell, 1990.

[19] By implication, all social actions are notable as $\alpha_{en} \wedge \alpha_{en}$.

[20] An alternative unit of analysis is Simon's concept of "decision" or "choice" (1957, p. 4). According to Simon, decisions occur where "there are a multitude of alternative (physically) possible actions, any one of which a given individual may undertake; by some process these numerous alternatives are narrowed down to that one which is in fact acted out." Depending on one's viewpoint, Simon's decisions can be perceived as either a precursor or subset of Parsons' social action. Given the importance of social context and expectations in our construct, we opt for the more complex conceptualized level of behavior as our unit of analysis.

[21] Herbert Simon, who admits having once entertained the possibility of empirically developing some generic performance measures for organizations (1957, pp. 41-44), eventually decided that "we can hardly hope" to empirically establish such criteria (1957, p. xxxiv). Nevertheless, his efforts to deal with decision making under conditions of bounded rationality resulted in the now well-known "satisficing" rational choice model: "While economic man maximizes -- selects the best alternative from among all those available to him; his cousin, whom we shall call administrative man, satisfies -- looks for a course of action that is satisfactory of 'good enough'" (1957, p. xxv). What started as a description of process soon emerged as an empirically reasonable basis for a performance standard. Thus, Given the limits and uncertainties with which they must deal, public administrators might be held to a performance standard of satisficing.

[22] The form of this notation is deliberate, for the performance of an enactment structure is not an inherent characteristic of the enactment, but instead exists independent of the actions involved.

[23] For present purposes, we assume such signals do exist independent of the act of being perceived (see Casti, 1989, chapter 7). However, of those signals, those which are subject to being enacted are of prime interest to us.

[24] The quotes are drawn from inquiries into the My Lai massacre of 1968; cited in Rogers and Argawala-Rogers, 1976, p. 3.

[25] Holland uses the notation *I to designate information received from the environment by the adapting structures.* See discussion above regarding how information is treated by Holland and others.

[26] The concept of expectations played a major role in at least two classic work in the study of public administration and political analysis during that period: Simon's Administrative Behavior (1957) and Lasswell and Kaplan's Power and Society Simon posits "knowledge, memory, and expectation" as the three factors in conscious human behavior that differentiated the social from the natural sciences (Simon, 1957, p. 251). He regarded expectations as a central characteristic of "purposive" group behavior, where "A's decision may depend on his expectation of B's behavior, while B's decision may depend on his expectation of A's behavior. . . ."

In Lasswell and Kaplan's Power and Society (1950), expectations were regarded as the basis for political activity, involving the actor's perspective on "the (past, present, or future) occurrence of a state of affairs...." Expectations were not the same as demands, nor were they reflections of one's identity. Rather, they stood as descriptions or matter-of-fact statements of what an individual presumed about the past, supposed about the present, and envisioned for the future. Thus, by themselves, expectations did not seem to have the power to stir action. However, when combined with demands, expectations became a key ingredient in individual "interests"; linked to sentimental feelings about an object, expectations provided the foundation for "faith" (Lasswell and Kaplan, 1950, pp. 19-25).

What these conceptualizations lacked is the acknowledgment that expectations play a major role in stimulating or shaping action (Dubnick and Romzek, 1993, pp. 47-49).

[27] See Kauffman, 1993 for a more technical elaboration of this argument as applied to evolutionary biology.

[28] This scheme is based on the work of systems theorist George Klir, summarized in McNeill and Freiberger, 1993, pp. 185-191.

[29] As McPhee's insightful work indicates, there are other aspects of the Army Corps' job in the lower Mississippi Valley that subject it to conditions of "dissonance." See McPhee, 1989, pp. 22-223.

[30] As part of his approach for maintaining the supportive consensus for NASA during the Project Apollo years, James Webb avoided developing a post-Apollo plan for the agency. In 1965, for example, he passed up the opportunity to provide the White House with a long-term plan because he felt it would make the agency vulnerable to attack from potential critics who were beginning to surface in the scientific and political communities (Lambright, 1990, p. 160). As a

result, after the success of Apollo 11, NASA lacked not only a long-range plan but also the organizational capacity to develop such a plan (see Sayles and Chandler, 1971, p. 23).

[31] On a more generic but relevant level, Robert Axelrod's work on the evolution of cooperation (1984) is an example of learning and memory playing an explicit and central role in politically-relevant behavior. The importance of Axelrod's work is without question among those studying adaptation in biology (e.g., Dawkins, 1989) and it has considerable attention within the general political science community. The relevance of his work for public administrative behavior, however, has yet to be mined. Nevertheless, there has been significant related work on the role of interagency cooperation (e.g., Chisholm, 1989) that shows promise in this regard.

[32] See Weick, 1979, chapter 8.

[33] Compare with the social construction of reality, discussed in Berger and Luckmann, 1966; also Gurvitch, 1971.

[34] Also see Hirschman, 1977.

[35] On the role of symbolic needs, see Nozick, 1993, pp. 26-35.

[36] The decision premises concept has also been used at the collective action (i.e., organizational) level by Thompson, 1967, pp. 134-143.

[37] Weick would not limit assembly rules to those explicitly designed and applied within an organization. He sees them as "inferred recipes" for combining or interlocking behaviors. Weick, 1979), pp. 112-113.

[38] It is appropriate to remind the reader that we have adopted a simplified version of Holland's framework rather than the elaborate one provided in his work.

[39] While borrowing the idea of systemic approaches from March, 1988 (pp. 273-274), we have taken considerable liberties with both his terminology typology.

[40] Giddens draws this view of accountability from Garfinkel, 1967. Also see McLaughlin, Cody and Read, 1992, and esp. Read, 1992

[41] In algebraic terms, we are dealing with a *symmetric group of degree* n, and calculated by the simple formula $S_n = n(n-1)(n-2)...1$, where S = n. In this instance, $S_4 = 4(3)(2)(1) = 24$.

[42] Most of the literature on organizational adaptation assumes a hypostatized perspective -- that is, seeing the ongoing adjustment as the action of a holistic collectivity (e.g., Etzioni, 1975; Katz and Kahn, 1978) instead of as that of a collection of individuals operating within an organizational context.

[43] Weick attributes the concept to a 1962 article by F. H. Allport; see Weick, 1979, pp. 90-91.

[44] Also see Aldrich, 1979.

[45] An additional advantage to Weick's organizing perspective is that it does not eliminate the individual as an important factor in shaping organization-level responses. Of course, no credible organization theory fails to consider the "variable human" factor (e.g., Thompson, 1967, Part Two), although many are indifferent to the relevance, import, or legitimacy of extra-organizational individual activity (see Denhardt, 1981, esp. chapter 3). For our purposes, the organization is best regarded as but one context for individual action plans. Beyond that, Weick's organizing perspective allows us to regard plans emerging at this level as manifestations of cooperation among individuals.

[46] Recent work in the study of organizational choice has helped to clarify the limits of organizational choice (Arrow, 1974; Bendor, 1990, pp. 399-403) as well as enhance our understanding of the dynamics of that composite selection process, particularly under "anarchic" conditions (Cohen, March, and Olsen, 1988; March and Olsen, 1989, pp. 11-14).

[47] This is the perspective implied in much of the public choice literature where institutions are reduced to their instrumental forms, thus allowing for the calculation of institutional "costs" and "benefits." For example, see North, 1990.

[48] However, see Grafstein, 1992.

[49] Underlying our approach is Giddens' view of how institutions are formed (1979, chapter 2; also see Giddens, 1984):

> -Social actions are the results of choices individuals make based on knowledge derived from tacit stocks of knowledge and explicit reflection on what is feasible in terms of both rules and resources.
>
> -Across time and space, recurring social actions develop into social practices.
>
> -Social practices exist as sets of structures which provide the tacit knowledge and object of explicit reflection through which social action choices are made.

-Social practices of the longest duration emerge as institutions. institutions are the medium through which structures and social actions are shaped, and vice versa. That is, the rules and resources of institutions enable and constrain social action.

[50] This is an especially appropriate conceptualization in our model, for our particular structural raw material (i.e., enactments) are not merely the product of their surroundings -- they are also the defining mechanisms through which those surroundings obtain meaning and relevance. Thus, when defining the limits of public administrative behavior adaptation we are also defining the entire domain of structural activity.

[51] On the idea of localized adaptation, see Kauffman, 1993, Part I.

[52] On the story of strange attractors, see Gleick, 1987, pp. 121-153.

[53] Since Holland focuses on genetic adaptation in his general discussions, he uses the term "fitness" instead of performance. Given his earlier definition of fitness as a performance measure, the synonymy is obvious.

[54] None of this is new to those who see and practice management in "Barnardian" terms; see Barnard, 1938.

[55] For a critique of both approaches to reform, see Rosenbloom, 1993.

[56] The Office of Personnel Management reported that only 1.4 percent of SES members transferred between agencies in 1991.

[57] This is not to say that chaotic change may not be desirable or even necessary at times. Pervasive corruption in an agency, for example, might call for its eliminating or the complete and immediate privatization of a government function. In such instances, the adaptation perspective developed her should minimize the shock of any surprising outcomes to such radical moves.

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