

On Averting the Tragedy of the Commons

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ABSTRACT / One of the enduring facts of the human condition is that the earth's resources are finite and its environment fragile. It is also evident that human behavior is rarely based on an appreciation of these facts. While the outlook may be bleak, so are some of the proposed solutions. Reasonable people have suggested that, to survive, an environmentally enlightened authoritarian government must be adopted. This article suggests that such a solution is unworkable, in part because it fails to consider critical aspects of human nature. A framework is proposed for developing solutions compatible with human capabilities.

There is considerable evidence that society is facing environmental limits. Close scrutiny of recent research points to a real and growing danger of adverse climatic change, depletion of the earth's resources, and irreversible damage to the global ecosystem (Catton 1982, Council on Environmental Quality and US Department of State 1980, Brown 1981).

The "Tragedy of the commons" (Hardin 1968) has proven a useful concept for understanding how we have come to be at the brink of ecological catastrophe. People face a dangerous situation created not by evil outside forces, but by the apparently appropriate and innocent actions of many individuals. This by now widely known paradigm is applicable in its broader sense to a great many environmental problems. Hardin has suggested that resource depletion and environmental degradation result from the seemingly reasonable decision-making dynamic of rationality. Dawes (1973, 1975, and 1980) and others (1977) have expanded the theoretical bases for research on commons dilemmas by suggesting that the entire series of decision-making tragedies (for example, the prisoner's dilemma, the *n*-person social dilemma games) may all be mathematically equivalent.¹ Simply stated, we face a serious dilemma which, although constantly reoccurring, has never been solved—an instance where individual rational behavior (that is, acting without restraint to maximize short-term gain) causes great long-range harm to oneself and others (Platt 1973).

The seriousness of the commons dilemma suggests the need for people to begin adopting and maintaining ecologically compatible patterns of behavior.

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For a variety of reasons, this has proven to be a difficult task. This article explores a possible framework within which acceptable solutions to the tragedy of the commons can be found, and will:

- 1) Point out why a much talked about approach to environmental problems, authoritarianism, is of questionable efficacy.
- 2) Suggest that the existing framework of "muddling through" is an effective way of enlisting human ingenuity in the effort to resolve the tragedy of the commons.
- 3) Suggest several key enhancements to muddling that will overcome certain crucial weaknesses in this process.

The approach presented here takes as its starting point two criteria that a solution must meet in order to be successful: compatibility with human nature and compatibility with available natural resources. These criteria have emerged from an analysis of why potential solutions to the tragedy of the commons have failed to make headway. Each is briefly outlined below.

Since current patterns of human behavior seem to be at odds with long-term survival, many solutions propose altering these patterns. A solution that seeks to alter human behavior significantly should be sensitive to basic human concerns.² One of the most salient human concerns to emerge is the need to maintain a degree of choice. A second issue involves limiting a solution's requirement for natural resources to those currently available. It seems prudent to treat existing resources as if they are all we will ever have. Relying on an increased drawdown of current reserves or the ever-continuing discovery of new resources will, at best, only delay the onset of shortages. These, then,

are the criteria that we will use to explore proposed solutions to the environmental dilemma being faced.

Coercive Solutions

Investigators in a variety of fields have come to the same conclusion: the future is indeed bleak unless major changes are made in patterns of resource use. Understandably, a great sense of urgency pervades recent writings on this topic and there is a willingness to consider solutions that constitute a major departure from current political practices.

Some scholars, seeking solutions to what they have identified as an impending ecocatastrophe, have sought them within the confines of the democratic process. Hardin (1968), with refreshing honesty, has focused attention on a lack of sufficient coercion within such processes. Only by seeing the necessity of mutually agreed-upon coercion can ecocatastrophe be avoided. This perspective has a certain intuitive reasonableness. There are, it seems, many solutions available, but like spoiled children we have not made ourselves behave. Yet mutual coercion has at least two implementational weaknesses. First, by eliminating choice, coercion increases the likelihood of resistance and opposition, phenomena discussed in more detail below. But even more fatal politically and psychologically may be the perception that "mutual coercion mutually agreed upon" leads to a grim future.

Other scholars, in formulating more radical solutions, tend to agree that (a) democratic systems of government are simply not up to the challenge as they are unable to act quickly and without compromise, and (b) we cannot rely only on individual prudence or discipline (Hardin and Baden 1977, Heilbroner 1975, Ophuls 1977).

Heilbroner (1975) suggests that "There will be no escape from the necessity of a centralized administration for our industrial world." Ophuls (1977) likewise contends that resource scarcity will produce "overwhelming pressures toward political systems that are frankly authoritarian." Thus, these scholars propose a centralized and often authoritarian solution in place of weak democratic institutions—a solution that would include the centralization of environmental planning, resource allocation, and political power (Orr and Hill 1978).

While the tragedy of the commons is a distressing event, the proposed authoritarian solution might well be equally disturbing. Nevertheless, the proponents of the authoritarian solution are not Machiavellian. They view the problem to be of such a great magnitude and urgency that people can neither wait for the demo-

cratic process to act nor tolerate the resulting compromise solutions. Their approach is viewed as a necessary evil, one that addresses the realities of ecological limits, not political acceptability. Authoritarianism, with its apparent direct and uncompromising approach, is, they argue, the only hope.

Reactance to the Elimination of Choice

While coercive solutions are perceived as overcoming the weaknesses of democratic institutions and human nature, they are not without their own limitations. A problem with solutions that eliminate choice is the undesirable effects they have on individuals (Vargish 1980). The characteristic negative human reaction to strong coercion has been analyzed in the context of psychological reactance theory. Psychological reactance is the motivational state of a person whose freedom has been constrained (Brehm 1966, Brehm and Brehm 1981). It is a response by which people show increased desire for a forbidden alternative or decreased desire for what they feel forced to do. This phenomenon is more than just a disturbing possibility. Reactance effects have been noted in numerous investigations including the study of legal prohibitions (Mazis 1975) and strongly worded prompts for pro-environmental action (Reich and Robertson 1979). The tendency to react against compulsory changes that involve one without consent appears to be a rather general phenomenon.

Loss of Diversity and the Potential for Grave Error

Nonetheless, some might conclude that the risk of reactance is a cost one must bear. The authoritarian solution is not, after all, a preferred solution; the argument is rather that it is a necessary one.³ Taking a step that is so decisively against the grain of human nature could, of course, only be justified in terms of its unequivocal effectiveness in the utilization of available resources.

Centralized planning attempts to manage resources, and simultaneously overcome human weaknesses, by applying one pattern to all possible settings. This approach reduces the chance of people "messing things up," but also loses the diversity and resilience so essential to effective resource management.⁴ Consider such federal energy conservation effort as the building temperature setback program with one target temperature for all climactic regions and building types. While such federal efforts have been evaluated as generally ineffective, there have been notable successes at the local level, each demonstrating a sensitivity to local conditions (Ridgeway 1979, Stern and Aronson 1984).

A related issue is the ability of authoritarianism to

commit a large percentage of available resources to what is judged to be a vital project. While the urgency of the environmental crises would seem to demand such a response, it entails considerable risk. There is the danger of making large-scale resource allocation errors. In fact, the potential for grave errors may be a major risk of the authoritarian approach. As Lindblom (1979) notes,

authoritarian systems are at least occasionally capable—apparently more often than in democratic systems—of such nonincremental change as the abrupt collectivization of agriculture in the Soviet Union and the Great Leap Forward and the Cultural Revolution in China (as well as the Holocaust and the recent destruction of Cambodia's cities and much of its population).

Thus, authoritarian systems may be less effective at avoiding ecocatastrophe than their proponents believe. What we know to be the limitations of large-scale institutions casts doubt on the appropriateness of an authoritarian approach (Orr and Hill 1978, Lindblom 1979). Such an approach, while consuming valuable resources, may contribute nothing to the problem at hand.

Muddling Through: A Framework for an Active Organism

In addition to identifying the dangers of authoritarianism, Lindblom (1959 and 1979) has nominated a candidate to take its place, a modest and incremental technique he calls "muddling through." This technique has a sufficient array of desirable properties to deserve a closer look.⁵

Muddling is highly compatible with human nature. One seeks the advice of those people most affected by the decision, checks out every step in advance for acceptability, and never ventures far from the result of past changes. Muddling is conservative in a functional way: it does not ignore traditional values or beliefs (Ophuls 1977). The outcome of muddling is a practical solution, one that at least makes a marginal contribution to the problem at hand.

One of the important contributions that Johnson has made is the fusion of the muddling process and environmental problems (Johnson 1978 and 1985). Johnson has shown that the prevalent human tendency to "make do" can aid us in adopting a frugal way of life without the need for an authoritarian bureaucracy.

The Problem of Small Steps

It is easy to see why people would opt for muddling. Muddling acknowledges the many constraints

facing people as they seek solutions. It demands, not an optimal, but an adequate and acceptable solution. And what limitations do exist are discovered and dealt with early in the process. Nonetheless, muddling has serious weaknesses that render it ineffective in dealing with the tragedy of the commons.

The proponents of authoritarianism would have the same reservations with muddling as they have with all democratic approaches. Muddling is a process characterized by a slowness in taking even modest steps, a tendency to compromise, and an avoidance of significant bold or visionary steps (Johnson 1978). These features of muddling offer much valued stability, but also prevent adapting to quickly changing circumstances.

Muddling as a Process of Sequential Exploration

It is of considerable interest in solving commons dilemmas to have the ability to explore a variety of potential solutions at the same time. It is our perception that the proponents of the muddling and authoritarian approaches may suffer in this respect. It would appear that they function by pursuing one solution at a time. Certainly they are capable of intelligently discussing alternative courses of action, but the outcome of such discussion usually is the selection of one option for implementation. Furthermore, this selection is more often based on political acceptability than on the feedback of facts or the reports from what one might call field tests. Essentially, an entire society explores a chosen solution. Implementing solutions on a national level without the benefit of pilot testing may strike the reader as risky. The failure of a solution could be costly, disastrous, or both. As an example one need only consider the "payment in kind" program that seemed to be a good solution to the huge US farm product surplus until the solution was implemented nationwide. Clearly, what was perceived to be an effective solution at the conceptual stage proved otherwise. It would seem less than prudent to move quickly from the conceptual stage to full-scale implementation without the benefit of smaller-scale explorations. Nevertheless, it seems to go on all the time.

Under certain conditions, this would be a tolerable approach to solving the tragedy of the commons. Any problems encountered at the larger scale could be handled in the next iteration of muddling. But the tragedy of the commons is presented as an urgent problem. The crisis of scarcity being envisioned is characterized by unprecedented rapid change from a state of abundance to one of want (Hardin 1968, Heilbroner 1975, Ophuls 1977). There might well not be enough time or resources for muddling's one-at-a-

time, trial-and-error process of stumbling toward the right solution.

There are, thus, several reasons why something more than muddling is needed. It is awkwardly slow in practice and tends to pursue only one large-scale exploration at a time. And this exploration involves an often untested solution implemented at a large scale. Without some adjustment, muddling will not be of much help.

The weaknesses of muddling have been acknowledged by other scholars and a number of alternative decision-making procedures have been proposed. One procedure that has received considerable attention is mixed scanning (Etzioni 1967). Mixed scanning has two main components, the first being a rational, optimizing procedure used for making fundamental policy decisions. The second component, incrementalism, is used once the basic policy direction is specified. This incrementalism allows for gradual change in the basic policy until such time as the need for a fundamental change is recognized (Janis and Mann 1983).

Although apparently promising, upon closer examination this approach is found to suffer from the elitism common to most decision-making procedures. Mixed scanning, even by a self-conscious decision maker, is still centralized, expert-based planning. It may be true that mixed scanning allows for more environmental inputs than are commonly considered in muddling (Bradley 1973). However, it does not necessarily open up the decision-making process to more people or ideas. It is also not clear how it overcomes the pitfalls of coercion discussed earlier.

Adaptive Muddling

We suggest that it is possible to build upon people's natural tendency to muddle through. It is worth salvaging the powerful advantages of muddling if its tendency toward slowness, compromise, and lack of direction can be overcome. We propose that muddling be improved by introducing three distinct facets of the decision-making process: exploration, stability, and distributed leadership. We are calling this new framework *adaptive muddling*.⁶

The three elements of adaptive muddling are not new concepts. They are found within various decision-making frameworks. Exploration sometimes seems to be the main task of industrial society. Stability is a much valued feature of any decision-making process. It is often used to describe the advantage that democratic systems have over other, more volatile governing models. And leadership has always played a pivotal role in human endeavors.

While each element has merit on its own, none does well in isolation. The effectiveness of adaptive muddling is based on the manner in which these three elements are included in a single framework. Exploration, stability, and distributed leadership are mutually dependent elements that function better when linked together into a system. Each makes the others possible and each derives needed input or support from the others.

A key feature of adaptive muddling is the relationship of scale to function. In the midst of a heated debate between the advantages of large-scale or small-scale solutions, Schumacher (1973) has suggested a middle ground. His concept of "intermediate technology" highlights the importance of finding the appropriate scale for solving a problem, not just the smallest scale. Using this approach, one looks for what each level of scale does best and allocates decision-making responsibility accordingly. In adaptive muddling, explorations are pursued at the smaller scale while stability is provided at a larger scale. As a system, however, adaptive muddling is not scale specific. It is as easily applicable to county-level issues as to national or multinational problem solving.

Exploration

One of the strengths of adaptive muddling is related to the small scale of these explorations. Both the authoritarian and conventional muddling approaches, by virtue of their focus on large-scale problems, tend to consider large-scale, national solutions. It is our assessment that the result is the implementation of only one solution at a time. In contrast, adaptive muddling allows explorations to be pursued at a smaller scale, making it possible to analyze, design, and implement a variety of alternative solutions simultaneously. Any successful small-scale explorations can be considered for implementation at a larger scale.

Such an approach is tolerant of failure for at no time is the entire resource base jeopardized. And yet adaptive muddling is not risk free. One's success or failure has relevance to the larger context. Failure will be felt by both the exploratory groups and all others who await a solution to the tragedy of the commons. The result is a heightened sense of genuineness and connectedness born of knowing that one is trying to solve an urgent dilemma.

The scale of the explorations can relate to the size of the individual experiments, the size of the group doing the experiment, or both. Numerous American communities have explored how they might make significant local changes in the way they use energy. Each

exploration has helped contribute to what might well become a national energy policy. During the last decade, many small towns have experimented with energy conservation programs. Osage, Iowa, with a population of only 3800, responded to the energy crisis of the early 1970s by promoting conservation rather than the construction of new utility plants (Daniels and Farley 1986). Osage explored a wide variety of approaches and the results were impressive enough to win the 1984 Award for Energy Innovation from the Department of Energy. Since the mid-1970s, their overall electrical consumption has remained steady and their peak electrical demand has dropped by 15%. The citizens have had their electrical rates drop four times since the early 1980s for an overall reduction of 13%. The town now has the lowest electric rates within a 50-mile (80½-km) radius (5.5 cents per kilowatt-hour). Natural gas has followed a similar pattern with rates (when corrected for inflation) dropping to half of what they were in 1976. Yet, despite these rate cuts, the Osage utility department has been able to retire all of its debt and accumulated a \$2 million surplus.

The effectiveness of small-scaled explorations can also be seen in the community planning efforts documented by Ridgeway (1979). The city of Davis, California, is illustrative of the effect a moderate-sized community can have on energy use. After conducting an inquiry into its energy use, the Davis city council began experimenting with a large number of energy-saving ideas. These ranged from the alteration of building codes to favor energy conservation to encouraging city employees to use bicycles when moving around town on city business. The data indicated that Davis regularly outperformed national conservation figures. For instance, two years after adoption of the energy-conscious building codes, there was a per customer drop of 12% in electrical consumption.

Explorations have not been limited to small cities. In the mid-1970s, Seattle began an extended political debate over whether to participate in the now-defunct Washington Public Power System (WPPS). Partly through the work of a citizen's committee, given an extraordinary free hand by the Seattle City Light top bureaucracy (the group that would normally conduct the planning process), the city ended up not supporting the WPPS and instead pursued a long-range plan to provide needed energy through conservation. In this instance, many small experiments were tried, including the development of new building codes, installation of a free bus system downtown, and the conduction of neighborhood energy conservation workshops. Even more ambitious ideas were considered, including the use of fast-growing timber as a fuel source

for power plants and the combining of solar power with hydropower.

Explorations have also been carried out by a few pioneering individuals. John Jeavons and his associates have examined two vital questions in a world where 35 million people die from hunger-related disease each year—how much food does a person require in a year and how small a piece of land could be made to produce that amount of food? (Ruttle 1986). Based upon a gardener working alone, they have come up with some very hopeful numbers. If one uses a variety of vegetables and plants (selected for dietary needs and productivity) and locates in an area with good soil and an eight-month growing season, one needs only 700 sq ft (65 m²). Including more popular plants and vegetables, reducing the growing season by half, or starting with poorer soil may only double the land area required (1400 sq ft or 130 m²).

Admittedly, such small-scale explorations will not always confront a problem in a comprehensive manner. Instead, exploration tends to pioneer a particular approach, with participants sharing a single vision of what is possible. Thus, within the larger consensus-driven framework of adaptive muddling, there is room for the commitment and intensity that are necessary for creativity and innovation.

But adaptive muddling offers more than just the ability to explore many potential solutions at once. In contrast to the authoritarian approach, which must work against human ingenuity as it attempts to implement a comprehensive solution, adaptive muddling is based on people being involved in the decision-making process. Adaptive muddling builds on people's desire to participate, to do things that can make a difference in a larger context and that matter in the long run. At a smaller scale, with fewer people involved, it is possible for each individual to comprehend the situation and for the exploration as a whole to be action oriented. People are most capable and effective when dealing with something they comprehend. They also respond well when there is a real opportunity for action (Kaplan and Kaplan 1982).

Stability

To deal successfully with the tragedy of the commons, one must explore alternative solutions. But explorations entail risk and uncertainty. There is, thus, a conflict—exploration is both necessary and dangerous. In such a situation, one benefits from a source of continuing and reliable support. With such support, one is freed of having to develop contingency plans against every possible failure (Cantril 1966).

Providing such stability is the function of a context

larger than that of exploration. Stability can occur at the level of the nation, the state, or some other institution. By creating the support structure that permits a variety of explorations to take place, it is possible to experience errors without endangering the entire system. Another advantage of being able to tolerate errors is that it permits the exploration of bold and innovative solutions.

There is, thus, a symbiotic relationship between exploration and stability. A stable and predictable environment provides a safe and secure source of support for exploration. In return, explorations provide tested solutions that can be considered for implementation in the larger context. Thus, explorations, which may be neither tightly interconnected nor centrally managed, are nonetheless tied to the larger context via the stability concept.

There are numerous current examples of this relationship. It is a feature common to most academic environments. Through the process of tenure, faculty are provided with a source of continuing support regardless of the direction their research might take them. With their support secured, faculty are freed to deal with theories and realms of thought that they might otherwise be wise to ignore or avoid in favor of a safer enterprise.

Interestingly, this combination of stability and exploration has also been identified as vital to the business world. Those companies that Peters and Waterman (1982) have identified as top performers usually have some sort of mechanism for encouraging small, experimental, "skunk works," bands of eight or ten zealots off in the corner . . ." These groups are usually left with a free hand and are often allowed to operate outside of the corporate chain of command. This lack of orthodoxy does not diminish their perceived value to the corporation. These groups are so valued for their innovative contributions that they are supported (that is, offered job security) even in the event one of the ventures should fail. Peters and Waterman are blunt as to the effectiveness of this approach: "No support systems, no champions. No champions, no innovations."

Another benefit of permitting many separate explorations to take place is the possibility of discovering solutions that address local conditions (Peters 1985, Runge 1985). Rather than a single experiment, adaptive muddling supports simultaneous explorations. While decisions are thus repeated many times over, the likelihood is increased that each exploration will include more of the unique facets of the problem in its setting. In the process, a diversity of solutions emerges. In this manner, regional differences in envi-

ronmental conditions or resource availability are addressed directly, not through the ad hoc modification of a "master" plan.

Distributed Leadership

An unintended consequence of a coercive solution is, as we have seen, that people are inclined to act in opposition to what they are told to do. This will be true whether the source of the solution is from an authoritarian bureaucracy as in authoritarianism or from a panel of experts as in most democratic decision-making processes. Adaptive muddling, by contrast, benefits from the insight and talent of the entire nation, experts and citizens. A major way in which people feel needed and can contribute to the problem-solving process is through distributed leadership.

Leadership has little or no explicit role in ordinary muddling; by contrast, in adaptive muddling, leadership is central. At the same time, leadership is not seen as residing in one or even a few individuals. The leadership appropriate to adaptive muddling depends upon contributions of many kinds, coming from people representing diverse skills, abilities, and interests. The effectiveness of distributed leadership depends upon its broad base of contribution and the diversity of its contributors (Wildavsky 1964). This can perhaps best be appreciated in the context of adaptive change. The clear message of the commons dilemma analysis is that human patterns must change, and change far faster than can be accommodated by biological modification. The burden, then, is necessarily on cultural rather than genetic evolution. Convincing a culture to adopt new patterns is admittedly a difficult task. Several factors, however, can facilitate the process. The provision of these facilitating factors is the role of distributed leadership. There are three distinct functions here, which might appropriately be labeled *vision*, *process*, and *themes for exploration*. These provide an essential support for the active cognitive basis upon which adaptive muddling depends. A brief sketch of each should make their significance clear.

The first function of distributed leadership is *vision*—the creating of an understanding of our situation, the possibility of a solution, and the challenge it offers to everyone. The urgency of the tragedy of the commons must be understood by all. There must be a shared understanding that this dilemma must be faced, not deliberately avoided. The very nature of the dilemma causes some individuals to feel helpless. Leadership must show that not only can a decent lifestyle be salvaged, but that there is the possibility of improving our quality of life in the process.

Another function of leadership is to create and

support a *process* for meeting the challenge of the tragedy of the commons. Leadership must clarify the role of exploration and stability. It is necessary to understand that the failure of explorations is an acceptable, and even necessary, outcome of the process. In fact, Peters and Waterman (1982) report that an indicator of success in a company is not only its being inclined to try something out, but a willingness to tolerate and even celebrate failure. The acceptance of failure may be made easier by developing the expectation that solutions discovered during explorations will become part of the stable, larger-scale institution. By understanding the dynamics of the exploration–stability relationship, it should become clear that failure of an idea at the exploratory stage is information vital to the system as a whole.

And finally, it is the role of leadership to identify and nominate *themes for exploration*. It is difficult to generate ideas that are worth pursuing. Themes that are worth exploring must fit a certain profile: they must deal with the problem and be compatible with human nature and available resources. Leadership in this context is more than just power or charisma. It involves insight that appreciates both the nature of the problem and of the people who must ultimately deal with it.

Adaptive muddling draws on the many facets of leadership, from the cultural and visionary to the day-to-day politics of the process and to the conceptual issues involved in particular explorations. It is not feasible, or even desirable, that one individual will fulfill all leadership functions. From this perspective, one can see leadership as coming from many sources. The novelist and poet who address the issue of environmental limits and suggest alternate patterns of living constitute important examples. At the same time, leadership is also demonstrated by citizens who, tired of red tape and delays, form grass-roots organizations to take direct action on an issue. The theoretician who suggests a strategy worth exploring provides a rather different, but no less important, aspect of this necessarily widely shared form of leadership. Clearly, adaptive muddling is more concerned with the insight that leadership provides than with the source of this insight.

There are numerous examples of leadership springing up without the encouragement of centralized authorities. Consider the Meadowcreek Project.⁷ These are people intensely aware of the environmental dilemmas being faced, but are unwilling to adopt a dismal outlook. Where others see a future clouded over with sacrifice, poverty, and famine, Meadowcreek sees a future demanding our participation, intelli-

gence, and ingenuity. Rather than avoiding dealing with the dilemmas facing society, they spend all of their time on them, and not just by writing about the opportunities. Meadowcreek is the sort of hands-on education and research organization that adaptive muddling is all about. They have created not only a vision of a positive future, but a location where themes suggested by others can be explored.

Another organization demonstrating such leadership is the Rocky Mountain Institute (RMI),⁸ which actively promotes alternate approaches to energy, water, and agriculture policy. Their pragmatic end-use/least-cost approach to energy options is an idea that took only a decade to move from a theme worthy of exploration into the mainstream of energy analysis. The RMI suggests that this approach can probably be repeated with other resources (Rocky Mountain Institute 1986).

Such an approach to problem solving in a cultural framework admittedly requires a great deal of human talent and effort. This approach may in fact appear to be inordinately costly. On the other hand, the environmental dilemma themes are at least as important as many currently being explored in science fiction, films, political campaigns, talk shows, and the other cultural forums of our time. Thus, to some degree, commons-related themes might come to replace currently popular topics. But such a simple substitution of themes is unlikely to be enough. Adaptive muddling may well require a considerable infusion of additional thought and effort.

It is thus likely that new talent must be enlisted to meet this heavy set of demands. While this could be counted a cost, we are more inclined to consider it a benefit. We live in a culture where the sense of not being needed, of being surplus, is widespread. Surely participation is to be preferred to further alienation. An increased capacity to involve talent not now being used might well improve the quality of life of these pioneers of this latest of frontiers. The potential benefits are, of course, not limited to the most active participants, for this is not an optional frontier, but one that must be dealt with, and dealt with forcefully and creatively, if it is not to be our last.

Adaptive Muddling and the Problem of Small Steps

A key issue as far as adaptive muddling is concerned is how the potentially fatal “small step” bias of conventional muddling can be corrected. As long as only modest steps are taken, the solution to problems will necessarily be slow and frequently too slow. Adaptive muddling deals with this difficulty on two fronts.

One source of reactance to new ideas and new al-

ternatives is the fear of change. While this may seem to be a rather foolish and small-minded fear, in recent times it has all too often been justified. Whether justified or not, however, such a fear can readily block innovation before a new possibility has even had a fair hearing. Here the stability aspect of adaptive muddling plays a central role. It provides assurance that unchecked and disorienting change is unlikely to occur. The stability-preserving feature of adaptive muddling will tend to block the widespread implementation of untested solutions.

A second factor is even more central. Much of what is considered a bias toward the status quo is in fact a bias toward the familiar. Although this may sound as if it is a rather small, perhaps even academic, distinction, it is in fact a crucial issue and one with major implications. A status quo bias means that little will change, and what does change will change only very slowly. A familiarity bias, by contrast, means that the size of the step is limited not by where people are, but by what they know. The key issue, in other words, is the sort of knowledge and experience that people have, not merely what their current circumstances happen to be. Fortunately, people can have knowledge and experience that extend far beyond the comfortable outline of the status quo.

It should perhaps be emphasized that a familiarity bias is not an expression of a foolish conservatism, but is in general a sound and reasonable practice. To move significantly beyond what one is familiar with is an invitation to disaster. Being on unfamiliar ground, one not only does not know what to do if something goes wrong; one may not even know what "wrong" looks like. Even the familiar is susceptible to surprise and uncertainty; managing these hazards outside of one's comprehension and confidence is a risky proposition indeed.

Since people are conceptual animals, what they can become familiar with is, fortunately, not limited to what they have experienced in a direct and literal sense. People can acquire familiarity through the written word, through artistic creations, and through simulations of various kinds (for instance, plays, TV, and computers). Here both leadership and exploration have key roles. Leadership can provide the imagery and the richness of context necessary to allow people to build models of the not yet present. Exploration can provide concrete alternatives that deserve attention and thought.

Although this discussion has followed a path quite distinct from that used by Edney (1980), the proposed framework is consistent with his analysis. His focus is on territory and trust as contexts for appropriate be-

havior. The familiarity concept is a means for developing the territorial feelings that he points out can be so powerfully motivating. Edney's concept of trust is even more closely aligned with adaptive muddling. Trust, while highly compatible with a democratic framework, is nonetheless a risky and potentially unstable venture. Edney suggests that this trust is stabilized by the territorial division of the commons. Adaptive muddling provides other stabilizing influences. The small scale of the explorations allows one to take advantage of the trust-building factors of shared imagery, group cohesiveness, and open communications (Stern 1978). A related issue is the mutual predictability of behavior at the smaller scale. It is far less risky to invest in trust building when one can reasonably assess others' behavior. And finally, the stability of the larger scale reduces the impact of a significant loss should an exploration fail or trust collapse.

Conclusion

In the parable of the tragedy of the commons, humans have been offered an early warning of what the future may hold, yet the response to date has been ambiguous. There are, of course, many reasons why people might avoid a confrontation with the realities of a people-rich, resource-poor future. One reason has already been mentioned—fear of change. But there are other barriers to action: a fear of disorder, a sense of helplessness, a feeling that there are no workable alternatives. Within the adaptive muddling framework, however, such concerns lose their significance. It is not necessary to give up all the things that one holds dear: order, predictability, hope, the desire to create a decent future for our children.

Clearly, the adaptive muddling framework has both limitations and advantages. Both our analysis and prescription are limited to the political and cultural setting of the United States although it may also apply to other well-established democracies. In addition, the adaptive muddling framework does not address certain very serious, large-scale problems that haunt human survival (for example, the carbon dioxide buildup in the atmosphere or acid precipitation caused by multinational activities). It is not yet clear just what other limitations there might be to our approach. Adaptive muddling is not proposed as a panacea; it is intended to address the vast number of environmental problems where solutions can be explored at a small scale.

The advantages offered by the adaptive muddling framework can be understood in its comparison with the authoritarian and conventional muddling ap-

proaches. Two issues highlight these advantages—how each problem-solving process deals with people and the character of solutions generated.

The authoritarian solution is characterized by the limited role offered individual citizens. There is room for their approval of the selected solution, but no opportunity for them to influence the choice. Even in democracies, the situation is often far from ideal. Williams (1986) describes citizen participation as “citizens (usually sitting passively in chairs) posing questions and comments to experts (if male, usually wearing a necktie). Two messages are clear: Citizens only have input as outsiders into a process controlled by professionals; and citizen involvement (as both obligation and privilege) is limited to planning.” The success of adaptive muddling, by contrast, is both sensitive to human concerns and relies on the talent of its citizens. Again, Williams (1986) suggests that citizens “have more than just input into a process; they also shape and define the project through their own actions.”

A similar contrast exists for the type of outcome desired by each decision-making process. The authoritarian approach seeks a comprehensive and unidimensional solution—an optimal response to the tragedy of the commons. Conventional muddling, with its reliance on due process, is neutral on the desired outcome. If a solution proceeds all the way through the tortuous procedure of due process, it will be acceptable. In contrast, the type of solution to emerge from adaptive muddling is largely independent of the problem-solving process. The solutions developed will be mainly influenced by the particular people involved in the adaptive muddling process and, via this direct involvement, a substantial increase in the overall commitment to the solution will develop.

The advantages of adaptive muddling over Hardin’s mutual coercion mutually agreed upon are of a similar nature. In contrast to the perceived bleakness of mutual coercion, adaptive muddling offers a way for people to be inspired by challenge. The necessary solutions, far from being obvious, will require creativity and innovation. Rather than an enforced uniformity, there is likely to be considerable diversity in the patterns of solutions adopted by different individuals. By engaging the imagination and preserving choice, adaptive muddling gains a substantial benefit both politically and psychologically.

Feasibility and Implementation

To some, our proposal might seem too close to the status quo. After all, there is considerable small-scale experimenting going on and muddling is certainly a major factor in the governmental process. A grave

weakness in the current situation, however, is that there is little or no linkage between these two domains of activity. Government neither provides support and encouragement for the explorations nor, by and large, utilizes the results.

Others may argue that our proposal is a renamed version of the “experimenting society” first proposed by Campbell (1981). The experimenting society is based on the central concept that governmental programs should be designed as experiments, complete with a built-in evaluation procedure.⁹ This evaluation is to be the province of social scientists; Campbell calls for rigorous, expertly designed experiments and rigorous statistical analyses. The results are intended to provide input to policy makers to guide decisions. But Campbell acknowledges that the results of such analyses tend to have little influence on the governmental process.

Our approach uses the concept of an experiment in a less restricted sense. Viewing an experiment as an organized way of learning from experience makes it available on a large scale as a means of exploring alternatives. We see the analysis of such experiments as being less formal and more compatible with current cultural channels. Newspaper accounts, reports by participants, visits by interested individuals, and the like, would be appropriate supplements to whatever record keeping or other hard data are available. The more specialized framing of an experiment and its evaluation make it not only less accessible, but also less likely to have impact.

Another contrast between these approaches concerns the degree to which the origin and guidance of the experiments are centralized or decentralized. It is clear that adaptive muddling falls on the grass-roots side of this spectrum. This might appear to be unrealistic, or at the least overly idealistic. On the other hand, Naisbitt (1984) has made a compelling case for the argument that the important trends do not in fact originate in Washington and New York. Many of the grass-roots themes that he identifies are quite compatible with adaptive muddling. These emphasize decentralization, networking, participatory democracy, an increased orientation to self-help, and an emphasis on multiple options.

While our proposal is thus not a restatement of the experimenting society or a description of the status quo, neither is it particularly utopian. It does not promise an easy happy ending to a difficult problem. We see a number of small but crucial changes as at least mitigating a dangerous situation. These changes will not produce instant paradise. Given the intractability of the tragedy of the commons and the urgency

of arresting these destructive trends, even a modest improvement would be welcome.

There is growing evidence that behavior is strongly affected by the model of the world one holds. What is lacking in the present situation is a model that relates what experimenting does occur to the decision-making process. Thus, implementation requires, at its roots, a change in the shared model of the governmental process. We have attempted to sketch out a blueprint for this needed model. Its major components can be described concisely. It requires acknowledging a problem (that is, environmental limitations) that tends to be denied. It requires a clear policy to the effect that (a) outcomes matter, (b) these outcomes cannot be known without exploration, (c) this exploration is best done at a small scale, and (d) in order to find solutions in a timely fashion, many such experiments must go on simultaneously.

Thus, the primary ingredients already exist. The talent exists. The problems exist. The history of muddling exists. What is required is the adoption of a new way of thinking about how these components can be brought together into a larger whole that is challenging, inspiring, and effective.

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Notes

1. At a time of enormous growth in the literature on the tragedy of the commons, with the parallel effort to differentiate between different types of commons, there has been work suggesting that many apparently separate decision-making problems are, in fact, similar. Dawes (1973, 1975, 1977, and 1980), who has been influential in expanding our understanding of these dilemmas, has suggested that the term "social dilemma" be used to encompass commons dilemmas, social traps (Platt 1973), and the prisoner's dilemma (Coombs and others 1972) since all share certain essential characteristics. Another researcher (Komorita 1976) has shown that, despite the apparent differences between the prisoner's dilemma and the commons dilemma, the prisoner's dilemma is, in terms of decision-making mathematics, a special case of the commons dilemma.

2. Scholars have identified a number of characteristics of environmental problems that prevent their straightforward solution (for instance, consequences may be irreversible, effects may be dispersed in both time and space or may appear after a long time lag, or there may be imperfect access to information). See Bartlett (1986) and Dryzek (1983a and b) for a discussion of these and other constraints. This article adds certain cognitive needs and constraints inherent in solving environmental problems. A systematic cognitive analysis of the requirements for reasonable human behavior can

be found in Kaplan and Kaplan (1982). In addition, see Cantril (1966), who has provided a compilation of universal human concerns in his last chapter.

3. Dryzek (1983b) has noted that democratic societies, on finding themselves unable to act effectively, may find it necessary to adopt an authoritarian system. This is sometimes observed during wartime.

4. For a discussion of resilience and resource management, see Lovins and Lovins (1982).

5. The matter is certainly more complicated than presented here. Muddling through is usually considered not a procedure, but a description of how public policy is actually made. Lindblom's (1979) prescription for improving public policy making is a process that he labels disjointed incrementalism. This article uses the term "muddling through" to represent Lindblom's contribution to the field of public decision making.

6. While muddling began as a description of the problem-solving process utilized by policy makers, Orr (1986) has shown how muddling is generally associated with the preservation of the status quo. We have attempted to show how correcting this difficulty allows a society to approximate the "adaptive scenarios" that Orr so effectively describes.

7. The Meadowcreek Project, Inc., Fox, Arkansas 72051, USA.

8. Rocky Mountain Institute, Drawer 248, Old Snowmass, Colorado 81654, USA.

9. Dryzek (1983a) also promotes the idea that public policy analysis must move well beyond the simple assessment and selection of "pre-ordained and well-designed alternatives, and toward policy design."

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