

PACIFIC SALMON &  
THEIR ECOSYSTEMS

STATUS AND FUTURE OPTIONS

Deanna J. Stouder, Peter A. Bisson, Robert J. Naiman, Editors

Marcus G. Duke, Associate Editor



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# Organizational Systems and the Burden of Proof

David A. Bella

## Abstract

To understand the salmon crises, we must come to a radically new understanding of human systems. The vast organizational systems of technological society should be seen as "CANL" systems—they are complex, adapting, and nonlinear. They display emergent behaviors that cannot be reduced to the intentions and values of individuals. We depend upon the emergent behaviors of these CANL systems to provide the technological services of modern society: "Benefits do emerge." However, destructive tendencies also arise as emergent phenomena. We misperceive such phenomena when we reduce them to the intentions and values of individuals. This paper departs from such reductionism. It develops a model to identify, explain, and even predict emergent tendencies that are destructive within these CANL systems of the human kind. The space shuttle explosion, the decimation of old growth forest ecosystems, and the decline of salmon (*Oncorhynchus* spp.) stocks are shown as outcomes of the same emergent phenomenon, "systemic imbalance." In this paper, I warn that we are unlikely to protect the salmon unless we recognize how our own perceptions are transformed to conform with systemic imbalances. This paper is radically new: it departs from conventional science, drawing upon recent notions from nonlinear dynamics—self-organization, the interplay of order and disorder, and the pull of attractors. Alternatively, this paper comes back to old notions such as independent checks and balances, responsible citizenship, and the democratic and prophetic traditions.

## Introduction

In 1892, Livingston Stone warned that the salmon (*Oncorhynchus* spp.) of the Pacific Northwest faced "the slow but inexorable march of those destroying agencies of human progress. before which the salmon must surely disappear as did the buffalo of the plains and the Indian of California." Today these agencies can be described as the vast organizational systems upon which our modern technological world depends. Such systems provide many benefits; in Stone's words, they contribute to human progress. Without denying these benefits, my objective here is to ask: What is it about such vast systems that allows them to shape the activities of ordinary people so that we ourselves contribute to "the slow but inexorable march of those destroying agencies of human progress. . ."? Conventional answers, I claim, are insufficient. This paper develops unconventional answers.

## A Paradigmatic Case Study

On January 28, 1986, the space shuttle Challenger exploded during liftoff, killing all seven passengers. The technical cause of the accident was a failed O-ring in one of the solid boosters that allowed hot gas to leak and ignite the adjacent liquid fuel. This accident, I claim, can be seen as arising from a general phenomenon known as systemic imbalance. Imbalance implies a tendency to reinforce some activities (type A) while suppressing other activities (type B). Systemic implies that imbalance arises from the normal behaviors of organizational systems. Such systems are not fixed structures. Instead, they are complex webs of information and resource transfers that continually adapt, displaying nonlinear behaviors such as self-organization. I call them CANL systems (complex, adaptive, and nonlinear) and I describe the accident from this perspective.

In the late 1960s, the Apollo Moon Program came to an end. The loss of program funding was a major disruption to the National Aeronautics and Space Administration (NASA) system. The system adaptively shifted to draw in funding needed to survive. In more general terms, the organizational system adapted to dampen disorders to nondisruptive levels. Thus, the space shuttle program emerged.

In the early and formative stage of this shift, disorders that threatened the emergent system included criticisms that the shuttle program would be too expensive and unable to meet its own schedules. From the perspective of individuals, such threats resulted in no small amount of wheeling and dealing and rearranging in ways that often seemed chaotic. From a broader perspective, however, one saw the emergence of complex patterns and networks that tended to reinforce disorder-damping activities (type A) while suppressing disorder-producing activities (type B).

In the earlier stages of development, type A activities included favorable assessments concerning cost and schedules while type B activities included unfavorable assessments. Systemic imbalance (A reinforced and B suppressed) emerged in the form of distorted assessments that justified the program and dampened experienced disorders (i.e., objections by critics). Funding was secured. However, the imbalanced assessments had a cumulative effect; they influenced expectations and created a systemic need to reinforce those activities that served to meet the demanding schedules and cost requirements that had been employed to justify the program. Given this adaptive history, we can identify two broad types of activities: (A) activities that served schedule demands and held costs down and (B) activities that promoted safety and avoided accidents. Good reasons were given for both types of activities. But type A (meeting schedules, cutting costs) tended to dampen disorders while type B (promoting safety) tended to promote disorders within the system. Adaptive change shifted toward A and away from B, not because of any deliberate plan but rather because of the adaptive tendency of CANL systems to gravitate toward those arrangements that dampen disorders to nondisruptive levels. Systemic imbalance emerged.

This CANL view helps us to explain why the United States (US) Commission (1986) found that the accident was “rooted in history.” The report states “heavy emphasis was placed on the schedule”; at the same time, “the safety, reliability and quality assurance work force was decreasing which adversely affected mission safety” (US Commission 1986). As the number and severity of O-ring problems grew, “NASA minimized them in management meetings.” In a review of organizational activities, Vaughan (1990) found the following:

NASA's incentive-fair fee contract itself prioritized cost savings and meeting deadlines — the fee system reinforced speed and economy rather than caution. . . when rewards were great for cost savings and meeting deadlines and punishment was not forthcoming for safety infractions, contractors would tend to alter their priorities accordingly.

The eventual outcome of this systemic imbalance was dramatic — the tragic explosion.

This accident reveals a general phenomenon at work, that of systemic imbalance within organizational systems. If unchecked, such imbalance leads to the inexorable march of destroying agencies. Because the shuttle explosion was sudden and dramatic, attention was drawn to the destructive consequences. In the case of salmon, however, the destructive outcomes are gradual and more easily overlooked. Nevertheless, the same systemic tendencies are involved.

Such systemic tendencies emerge through the interplay of order and disorder within CANL systems. To illustrate, consider for a moment succession in natural ecosystems (Odum 1966). On the one hand, succession involves the emergence over time of complex ecosystems, networks of interrelationships, as if an attractor drew out levels of organized complexity. On the other hand, disorders caused by forest fires, floods, and storms shape the character of ecosystems in important ways. In other words, ecosystems are not static structures. Instead, they are dynamic CANL systems, shaped and formed through the continuing interplay of order and disorder over time. I examine organizational systems from a similar perspective.

## **Order and Disorder**

Within organizational systems, we can observe humans attempting to sustain some form of order in their own affairs. They rush to meet schedules, work to complete assignments, fight to secure funding, and struggle to resolve and contain disorders of all kinds. Their activities and personalities are extremely diverse and change over time. Confusions, misunderstandings, conflicts, and other forms of disarray are not uncommon. Evidence of disorder is not hard to find. At the same time, however, not all these busy activities are random and disconnected. Amid a sea of apparent disorder, one can notice relational patterns, vast webs of information and resource transfers that exert nonarbitrary influences upon behaviors far beyond the individual viewpoint. These patterns shift, adjust, and emerge in new forms. Amid constant shuffling and apparent disarray, activities tend to settle into mutually reinforcing patterns. Activities coalesce into arrangements of codependency linked by complex networks of information and resource exchange that tell individuals to do an activity and receive a reward in return. These networks, webs, and patterns constitute systemic order, a dynamic state of affairs that draws together activities to form CANL systems with behaviors and capabilities far beyond those of individuals.

The nature and character of systemic order are radically different from the deliberate order implied in organizational charts. Such charts imply that order, the coordination of activities to form integrated wholes, is the result of deliberate human design and control. Those in higher position direct the activities of those below. Order is presumed to be deliberate, arising from the intentions, designs, and control of particular humans and groups. Such deliberate order presumes that people know what they are doing and do it. Systemic order implies no such thing.

Clearly, evidence for deliberate order (intentional design) can be found in many human undertakings. But the scale of modern technology and the order it depends upon have grown far beyond the capacity of anyone to grasp, much less design and direct. Deliberate order becomes a misleading model for describing the vast scale of modern technology and its consequences.

To appreciate the vast scale of organized complexity in modern technological systems, consider the impenetrable mazes of codes, regulations, specifications, laws, contracts, and software. Consider the bewildering assortments of specialists, each with their own techniques, jargon, and paradigms incomprehensible to all but a few. Consider the networks and hierarchies—Overt and covert—through which status, position, and authority are gained and denied. Consider the endless procession of instruments, machines, devices, and computer codes. The world that you and I depend upon, even for a drink of water, depends upon such things continuously coming together in coherent ways that are ever changing. All this is far beyond the capacity of deliberate order. Thus, people must limit their notions of deliberate order to local activities of limited complexity contained within and shaped by vast systems of organized complexity far beyond the capabilities of intentional design. Of course, intention, design, and deliberate acts by powerful individuals and groups can often influence and exploit such vast systems (Jackall 1988), but this is quite different than designing, directing, and controlling organized complexity itself. In exploring the emergence of organized complexity, I suggest we do not presume intentional design on vast scales.

To grasp the dynamic character of systemic order, imagine an order-disorder scale (Fig. 1). Systems located to the far right are characterized by organized complexity; that is, they contain vast interconnected webs of resource and information exchange that provide coherence to many diverse but widely separated activities. Toward the left end of the scale one finds disorganized commotion, diverse and disconnected activities with little coherence. The emergence of reinforcing patterns of order can be seen as a shift from left to right (much like a maturing ecosystem) as if drawn by an R attractor. A disruption can be seen as a flip back to the left (much like a forest fire or, in organizational systems, a cutback in funding as NASA faced).

Human activity can be seen as constant shuffling. Interrelationships and codependencies form patterns. Some patterns are more persistent, renewing; and enduring than others, and tend to be self-reinforcing. When such patterns emerge, the behaviors within them tend to be enduring. Organized complexity emerges in the form of multiple webs of self-referencing loops of influence that mutually reinforce their own internal behaviors. These CANL systems display the properties of self-organization. They are self-renewing, drawing in behaviors from a sea of disorder toward coherent patterns on vast scales.

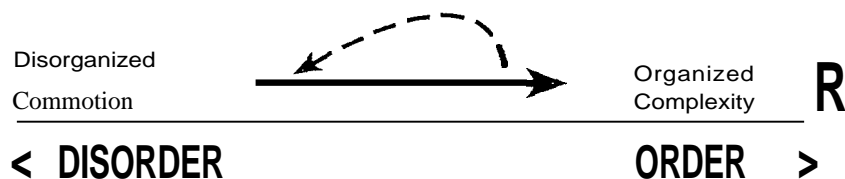


Figure I. The order-disorder scale. The R attractor (R) pulls toward order (solid arrow); disruptions flip the system toward disorder (dashed arrow).

From this CANL perspective, systemic order emerges as behaviors coalesce into enduring forms of mutual reinforcement. The emergence of organized complexity is a systemic outcome having to do with the tendency of human activities to adaptively gravitate toward patterns of self-reinforcement. Amid endemic shuffling around, indeed because of it, behaviors tend to settle into those self-supporting patterns able to endure. Thus, from disorganized commotion, behaviors are attracted toward relational loops, webs, and networks that provide mutual reinforcement. This emergence of systemic order results in an adaptive shift (e.g., to the right in Fig. 1).

## The R Attractor, Disorder, and Time

Systemic order in human affairs requires that systems develop good reasons for people to accommodate to systemic demands. While good reasons of many kinds can and do emerge, a common reason is that people get paid for some activities and not others. Behaviors that accommodate systemic demands are rewarded with financial support (salary, contract payment, etc.). Since too many required behaviors are not sufficiently enjoyable on their own, payment is the common incentive to get them done. The payment of money (along with position, status, and security) and the threat of its loss provide good reasons for acting out the behaviors organizational systems require. But to provide such good reasons, these systems must reinforce those patterns of behavior sufficient to secure funding. Contrary behaviors promote disorder. All this should sound familiar to managers who must continually deal with funding requirements. The difference, however, is that I suggest that people view these requirements as systemic. Systemic order requires mutually accommodating behaviors that allow a system to secure the funding needed to promote mutually accommodating behaviors—a circular pattern. Reinforcing behavioral loops forms the basis for self-generating order.

Systemic order in organizational systems can be sketched as a characteristic pattern (Fig. 2) that emerges under many different conditions. Note that each statement in this pattern supports (provides good reasons for) another statement, which in turn loops back to support the first statement. This pattern allows those behaviors that support organizational survival to become mutually supporting. Arrangements of human activity that do not conform to such a pattern are likely to be replaced by arrangements that conform more closely. Amid different conditions of continual change and shifting arrangements, organizational systems are likely to gravitate toward this overall form. Thus, this sketch (Fig. 2) describes what I define as the attractor for organizational systems. The term R attractor is used to describe a characteristic or property of CANL processes, the tendency of behaviors to be drawn into (attracted toward) mutually reinforcing patterns. The R attractor acts like a gravitational field, pulling activities within its grip toward organized complexity on the order-disorder scale (Fig. 1). While particular forms of systemic order are not predetermined or predictable, one can say that, amid constant change, adjustment, and turmoil, a tendency toward those forms more consistent with the R attractor is likely to emerge.

The pull of the R attractor itself, however, is insufficient to explain the emergence of organized complexity on vast scales (far beyond the capabilities of intentional human design and the boundaries of individual firms and agencies). The R attractor should be viewed in a broader context involving the dynamic tension between order and disorder over time (Fig. 3). The trajectory toward organized complexity lies on the plane formed by these two dimensions.

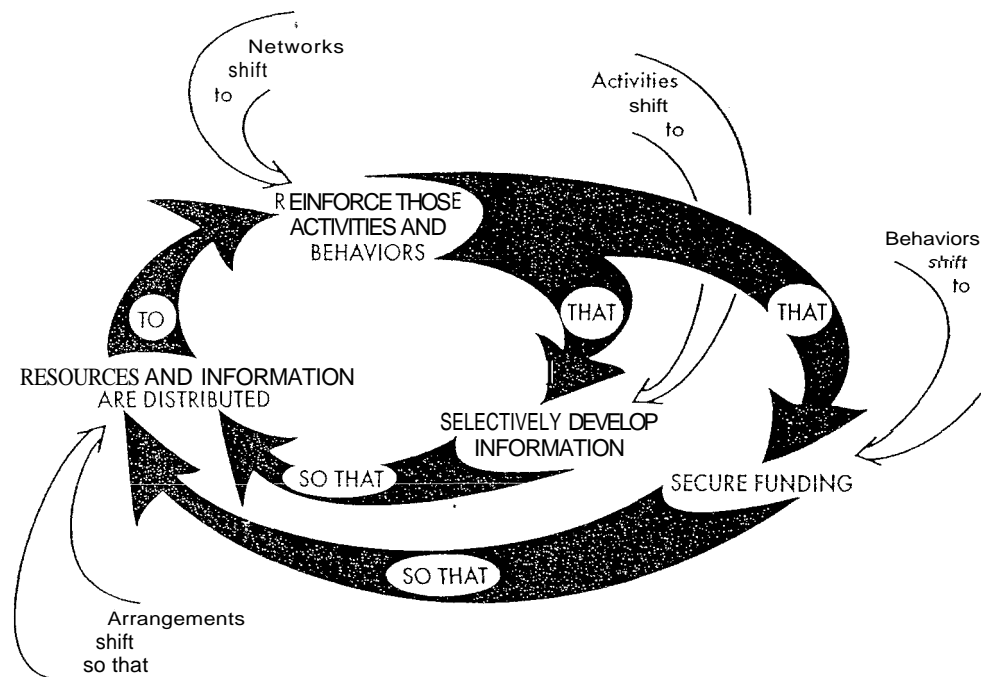


Figure 2 The R attractor: sketched as self-reinforcing loops that draw in (attract) activities, behaviors, arrangements, and networks.

A significant feature of this trajectory is its jagged shape, illustrating the dynamic interplay of order and disorder over time. Behaviors tend to coalesce into self-sustaining patterns that constitute systemic order (solid lines, Fig. 3). This adaptive process involves the emergence of self-regulating systems that draw behaviors into mutually reinforcing patterns while dampening disorders that would disrupt such patterns. This tendency is described as the pull of an R attractor (toward the right). If only this tendency were involved, systemic order would likely stabilize at some limited but static level. Systemic development would cease. But, as experience shows us, such stable states are not likely to persist in either natural or human systems. Disorders do arise to disrupt reinforcing patterns (Fig. 3).

Disruptions are characterized by shifts toward disorder. Such shifts also open up possibilities for order to re-emerge in different and more complex ways. Given the continual pull of the R attractor, disruptions exert a creative influence that allows order to emerge at higher and more complex levels. Engineers recognize this as a trial and error approach; much of our technological progress has arisen from failures and disasters that disrupted old ways of doing things, thereby clearing the way to construct things in new and more advanced ways. Albert Speer (1970), the Minister of Armaments under Hitler, claimed that the earlier bombing of German industries in World War II opened up new possibilities for higher levels of industrial productivity. These raids were regarded as helpful (Speer 1970). The development of new scientific paradigms has been seen as arising from revolutionary crises that disrupt established ways of doing things (Kuhn

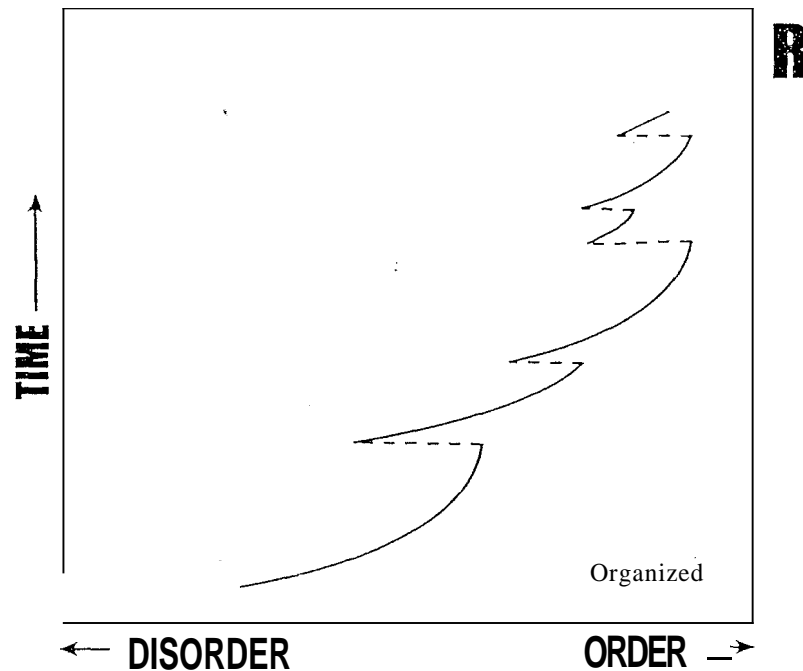


Figure 3. The interplay of order and disorder over time. The R attractor (R) draws activities and behaviors toward order (solid line): disruptions shift system toward disorder (dashed line).

1962). Innovations disrupt established organizational systems, allowing new technological development to emerge as competition promotes a scramble to secure favorable positions within the R attractor. In all such examples, we see the interplay of order and disorder over time (Fig. 3).

The tension between the pull of the R attractor and the experienced disorders serves as a systemic process seeking new forms of order. But the new patterns of order may also amplify small disturbances to disruptive levels. Moreover, disorder can be self-generated, allowing new forms of order to emerge. The R attractor can be viewed as pulling behaviors toward the continual interplay of emergent order and disorder on vast scales. Nothing is final in such a CANL world. Discoveries, innovations, entrepreneurial initiatives, mistakes, and even disasters (e.g., the shuttle explosion) promote disorders, thus renewing the adaptive search for order. We should not look for fixed structures of order; instead we should explore the dynamic interplay of order and disorder over time and the systemic tendencies that emerge from it. Such dynamic interplay occurs at different temporal and spatial scales and is similar at different scales (much like fractals).

Evidence of this developmental interplay of order and disorder abounds but is often missed because we see order in mechanistic rather than CANL ways. A mechanism, such as a lawn mower, is not likely to develop into a higher level machine if we kick it or drop it from the garage roof. But a mechanism is not an adaptive system; thus, it is meaningless to describe its systemic behavior in terms of an attractor that shapes components into coherent wholes through a history of disorder. Deliberate order is indeed required for the design and repair of lawn mowers, but it is insufficient for organized complexity within CANL systems.

Beyond mechanisms such as lawn mowers, the interplay of order and disorder in many CANL systems is evident, including the vast organizational systems of modern technology. We begin to recognize the limitations of organizational charts; they misleadingly show order in human affairs in a manner similar to order in a lawn mower. Instead of the intentions, designs, and plans of decision makers, the interplay of order and disorder over time—the pull of the R attractor and the formative role of disorders—must be examined. We can summarize this CANL process with statements of general tendencies.

Tendency 1: Adaptive change leading to organized complexity involves the emergence of reinforcing relational patterns that tend to dampen disorders to nondisruptive levels.

This tendency can be described as the pull of an R attractor (Fig. 2) that draws activities and behaviors away from disordered commotion toward organized complexity (Figs. 1 and 3).

Disorder can be seen as events that disturb and disrupt reinforcing patterns, thus allowing and forcing the system to respond to the R attractor in different ways. The adaptive process adjusts to dampen experienced disorders below disruptive levels. Thus, the character of organized complexity, with its emergent behaviors and capabilities, reflects its history of experienced disorders (i.e., disturbance regime), forcing adaptive change towards some patterns and not others. Tendency 1 leads us to the following.

Tendency 2: The emergent behaviors of organized complexity reflect the history of experienced disorders that the adaptive process was forced to accommodate.

By considering disorders common to organizational systems (i.e., the common disturbance regime), one can infer generic behaviors that tend to emerge through the interplay of order and disorder. Common disorders involve events and threats such as budget crises, neglect of assignments, and schedule failures. Given this common disturbance regime, we should expect organized complexity to emerge in ways that tend to dampen such disorders. That is, we should expect CANL systems to reinforce some kinds of behavior while suppressing others (Table 1). These systemic tendencies can be observed in the behaviors of millions of people caught up within organizational systems throughout the world. That such behaviors come as no surprise reflects the pervasive and persistent pull of the R attractor upon human behavior.

## Systemic Imbalance

The capacity of a CANL system to selectively reinforce some activities while suppressing others is a necessary property of systemic order. People experience such order when they are rewarded for carrying out some tasks and not rewarded for others. The requirements are defined for workers in assignments, contracts, and instructions; they are implied in evaluations, job descriptions, and opportunities for advancement or profit. Rewards and reprimands, overt and covert, serve to reinforce some activities while suppressing others. All of this is common experience within organizational systems. People don't get to do whatever they want to do. If

Table 1. Generic behaviors reflecting the common disturbance regime of organizational systems.

R (reinforced) behaviors tending to sustain order	S (suppressed) behaviors tending to promote disorder
Securing and distributing funds to support revenue-producing activities	Undertaking activities not promoting and possibly threatening the funding and support of activities
Accommodating to established arrangements, schedules, assignments, objectives, information channels, and authority	Departing from established arrangements, contrary to schedules, beyond assignments, going outside of information channels, and around authority
Gaining approval for activities; shaping behavior to performance evaluations	Acting without, and possibly contrary to, prior approval; sustaining behaviors not favored by established performance evaluations

everyone did, disorganized commotion would result. Thus, if organized complexity is to endure, human behaviors must be shaped in nonarbitrary ways (some activities reinforced, others suppressed) so that coherence and coordination emerge despite individual inclinations.

Consider such behavior from the perspective of the system rather than the individuals within it. Again, think of systems not as the outcomes of deliberate order, but rather as adaptive outcomes — networks of resource and information transfer that continually emerge as self-reinforcing patterns. While detailed prediction is impossible, one can describe general characteristics of activities likely to be reinforced or suppressed within such systems. In other words, the R attractor tends to pull together (coordinate, promote, organize) some activities and not others. Such selectivity reflects systemic requirements. Stated simply, one should expect the adaptive process to reinforce those activities that allow reinforcing patterns to continue and expand while suppressing those activities that tend to disrupt these patterns. Only when such selective reinforcement emerges over time can organized complexity grow to levels beyond the limited capabilities of intentional design.

Consider an imagination experiment. Assume that two types of activities, A and B, are sustained at equal levels within a CANL system. Both activities involve the coordinated efforts of many people, including a wide range of specialists. Thus, each activity can be considered as a systemic outcome. Assume that both systemic activities are found to be equally worthy on the basis of independent and credible assessments. With respect to activities A and B, the system is initially balanced, showing no preference of one activity over the other. Now, consider how adaptive change proceeds from this initial balanced condition.

The CANL system is not static. Mistakes, budget crises, personnel changes, conflicts, political pressures, entrepreneurial initiatives, and competition promote a continual shuffling around, forcing people to often rush about solving a seemingly endless variety of local problems. Amid such disorders, shifting arrangements tend toward self-reinforcing patterns as though drawn by an R attractor. Systemic order emerges in ways that tend to dampen rather than amplify disorders (Tendency 1). Imagine activities A and B within this dynamic process.

Activities A and B will fluctuate and shift in response to the dynamic nature of the system and the disorders that continually arise within it. Assume that variations of A and B produce different responses within the adapting system such that when A is increased, disorders tend to be dampened and, in contrast, when B is expanded, disorders experienced within the system

tend to be magnified. As activity A decreases, greater and more widespread disorders tend to arise within the system. The reverse tends to occur within B. In other words, disorders experienced within the system tend to be inversely related to A and directly related to B (Table 2).

Given that CANL systems are dynamic, arrangements tend to shift around. When reforming tends to reinforce activity A, disorders tend to be reduced. In comparison, when these shifts tend toward activity B, disorders tend to grow. Thus, in the shifting around, arrangements that reinforce A while suppressing B tend to be more enduring (less disrupted) than arrangements that reinforce B while suppressing A. Given the normal shuffling around, reinforcing arrangements will adaptively shift toward A rather than B. Any adaptive shift contrary to this tendency would increase disorder, pressing more people to take more steps to contain disorders, thus forcing rearrangements. The tendency of shifting arrangements (the pull of the R attractor) will be to settle into less disorderly and hence more enduring arrangements that reinforce A while suppressing or neglecting B.

Through such adaptive change, the networks and reinforcing loops of the system shift away from the balanced initial condition. Activity A is reinforced while, in comparison, activity B is suppressed. Systemic imbalance emerges. All that is required from individuals are their countless local efforts to address the immediate disorders they experience within the system. Through the countless activities of many people, each striving to solve local and immediate problems in some coherent manner, the system adapts in ways that contain the growth and spread of experienced disorders (Tendency 1). We should expect adaptive systems to do this. Given the continuing fluid tension between order and disorder, a systemic tendency emerges: activity A is accommodated and reinforced while activity B is neglected and suppressed. No conspiracy, plan, or deliberate decision is needed. The system adapts to attract A and not B. This is a normal systemic outcome (Tendency 2).

To express a general model, envision a behavioral phase plane (Fig. 4). Using the order-disorder scale (Fig. 1) and rotating this scale 90° counterclockwise results in the R attractor acting much like gravity pulling systems downward toward “order” while disruptions shift systems upward toward “disorder.” Consider the horizontal (x) axis to represent the relative emphasis upon type A and type B activities (as defined in Table 2). Toward one end (left), A activities dominate. Toward the other end (right), B activities dominate. A balance between A and B would be indicated by a “state” position within the central region of this dimension. Together, these two dimensions constitute the behavior phase plane (Fig. 4).

Nonarbitrary behavioral shifts emerging from CANL systems are shown as trajectories toward the R attractor located in the lower left region of the plane. Such trajectories lead to the emergence of systemic order (y-axis; previously described in Figs. 1 and 3). These same trajectories involve a systemic shift toward type A activities and away from type B activities (x-axis).

Table 2. General characterization of activities based upon disorder response

Activity variation	Disorder response
A - Increase, expand	Decrease, decline
A — Decrease, decline	Increase, expand
B — Increase, expand	Increase, expand
B — Decrease, decline	Decrease, decline

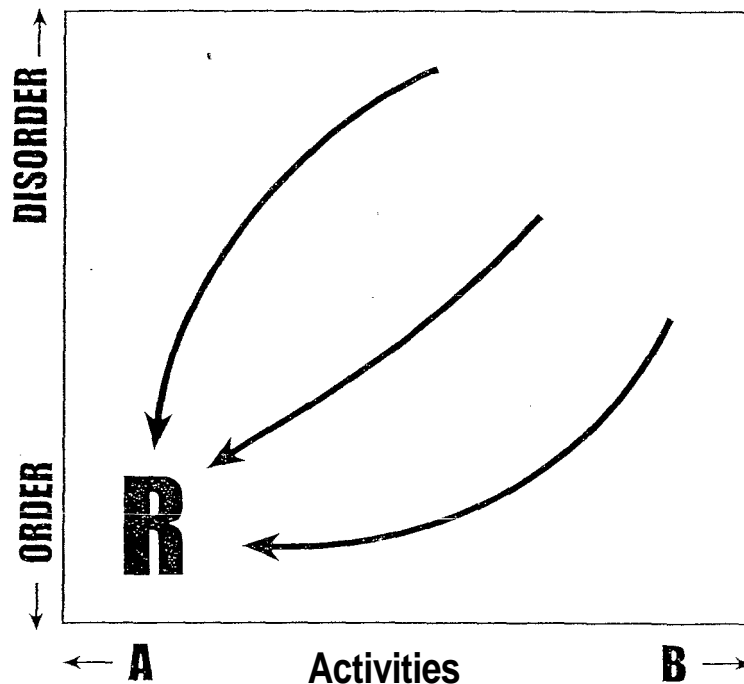


Figure 4. The behavioral phase plane showing trajectories toward the R attractor (see Table 2 for a characterization of A and B activities)

Imbalance (A over B) emerges through the normal adaptive process that gravitates toward self-reinforcing patterns.

Given the character of the R attractor (Fig. 1), we can infer general characteristics of activities likely to be reinforced or suppressed (Table 3). Type A activities are those consistent with the systemic need to sustain reinforcing patterns of order. They tend to dampen disorders, allowing patterns to endure and expand. Such activities allow schedules to be met and assignments completed in a coordinated way. Type A activities tend to enhance funding, rather than undermine it. The R attractor should be expected to draw out type A activities. In contrast, type B activities would be more disruptive, less accommodating, and more troublesome to schedules and coordination. Type B activities would pose funding difficulties, threatening existing and future funding. If, in a relative sense, a particular activity fits the generic characteristics of A more than B, expect the attractor to reinforce it. If an activity conforms more to the generic qualities of B, expect systemic neglect and even suppression. Thus, some guidelines to identify and even predict systemic imbalance exist.

Again consider the shuttle explosion. The vast NASA system had reconfigured into a new form of order. Organized complexity emerged involving the coordinated activities of thousands of specialists. An adaptive transformation occurred. But this same adaptive shift involved a systemic reinforcement of type A activities (meeting cost and schedule requirements) and a relative suppression of type B (meeting safety requirements). Systemic imbalance emerged.

Table 3. Generic characteristics of activities with different systemic responses (see Table 2)

Type A (disorder damping) activities tend to	Type B (disorder promoting) activities tend to
<ul style="list-style-type: none"> <li>• secure funding</li> <li>• support systemic activities</li> <li>• avoid and resolve budget crises</li> <li>• meet schedules, quotas, or deadlines</li> <li>• satisfy those in higher position</li> <li>• reassure the public</li> </ul>	<ul style="list-style-type: none"> <li>• threaten funding</li> <li>• undermine support for systemic activities</li> <li>• promote budget crises</li> <li>• disrupt schedules, quotas, and deadlines</li> <li>• upset those in higher position</li> <li>• expose shortcomings, failures, and risks</li> </ul>

The fate of the shuttle passengers and the fate of the salmon, I claim, both display the some general phenomena (illustrated in Fig. 4). Systemic imbalance is a normal outcome that should be expected as CANL systems of the human kind adaptively shift to dampen disorders (Tendency 1). Thus, the third tendency emerges:

Tendency 3: As organizational systems shift to dampen disorders over time, they tend toward systemic imbalance, reinforcing some activities (type A) while suppressing others (type B), sometimes to destructive extremes.

Conspiracies, schemes, and intentional designs by individuals are not required. What is required of individuals is that they become preoccupied with the normal behaviors reinforced by organizational systems (Tables 1 and 3), rushing to meet schedules, seeking funding, defending budgets, completing assignments, and having little time to stand back and question what going on.

## Applying the Model to Ecosystem Protection

Stone (1892) described two types of activities relevant to the salmon of the Pacific Northwest. Type A included mining, road building, and timber harvest. Type B included the protection of natural habitats and ecosystems. Stone (1892) proposed a Salmon National Park to protect the salmon as Yellowstone Park had protected the buffalo. Ross L. Leffler (1959), Assistant Secretary of the Interior in the Eisenhower administration, expanded the type A activities to include the construction, operation, and use of dams. Type B activities again included the protection of natural habitats and ecosystems. Leffler (1959) recommended that “we can and should forthrightly declare that certain river basins of the Pacific Northwest should be dedicated to the conservation and development of fish and wildlife resources as their highest and best use.” Nehlsen et al. (1991) lead one to expand type A activities, including the operation of hatcheries. Echoing Stone’s (1892) concern from a century before, they too call for the protection of habitat and ecosystems, again type B activities. Good reasons can be given for both types of activities but the model (Fig. 1) suggests that the normal adaptive tendencies of organizational systems is toward imbalance. A over B (Tendency 3).

Consider US federal forests. Two kinds of activities can be identified: (A) harvesting timber (“getting out the cut”) and (B) protecting diverse forest ecosystems (Overton and Hunt 1974).

Good reasons can be given for both activities. Laws were established to promote a balance between A and B. Given that older forest ecosystems contained dense stocks of harvestable timber, activities A and B were often mutually exclusive to a significant degree. The funding of the US Forest Service was heavily dependent upon timber harvest (activity A). Under such conditions, shifts away from A toward B tended to amplify disorders (including political pressures) to disruptive levels. In contrast, a shift away from B toward A served to dampen immediate disorders and their disruptive threats. Given the dynamic interplay of order and disorder over time, the system shifted (as the NASA system did) toward A and away from B (Fig. 4). In both cases we see an adaptive shift, damping experienced disorders. Systemic imbalance emerged.

The salmon crisis in the Pacific Northwest provides evidence that systemic imbalance is a persistent and pervasive phenomenon. There are many salmon stocks. Their life cycles carry them across wide geographic areas. The decisions that contribute to their decline span more than a century, involving countless individuals, agencies, and organizations. Many voices have called for their protection. Laws, regulations, and technological mitigation have been employed, each claiming to offer protection, and yet, the decline has continued. Many stocks are threatened with extinction. The model developed herein offers some explanation for such an outcome.

Consider Stone's (1892) call for a Salmon National Park and Leffler's (1959) recommendation that certain river basins be dedicated to the conservation and development of fish and wild-life resources. As part of a comprehensive approach, couldn't we now develop a distributed Salmon National Park to protect a wide range of habitats and ecosystems? Given the popularity of existing national parks and their overcrowding, one could hardly dismiss such a proposal as unpopular or wasteful. People seem to be more tolerant of type A financial disasters than type B proposals that would protect natural ecosystems for this and future generations. Why? People are caught up within CANL systems that shape their activities. Their perceptions of what is reasonable, possible, and proper gravitate toward a vast R attractor, and the world is being transformed in its image (Fig. 2). People will not come to understand this transformation by merely observing the salmon. They must also observe the influence of systemic imbalance upon our own behaviors and perceptions.

## Systemic Imbalance and the Burden of Proof

Inquiry, discourse, and decisions are shaped by a background of premises (givens) that form the basis of activity (Simon 1976). Individuals work within environments of givens. Techniques, attitudes, and language reflect implicit premises that are seldom critically examined. As an example, Overton and Hunt (1974) describe how an exploitive forest policy is implicit in the techniques and language commonly employed by foresters. The premises behind inquiry, discourse, and decision, implicit within techniques and language, cannot be explained solely in terms of the reasoning and concerns of individuals. Something else is occurring!

Imagine two broad classes of possible premises, A and B as defined in Table 2. Type A premises influence inquiry, discourse, and decisions in ways that tend to dampen and contain disorders. In contrast, type B premises tend to promote and amplify disorders to disruptive levels. The proper balance between A and B should itself be a topic of ongoing concern and reasoned inquiry. But the relative persistence of A and B within organizational systems, hence their relative influence, is also an emergent outcome that cannot be reduced to individual reasoning and

concern. Systemic imbalance should be expected. The normal adaptive behavior of organizational systems, the pull of the R attractor, involves a persistent and pervasive shift in premises toward A and away from B (Fig. 4). This tendency can be stated as follows:

Tendency 4: As organizational systems adaptively shift in their normal manner, they tend toward the reinforcement of some premises (type A) and the suppression of others (type B).

Consider two classes of activities, A and B. Upon reflection, individuals might agree that a particular activity (type B) is important, but then they rush off to meet more pressing (type A) demands. Clearly, the premises that people employ to address how they devote their time influence their activities. For each individual, the shift of such premises, toward A and away from B, may appear as an innocent and practical necessity. But, if this shift is seen as a nonarbitrary tendency common to vast organizational systems (evidence of an R attractor of grand scale), a powerful force in human affairs becomes evident. There exist subtle, widespread, and nonarbitrary shifts of premises (Tendency 4) that shape human responses to the following kinds of questions. To what should people devote their efforts? How should resources be allocated? What problems deserve attention? What must an individual do to be successful? What are an individual's responsibilities? The R attractor draws people to answers consistent with its own character.

Accommodation to systemic imbalance (Tendency 4) can lead to emergent outcomes including distortion of information (Bella 1987, 1992) and de facto decisions contrary to human ideals, values, and intent. Consider again the shuttle explosion. Prior to the fatal launch, engineer Rodger Boisjoly strongly objected to the O-ring design that became the technical cause of the accident. Pre-launch meetings were held to examine safety issues. Boisjoly testified:

This was a meeting where the determination was to launch and it was up to us to prove beyond a shadow of a doubt that it was not safe to do so. This was a total reverse to what the position usually is in a preflight conversation or a flight readiness review. It is usually exactly opposite that. (US Commission 1986)

Robert Lund, an engineer and manager who played a key role in this meeting, also testified:

We had to prove to them that we weren't ready, and so we got ourselves into the thought process that we were trying to find some way to prove to them it wouldn't work, and we were unable to do that. We couldn't prove absolutely that the motor wouldn't work. (US Commission 1986)

Given the pressures of type A activities (Table 3, e.g., meeting schedules, sustaining order, etc.), the burden of proof shifted so that those raising type B objections (e.g., R. Boisjoly) were unable to marshal evidence sufficient to disrupt the launch schedule. Once this shift in the burden of proof occurred, the decision to proceed with the launch had in effect been made. Those caught up within the system came to accept type A premises in ways that they themselves did not recognize. Within their discourse and deliberation, the burden of proof shifted (Tendency 4) in a way compatible to the pull of the R attractor (Fig. 4). The burden of proof shifted to dampen disorders that might disrupt the ongoing process (toward A, away from B). Given this premise shift, the decision to launch had essentially been made: the individuals merely acted it out under

the givens. If a systemic shift of premises can occur under these conditions (where everyone agreed that a catastrophic possibility did exist, responsibilities were clearly defined, and the policy had been clearly stated), then we should expect similar shifts to occur for environmental concerns where catastrophic possibilities are often subtle, responsibilities are diffused, and policy is not so clearly stated.

The systemic shift of burden of proof (consistent with Tendency 4) is expressed in three steps clearly seen in the Challenger episode. First, resources devoted to the collection of information tend to promote A and neglect B. Second; when evidence supporting B and challenging A does arise, it tends to be dismissed as insufficient, allowing A to continue; often those presenting such evidence face criticism. Third, activity A continues until some serious and irreversible consequences become so apparent that they cannot be denied.

In the case of salmon decline, these same three steps recur in less dramatic but more persistent ways. From a broad historical perspective, a recurring theme emerges. Attention to type B concerns tends to follow rather than avoid irreversible losses. At each step in this process, we find that evidence is dismissed as incomplete and inconclusive. Activity A continues until consequences become too apparent to deny. With time, Evidence does accumulate to place some constraints upon A. But, too often, evidence only becomes convincing after irreversible losses occur. The pattern repeats itself as other type A activities arise. This approach has worked reasonably well for acute and reversible environmental impacts that can be directly related to specific activities (e.g., dissolved oxygen reductions and turbidity increases). For irreversible losses resulting from many activities (e.g., habitat loss), however, this pattern has led to cumulative impacts not adequately addressed. Any plan to prevent the further decline of salmon stock must break this pattern by protecting habitats and ecosystems before degradation occurs and shifting the burden of proof onto those who would alter these systems.

Systemic imbalance expresses itself in the form of an ongoing tendency for protection actions to arise after irreversible losses become apparent. Given an expanding array of type A activities, losses accumulate. Something must almost be lost before actions are taken to protect it. Protection of riparian zones and alteration of road construction techniques, as examples, have occurred only after considerable evidence accumulated and irreversible losses occurred. The Endangered Species Act (1973) attempts to reverse the burden of proof, but this occurs only after significant and potentially irreversible losses have occurred. Moreover, at present, it remains to be seen whether organizational systems will adapt to correct the conditions that led to the threatened extinction of species or, instead, force alterations of the Endangered Species Act to accommodate the needs of the organizational systems themselves.

## **Credible Disorders**

How can systemic imbalance be corrected? To address this question, consider again the interplay of order and disorder that forms the basis of the model developed herein. From this perspective the character of organizational systems reflects the history of disorders they have experienced (Tendency 2). The explosion of the Challenger served as a credible disorder that disrupted the NASA system, forcing it to reform in less imbalanced ways. By a credible disorder I mean an event that is both compelling and contrary to established arrangements (patterns, networks) and hence disruptive. Clearly, there are more desirable ways to produce credible disorders so that

systemic corrections occur before catastrophic disorders emerge. Testing, monitoring, and assessment are efforts to produce credible (reasonable and compelling) disorders (departures from established order) before catastrophes occur. The intent is to produce credible disorders earlier in the history of a system rather than allowing systemic imbalance to continue until larger disorders emerge. However, there is a systemic problem. Testing, monitoring, and assessment must themselves be sustained and accommodated by organizational systems. They depend upon sustained resource transfers to support potentially disruptive inquiries. They depend upon widespread information networks that will distribute disruptive information when it arises. The problem is this: systemic imbalance that emerges in CANL human systems (Tendency 3) tends to suppress such arrangements.

Independent checks and balances are experienced as type B activities; they promote disorders (Table 2). A future catastrophic possibility is not yet experienced as a disorder because it hasn't happened yet. Organizational systems adapt to dampen experienced disorders (Tendency 1); this can occur through the suppression of type B activities. This happened in NASA and the USDA Forest Service. It is expected that CANL systems require no deliberate conspiracy or plan. It only requires that people accept type A activities, striving to meet schedules, secure budgets, complete assignments, and sustain some sense of order (Table 3). How can people avoid such destructive tendencies? They must strive to sustain those independent social conditions from which credible disorders arise before catastrophic disorders emerge.

In the case of salmon, the Native American tribes and professional societies have served as independent checks upon organizational systems. They have been a source of disorders that forced adaptive change toward the protection of salmon. The Endangered Species Act is a source of similar disorders. Organizational systems with a history of disorders of this kind are more likely to accommodate the survival of salmon and the ecosystems upon which they depend (Tendency 2).

Unfortunately, in the case of US federal forests, the notion of independent checks and balances has been misperceived. On organizational charts, federal agencies were separated from the private firms. Nevertheless, the funding of federal agencies was strongly dependent upon activity A (harvesting timber) and weakly dependent upon activity B (protecting diverse ecosystems). Thus, the R attractor for both federal agencies and private firms pulled in similar directions. In effect, a single system emerged, a powerful timber-industrial complex. The R attractor of this system became strong, pulling the entire system toward activity A and away from B (Fig. 4).

Some will object, claiming that I have overstated the problem of imbalance. They will point to organizational systems that do serve environmental protection, even at substantial cost. I am aware of such outcomes. But to understand these outcomes, the history of credible disorders experienced by such organizational systems should be considered (Tendency 2). Such credible disorders require human activity not defined by organizational systems, behaviors not yielding and often contrary to the pull of the R attractor. How should people describe such activities and behaviors?

In his farewell address, US President Eisenhower (1961a) warned of the power of vast organizational systems, in particular, the "military industrial complex." He also warned that the nation's scholars could become dominated by "the power of money" and "that public policy could itself become the captive of a scientific technological elite." He described the dangers in terms of "imbalance," warning that we "must avoid the impulse to live only for today.

plundering for our own ease and convenience the precious resources of tomorrow.” “We should fake n’othing for granted,” Eisenhower warned, saying “Only an alert and knowledgeable citizenry can compel the proper meshing” of the vast organizational systems upon which that society depends.

If activities and premises employed to assess their consequences are openly examined and found to be deficient (imbalanced in significant ways), potential disorders within existing organizational systems arise. If reasoned inquiry and discourse expose such deficiencies, then these disorders gain credibility. If civil discourse exposes these deficiencies and if people take them seriously, these credible disorders persist and grow as long as the deficiency continues. Then, given the interplay of order and disorder, CANL systems adapt to accommodate such disorders.

Of course, suppression of the discourse can be the adaptive response. But if such suppression is not tolerated, if suppression of discourse expands rather than dampens disorders, then the adaptive response is more likely to be credible. That is, in adapting to dampen disorder, the system shifts, adjusts, and rearranges to correct the deficiency that was the source of the disorder. In such a manner, the imbalanced activities and premises of organizational systems become sources of credible disorders that force adaptive change in less imbalanced directions. But for this to occur, the background of credible discourse and inquiry must not be shaped and molded by organizational systems themselves. To sustain such inquiry and discourse constitutes what Eisenhower (1961b) called “the duties of responsible citizenship,” the essential role of “an alert and knowledgeable citizenry” (Bella 1992). Credible disorders arising from civil discourse broadly practiced serve to ensure that systemic coalitions can seldom persist “on any other principles than those of justice and the general good” (Madison 1778 in Hamilton et al. 1982).

Responsible citizenship requires inquiry and discourse that is both credible and independent of organizational influences, rewards, threats, and demands. Ideally, the inquiry and discourse of a responsible citizenry provide the fertile ground from which credible disorders arise and grow to disruptive levels. Organizational systems are shaped by the history of experienced disorders (Tendency 2). If this history contains credible disorders, then, as adaptive change shifts to dampen disorders (Tendency 1), less imbalanced arrangements are more likely to emerge. If, however, responsible citizenship is not practiced, if inquiry and discourse are superficial and uncivil, if citizens see themselves merely as customers, and if people act out the roles of functionaries merely completing assignments, then systemic imbalance is allowed to continue (Tendency 3), transforming not only our physical and social world but the premises (Tendency 4) upon which our inquiry and discourse are based. From this model, the character of organizational systems reflects the history of inquiry and discourse sustained by the citizenry. For the model developed herein, one can state the following:

Tendency 5: The degree of systemic imbalance that emerges within modern society and its consequences are inversely proportional to the credible disorders that organizational systems experience through the continuing activities of independent checks, which ultimately depend upon an alert and responsible citizenry.

In Tendency 5 one finds the good news of the model. One can point to a wide range of laws and institutional actions including the protection of a range of habitats and ecosystems. Stone’s (1892) example of Yellowstone Park has been followed by actions that continue to this day. This gives hope that wild salmon will not be completely driven to extinction. But such hope is likely

to be misplaced if people fail to appreciate the essential role of independent checks and balances and an alert and knowledgeable citizenry. Of course, such notions are not new but they are not well accommodated by current modes of thinking.

In current discourse productivity is the ideal; people hear little of checks and balances appropriate to the challenges they face. In today's world people speak of customers rather than citizens. People defer to "policy makers" and "decision makers"; the notion of an alert and knowledgeable citizenry is too often cynically dismissed. Despite such views, I suggest that the history of environmental protection provides strong evidence supporting Tendency 5 (Paehlke and Torgerson 1990). Where environmental protection has occurred, one is likely to find a history of questions, challenges, and credible disorders sustained by people acting independently and often contrary to the assignments and interests of organizational systems. Without their actions, I doubt people would even recognize that a salmon crisis exists.

## Moral and Spiritual Traditions

The model developed herein has drawn upon concepts from a broad field of scientific study loosely described as nonlinear dynamics (Prigogine and Stengers 1984, Waldrop 1992). Chaos, self-organization, organized complexity, and emergent behaviors are among the topics arising from such study. Briggs and Peat (1989) warn us that to see the world from such perspectives is to enter a "twilight zone," to encounter an "alternative reality" where "exact prediction is both practically and theoretically impossible." In describing such views, the *Wall Street Journal* (Farney 1994) depicts "one of history's great intellectual upheavals unfolding. It amounts to a reshaping of the thought-world that Western man inhabits like a turtle in its shell." The belief in progress through rational control has been challenged. Instead, one finds a world far less predictable and controllable, a world where history and disorder play crucial roles. "Clearly," Farney (1994) writes, "something has eroded away over time: The supreme confidence-or hubris—that characterized earlier eras of science."

The model (described in Fig. 4) and five tendency statements do challenge established views—in particular, those that assume that decision makers and policy makers can direct CANL systems if given the proper information from specialists. At the same time, however, the model can allow us to appreciate traditions of human responsibility that predate the reductionist (analytical, technological) traditions that have dominated modern technological societies. Such traditions do not limit responsibility to assignments, roles, jobs, and positions but rather broaden responsibilities in ways that cannot be delegated or turned over to experts and authorities.

In "Habits of the Heart," Bellah et al. (1985) examine the involvements of citizens within the United States. They describe the notion of citizenship in terms of the Biblical and Republican traditions. The prophetic tradition described in Biblical tales calls people to speak out against unjust systems despite the often high personal costs and remote promise of success. It is a tradition of criticism and empowerment that acts in history, promoting credible disorders over time (Brueggemann 1978). The Republican tradition calls for civil discourse, practiced as virtue. The Biblical tradition calls for this discourse to be inclusive, not defined by position and authority but rather directed toward the creation of a community where a genuine ethical and spiritual life could be lived (Bellah et al. 1985). The tradition of democratic deliberation (Reich 1990) emerges from these earlier traditions. It cannot be reduced to occasional voting. Instead, the democratic

tradition calls for an independent, alert, and knowledgeable citizenry that, like the Biblical prophets, sustains that kind of discourse from which credible disorders arise despite the suppression by established systems.

The tradition of democratic deliberation calls for civil discourse and credible inquiry often suppressed within organizational systems. This tradition refuses to submit human responsibility to the pull of the R attractor. Responsibilities of a different moral kind are called for. Such responsibilities often lead people to Type B activities that produce disruptions within organizational systems (see Table 2).

From its prophetic roots, the democratic tradition calls for behaviors that disrupt systems of power in morally compelling ways. This calling can be described in terms of an S attractor that emerges whenever the R attractor and systemic imbalance become strong (Fig. 5). The existence and character of both attractors is inferred by nonarbitrary trajectories in behavior space, much as gravity is inferred by trajectories in physical space. The R attractor pulls toward nonarbitrary systemic requirements (Fig. 2). The S attractor pulls toward moral requirements, also nonarbitrary, sketched in those traditional stories (*e.g.*, the Good Samaritan parable) that people find compelling even when sacrifice is required. An essential tension exists between the two, sometimes strong, sometimes not. The S attractor is moral and nonsystemic, drawing out morally compelling disorders. The R Attractor is amoral and systemic, drawing behaviors and activities into

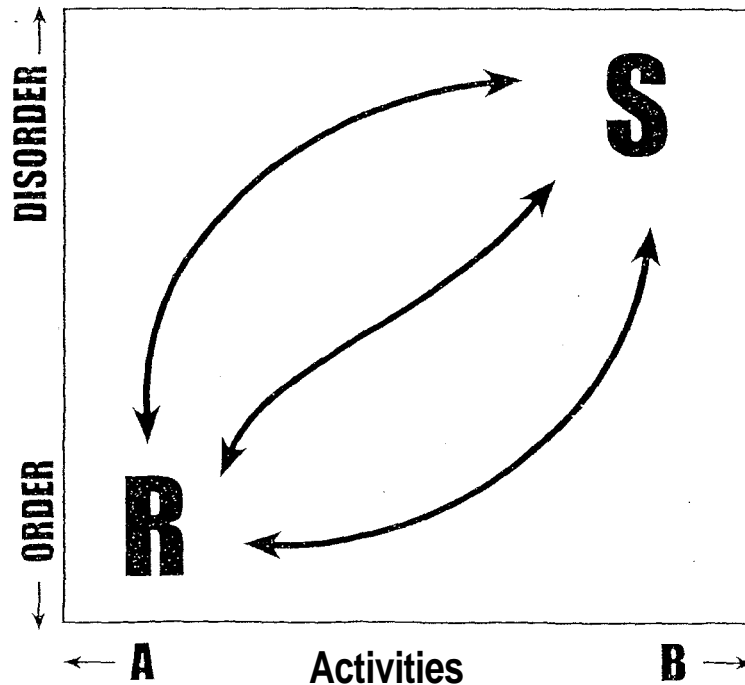


Figure 5. The essential tension between the R attractor and S attractor. Note: Each attractor is inferred by trajectories in behavioral phase space.

coherent patterns of order, which may or may not be morally compelling. The essential tension between the two is played out through a history of credible disorders (drawn out by the S attractor) that force amoral systems of order (drawn out by the R attractor) to continually adapt (Tendency 2) in ways that are not morally arbitrary. Remove the R attractor and disordered commotion results. Remove the S attractor and amoral (nihilistic) order takes over.

The democratic tradition can be described as an effort to sustain this dynamic tension between attractors (Fig. 5) so that the interplay of order and disorder over time (Fig. 3) tends toward systems of order that have moral worth, not because of order itself or the goods it provides, but because of the morally compelling behaviors people act out over time. The stories of such people point toward what I have defined as an S attractor, which draws people to those behaviors and activities from which credible disorders emerge. The degree of systemic imbalance that emerges is inversely proportional to the history of such credible disorders (Tendency 5).

The essential tension between R and S attractors describes the frustrations of actual people caught up within organizational systems, pulled in by the demands of the R attractor and yet drawn toward something else. Consider the salmon as a symbol, one of many, of the S attractor. This book provides ample evidence of people who had been drawn to type B activities by the condition of the salmon rather than the conditioning of their jobs. Over time, their activities constitute a compelling disturbance regime, a history of credible disorders, that can serve to correct systemic imbalance in non-trivial ways. The notion of contrary attractors (Fig. 5) will not resolve their frustrations nor will it tell them what to do, but it does provide a way of saying that their struggles are not meaningless. In other words, there are good reasons for being maladjusted to systemic order and "it may well be that the salvation of our world lies in the hands of the maladjusted" (King 1961).

I realize that this model (Fig. 5) cannot fully account for the implications of moral and spiritual traditions, but it can help people to better appreciate their relevance within a world of vast organizational systems. Of course, a purpose of such traditions is not disorder but rather a more meaningful balance (some traditions speak of harmony) than the organizational systems of modern technology will provide independently. Credible disorder, as described herein, is like tuning in music. It is disruptive, but without it, disharmony (or imbalance) emerges over time. Credible disorders arise from responsibilities that transcend the assignments, incentives, and roles defined for us by established organizational systems. This model accommodates such notions. It may lead us to appreciate that different moral and spiritual traditions have more in common with each other than with the hubris that leads us to transform the world into the image of the R attractor (Fig. 2), a world that has no place for wild salmon or anything else that does not serve the self-reinforcing needs of ever more powerful organizational systems.

## Conclusion

All models have limitations that must be recognized if they are to be properly applied. Because the model developed in this paper has a broad perspective, it will not provide the sharp focus needed to evaluate specific decisions. The specific decisions of individuals and groups can have significant consequences, and these decisions must be evaluated under the particular conditions in which they are made. Individuals must be held accountable. But decisions are shaped by pressures, premises, and available choices that constitute the contexts within which decision makers

act. A narrow (high resolution, reductionist) perspective focuses upon particular decision makers within specific contexts. From a broader (wide scope) perspective, however, this paper examines systemic tendencies that influence the contexts of many decisions over extended periods of time. Such tendencies can influence outcomes in ways not apparent when people focus upon specific decisions. Thus, both narrow and broad perspectives are necessary to understand the outcomes of human activities and the responsibilities they demand. The model developed herein takes a broad perspective and serves to complement rather than replace the narrow perspective models more familiar to us.

From this broad perspective, tendencies are identified that must be described as emergent behaviors of organizational systems, and are not reducible to the deliberate decisions of individuals. Such tendencies are observable and their consequences are significant. From this perspective, one sees the decline, decimation, and extinction of salmon stocks in the Pacific Northwest as an outcome of a general and widespread phenomenon, systemic imbalance within the vast organizational systems of modern technological societies. The notion of human responsibility is expanded to include responsibilities of citizenship essential to prevent systemic imbalance from developing to catastrophic proportions.

To some, these notions will seem esoteric, remote from the pressing issues we now face. This is a serious mistake! To illustrate, try an experiment. For several days, watch the television and play the video games that young people actually watch and play (activity A). Then withdraw from this world; spend time in a natural ecosystem watching and listening to salmon, birds, trees, and other participants on their own terms (activity B). Then ask the following question. What credible values and beliefs would lead a sane, concerned, and reasonable person to conclude that human efforts should be devoted to providing our children—the future—with an ever-expanding abundance of A while reducing and eliminating B? I cannot imagine values that would rationally support such a choice. Nevertheless, the evidence of such an outcome (A expanded and B eliminated) is overwhelming. How can we explain such outcomes? What is required so our own actions do not contribute to them? What is needed to direct human activity away from such imbalanced outcomes? What is required to hold accountable the vast organizational systems of modern technological society?

This paper addresses such questions. It leads us to see such outcomes (e.g., A expanded and B eliminated) as the normal and predictable tendencies of the organizational systems humans have grown dependent upon. It warns us that our reductionist habits—the dominance of narrow perspectives—fail to grasp such tendencies and serve to divert attention elsewhere. Reductionism in human affairs serves to protect organizational systems by leading people to dismiss emergent properties as esoteric. This paper challenges such views and claims that as a society we cannot address the salmon crisis and countless other consequences of systemic imbalance without taking a broader view that allows us to better grasp the nature of modern organizational systems and hold them accountable.

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