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Chaos Theory as a Model for Managing Issues and Crises

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ABSTRACT: This article uses chaos theory to model public relations situations whose salient feature is the volatility of public perceptions. After discussing the central premises of the theory itself, it applies chaos theory to issues management, the evolution of interest groups, crises, and rumors. It concludes that chaos theory is most useful as an analogy to structure persistent image problems and to raise questions about organizational control of public perceptions. Because it emphasizes uncertainty, open-endedness, plurality, and change, chaos theory sets limits on the purposeful management of volatile issues.

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The term *chaos* introduces jarring connotations into a public relations context, implying crisis, disunity, loss of control. Despite these negative connotations, however, the relatively new field of chaos theory may help to establish some coherence within public relations situations whose salient feature is the unmanageability of public perceptions. This article will suggest both benefits and limitations of applying chaos theory in such public relations contexts.

A complex brew including physics, topology, and systems theory, chaos theory developed in the natural sciences during the 1970s, and the social sciences during the 1980s. Recent applications include epidemiology, ecology, geography, eco-

nomics, and social organization.[1] In fact, chaos theory appears relevant to such a broad array of disciplines that some view it as a scientific version of postmodernism; a scientific metaphor for late-20th-century cultural values of relativism, plurality, and chance.[2] Public relations practitioners are—or should be—acutely sensitive to such broad-based social presentiments because their field is itself culturally grounded, taking its assumptions and methods from the social context in which it operates. Hence those in public relations could benefit from familiarizing themselves with chaos theory and examining its affinities with their own area of social science.

SOME KEY CONCEPTS OF CHAOS THEORY

The very term *chaos theory* is somewhat misleading: some researchers prefer terms like non-linear dynamics, bifurcation theory, change theory, or self-organizing theory.[3] Although it incorporates elements of chance, chaos is not random disorder. Rather, chaos theory attempts to understand the behavior of systems that do not unfold in a linearly predictable, conventional cause-and-effect manner over time. When viewed as a whole, these systems manifest definite patterns and structures. However, at no single point could their future direction have been predicted from their past history. For example, while a given person's view on an issue cannot be exactly predicted, it is possible to discern an underlying order in public opinion over the long term. In this sense chaos is far from random, and chaotic systems can be both determinate and unpredictable—an oxymoron from the perspective of modern science.

In fact, chaos theory generally represents a postmodern departure from the social science worldview that unfolded from theories about the physical universe articulated by Galileo, Bacon, Descartes, and Newton. According to this tradition, the universe functions like a vast machine governed by unchanging laws that can be deciphered through scientific analysis. This view leaves little to chance, for "reality is basically static and tautological. Time is 'reversible,' meaning that one could go forwards or backwards at any point and the same essential laws would be in operation."[4] In contrast, chaos theory urges us "to reinterpret the universe as being constituted by forces of disorder, diversity, instability and non-linearity."[5] Chaotic systems can self-organize and self-renew, with periods of order broken by sudden transformations whose direction has elements of chance and cannot be reversed.

Chaos theory has its own key features and terminology, and it is not possible to interpret it without using these terms. The remainder of this section will therefore lay a foundation with these central assumptions; the second half of this article will examine their implications for public relations.

1. Nonlinearity

Central to Newtonian science is the principle that causes and effects have a proportional relationship, so that small changes in original con-

ditions will create consistent changes in their effects. Thus, outcomes unfold predictably from initial conditions; unpredictability becomes an artifact of multiple variables within the experiment itself or intruding from the environment. The concept of probability mitigates such problems with excessive "complexity."

However, chaos theory maintains that many—indeed, most—natural events violate these expectations. Rather, minuscule changes in some systems' initial conditions may actually amplify exponentially as their effects unfold so the end result bears little resemblance to the beginning. As a result, predicting final outcomes—or indeed anything beyond the very short term—becomes impossible.

2. Feedback

The Newtonian view of modern science posits a machine-like universe that regulates itself according to immutable laws. Within this worldview, systems maintain their stability by means of negative feedback, a mechanism that, like a thermostat, takes corrective action to discourage deviation and preserve a steady state. Indeed, such views assume that stability is the "normal" state, and that apparent instability comes either from faulty observation or a temporary derangement of normal continuity.

In contrast, a chaotic system evolves by means of positive feedback. This process is analogous to placing a loudspeaker next to a microphone so that sound distortions become amplified as they replay through the system; as each output from the loudspeaker becomes the input into the microphone, more and more noise enters the system. Similarly, as a chaotic system evolves, each step's output provides the material for a new formulation and outcome; initial uncertainties become so magnified as iteration proceeds that the system eventually cascades into disorder. Thus, while negative feedback regulates, positive feedback amplifies deviations, working to destabilize existing states and introduce new patterns.

3. Bifurcations and Phase Changes

This trend toward destabilization in a chaotic system can lead to sudden changes in the system's direction, character, or structure, called *bifurcations.* At such points the system rearranges itself around a new underlying order, which may come to resemble, or be very different from, the prior one.

Some theorists believe the onset—though not the outcome—of these catastrophic leaps can be predicted. For example, systems evolving from orderly to random states often appear to follow characteristic patterns whether they are dripping faucets or Niagara Falls, electric circuits or business cycles. Mathematical models of such systems maintain their initial stability reasonably well for several iterations, but further iterations precipitate a leap into disorder. It may be possible to apply specific, universal values (*Feigenbaum numbers*) representing points during the development of a nonlinear system when it exhibits rapid change.[6] However, while the occurrence of bifurcations may be predicted, their outcome cannot. Thus systems are creative in that they achieve new structure and complexity, but one cannot choose their aftermath.

4. Strange Attractors

Again, to say that a system is unpredictable is not to say that it lacks coherence or structure. Some situations may indeed be structured so that effects flow predictably from causes. However, even nonlinear systems that appear to explode into unpredictable outcomes do possess a deep structure, termed an *attractor*. An attractor is an organizing principle, an inherent shape or state of affairs to which a phenomenon will always tend to return as it evolves, no matter how random each single moment may seem.

Some attractors' patterns can be easily grasped and mapped through traditional analysis. For example, the straight line of a *static attractor* maps an outcome that continues unchanged at a given level; the regularly waving line of a dynamic attractor maps an outcome that varies periodically and predictably about a mean. But chaotic situations are characterized by *strange attractors* where outcomes wander constantly and unpredictably within a bounded range. Maps of such situations, in which multiple variables are pulling events in contradictory directions, may resemble scribbled doughnuts (*tori*) or butterfly wings (joined tori). However, the underlying order represented by the attractor constrains excessively erratic behavior and imposes a structure even though discrete events may be unpredictable within the bounds of that structure.

On a social level, attractors have been seen as indices of human agency and free choice. For example, deterministic societies with little room for human change follow the patterns of static or dynamic attractors; societies that allow some variation within an overall conformity can be mapped as tori; societies patterned after linked tori offer still more freedom for human choice, and so forth.[7] On an individual level, "[psychological] constructs like personality may operate in a manner analogous to an attractor. This idea may explain why personality variables often have low predictability for a single behavioral incident, but a pattern of behavior reflecting a personality style can be established."[8] Some researchers view organizational culture as a strange attractor, a common set of values that informs behavior but is not articulated in words as a corporate mission statement.[9]

5. Scale

Because the evolution of a chaotic system is so hugely complex, and so prone to perturbation by chance, it is impossible to discern its underlying pattern—its attractor—by looking at a single small event at a single point in time. The difficulty of perceiving pattern in chaos relates to the *scale* at which one views a phenomenon—another distinction between the worldviews of modern and chaos sciences. Modern science views scale as unimportant because the same universal laws pertain whether the object is observed close up or at a distance, whether it is measured with a ruler or a yardstick.

However, chaos theorists note significant differences in the very structure and dimensionality of an object, depending on the observer's standpoint and measuring tools. Mandelbrot's classic example[10] uses a ball of thread: at a great distance, the ball appears as a single point (one-dimensional); closer, it is a sphere (three-

dimensional); closer still, the thread forms a long, twisting line (one-dimensional); closer still, the thread looks like a tube (three-dimensional); closer, a line of fiber (one-dimensional); at the atomic and subatomic levels it has yet different structure. In a sense, then, the viewer can determine the true nature of the ball of thread simply by choosing a particular scale for observation.

Similarly, one's interpretation of the form and coherence of a chaotic phenomenon is affected by the scale of the observations. To see overriding patterns—the strange attractors, or deep structures—we may need to review a system's entire evolution *a posteriori.* This evolution is best conceptualized as a *phase space,* an imaginary map tracing the past behavior of a system through a number of bifurcations.

Awareness of the full map—or history of a system, or phase space—is important because different behavioral patterns are likely to prevail in different parts of the map. As previously explained, such systems may switch from one attractor, or set of underlying rules, to another at bifurcations. Indeed, systems may behave chaotically during some phases in their evolution and quite linearly during others. Therefore, some theorists look on phase space as "a basin of varying outcomes . . . [where] there are regions of mechanistic prediction and regions of widely varying outcomes."[11] Newtonian logic tells us that we can generalize from the part to the whole; chaos theory tells us that we must see the whole before we can draw accurate conclusions, even about parts.

In a social context the concept of scale raises questions about whose version of reality should prevail. Studying a chaotic system at a single point is likely to give only part of the answer, but we may take those results to be universally true and generalize them, mistakenly, to the system as a whole. By contrast, in a chaotic system, "the truth value of any theory is, in part, a feature of human choice about the scale of observation or about the region of a basin of outcomes to use in making general statements."[12] The 'reality' that describes a given phenomenon is determined, not by its universal qualities, but by the observer who chooses the scale. Such concepts have created a convergence between chaos theory and the postmodern "realization that what has always been thought of as the essential, unvarying components of human experience are not natural facts of life but social constructions."[13]

6. Fractals and Correspondences

The holistic focus of chaos theory sharply contrasts with modern science's assumption that single units are microcosms from which the whole system's behavior can be deduced. By contrast, chaos theory assumes that concentration on individual units can yield insignificant or misleading information. In fact, individual measurement units often produce quite different results, a problem which Mandelbrot[14] addressed by speculating on the length of Britain's coastline. Measuring at every 100 meters will give one answer but will omit a good deal of coastal detail; measuring at every 10 meters will capture more detail and yield a different answer; each successive refinement in measuring will yield

yet another, larger sum. If rocks, sand, even molecules are measured, the coastline will be infinite. In fact, it will be the same length as any other (also infinite) coastline in the world whether it is Africa or Guam.

Therefore, quantitative units of measurement may be poor yardsticks to describe the world. Instead, Mandelbrot suggested a qualitative measurement termed a "fractal," which describes "the relative degree of complexity of an object."[15] By abandoning traditional quantitative measurement scales and using fractals, it becomes possible to identify correspondences or "couplings" between forms that vary vastly in scale but have similar patterns of complexity, such as clouds, coastlines, or mountains. In a chaotic system, a strange attractor is a fractal curve that imbues all the diverse elements it governs with its own underlying pattern.

Because it combines iteration with elements of chance, a fractal representation of a system shows highly similar, though not identical, patterns at successively greater magnification. (Figure 1 shows such successive generations of patterns in a fractal set.) In theory such forms can bifurcate to infinite complexity, yet each generation is based on the one that preceded it. Any given outcome cannot be considered apart from its history; each step recapitulates (albeit unpredictably) elements of the step that came before. This self-similarity makes it possible to analyze chaotic systems by tracking similar patterns through successive stages of evolution. Instead of studying individual units and generalizing, researchers look for "correspondences across scales of different lengths...., emphasizing overall symmetries and the complex interactions between microscale and macroscale levels."[16]

7. Self Organization and Self Renewal

Some theorists believe this sensitivity of a chaotic system to its own history helps to pull it out of disarray as well as impelling it into chaos. As previously explained, iteration involving positive feedback works to destabilize a system. On the other hand, iteration also means that systems have continuity; they carry elements of their original order from step to step, shown in the shapes of strange attractors or fractals. These correspondences, or couplings, among various stages in the system mean that a change in one area rapidly communicates itself around the entire entity, so that separate parts bear the stamp of the same pattern. In this way chaotic systems "generate their own new forms from inner guidelines rather than the imposition of form from outside."[17] The ability to reorganize is inherent in the chaotic system itself and does not require external intervention. This self-referentiality has presented problems in social applications, with some theorists concluding that change by external agents is virtually impossible,[18] while others urge that change can be imposed if properly timed to coincide with bifurcations,[19] or if change agents can be introduced into the system to perturb its embedded patterns.[20]

Chaos thus follows an orderly inner logic, but its type of order is quite opposed to a mechanistic representation of the universe as passive matter that follows

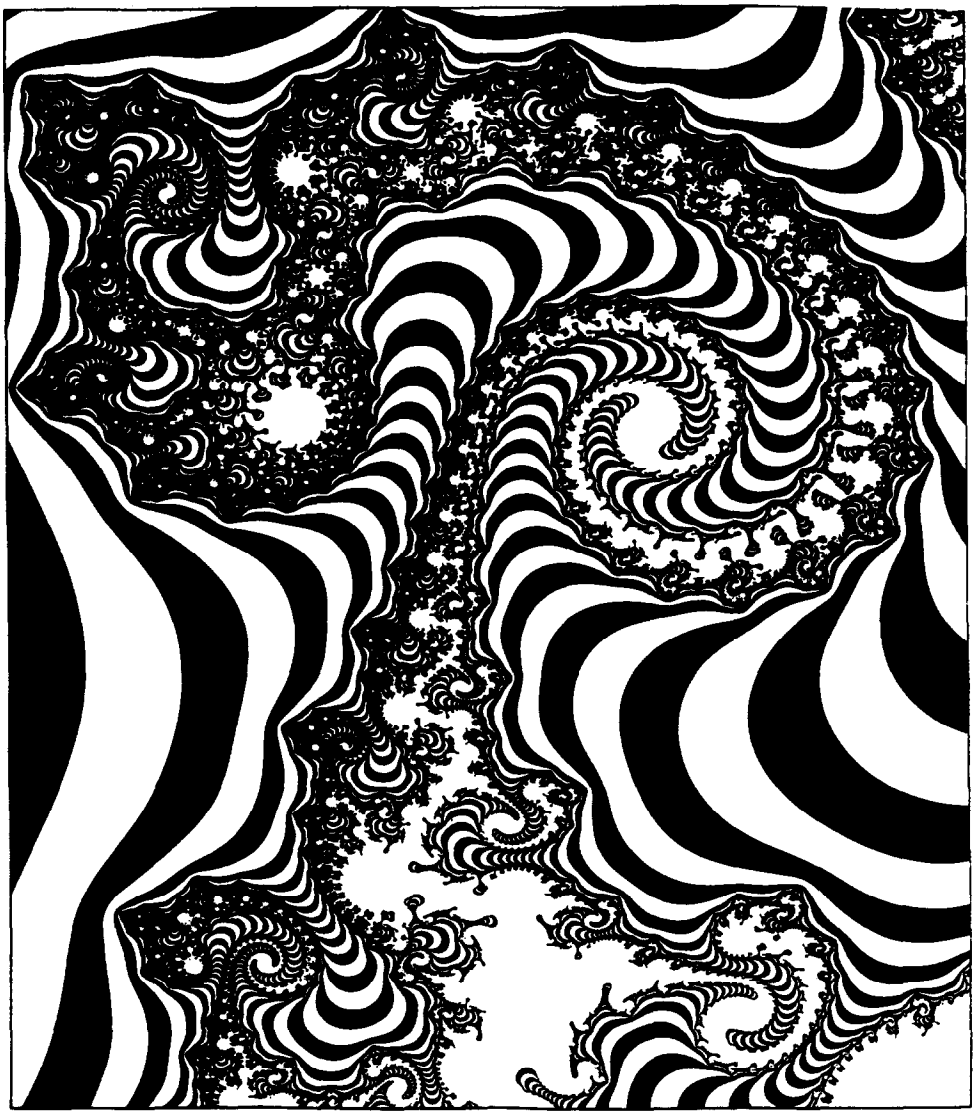

Figure 1. Fractal from IBM labs at Boblingen, FRG, created by W. Hehl and D. Wollschlager[57]

immutable laws and can be understood by objective research. Rather, a chaotic universe is an unstable combination of randomness and plan, broken by flash-points of change. Chaos science therefore highlights the role of chance, the possibility of many outcomes, and the ability of the observer to choose which outcome will be called 'reality.' In this sense chaos theory is emancipatory, but the price for this open-endedness is extreme uncertainty and loss of a sense of control.[21]

SOME IMPLICATIONS OF CHAOS THEORY

One would expect a theory that counters 300 years' worth of accepted scientific thought to elicit a good deal of discussion and new work, and it has—but largely in the natural sciences. In the social sciences, chaos theory has mainly been applied to economics, although work has begun to surface more recently in literary theory,[22] public policy,[23] and sociology.[24]

In a public relations context, Cottone used chaos as an overriding metaphor to urge change in public relations research from a hard-science paradigm to "scholarship that parallels the three themes of chaos researchers[:] the multidisciplinary effort, an investigation of extremist ideas, and work that is transformative in nature." In this sense chaos represents "scholarship that explores difference and diversity" and "leads to discoveries that cannot be revealed through traditional investigations," such as feminist, Afrocentrist, and womanist worldviews.[25]

Other social science applications of chaos theory (including this article's) also operate by analogy. Rather than offering novel solutions, they generally use chaos theory to structure persistent problems and explain why they are intractable. According to Lucking, this limitation may persist "until someone can model the non-linear dynamics of free will."[26]

In the case of public relations, both the usefulness and the limitations of chaos theory resemble its contributions in other social sciences. Most immediately, it raises methodological problems that undermine statistically based research and resulting theories about publics. However, its main contribution may be to offer new models for public opinion and to raise questions about how (or even whether) organizations can control public perceptions of issues. Ultimately, the theory raises questions about the role of public relations professionals. Because it emphasizes uncertainty, open-endedness, plurality, and change, chaos theory runs counter to the goal-oriented, certainty-seeking mode which many public relations professionals and their managements are currently trying to refine.

From a methodological standpoint, chaos theory cautions against uncritical acceptance of traditional statistical analysis. The methodological problems raised by chaos theory for social science research have been examined in depth by Gregersen and Salter,[27] and do not need much recapitulation here. Briefly, the results of statistical research on a chaotic system will vary greatly depending on scale—that is, which portion of a phase space the researchers happen to study. Because one cannot assume that any system behaves linearly, results that appear significant for one portion may have little significance for the entire system; in turn, seemingly weak or insignificant results may actually have important explanatory power for the system as a whole. Therefore, if the phenomenon being studied appears unstable, researchers should assume they are dealing with a chaotic system and consider qualitative methods aimed at understanding, rather than quantitative ones aimed at prediction and control.

In public relations, few phenomena appear more unstable than public opinion, and it is here that chaos theory has most relevance. Patterns of media coverage, the rise of special interests, sudden-onset crises, or persistent rumors—all these

areas combine multiple variables in a vastly complex, or chaotic, interaction. Indeed, a chaos-based model may capture the complexity of public opinion with more verisimilitude than cross-sectional statistical analysis, when we are trying to understand broad-based phenomena such as emerging social issues or cultural values. Chaos-based models may also help to explain why close prediction or control often proves elusive even when audiences' attitudes have been thoroughly researched.

Issues Management

Chaos theory is particularly useful for structuring emerging social concerns and interest-group behavior, the province of issues management. Issues management attempts to discern trends in public opinion so that an organization can respond to them before they amplify into serious conflict which breaches the social fabric and eludes control—that is, before chaos sets in.

Successful issues management has the ability to show the interplay between factors as diverse as social concerns, news events, cultural values, and corporate goals, an approach which demands a high level of context sensitivity. In a process similar to analyzing fractal patterns, issues managers look for relationships between emerging social concerns, and then seek correspondences between industry or organizational actions on a micro scale, and the social context on a macro scale. For example, Union Carbide's 1984 Bhopal tragedy resulted from complex interplay between scales as diverse as financial planning at the U.S. parent company, Indian agricultural policy, and tea-break customs at the Bhopal factory.

Such linkages often are invisible to linear cross-sectional analysis but manifest themselves through a holistic analysis of patterns. Issues managers describe this fractal approach to complexity as a "sixth sense," a "heightened sensitivity," or even being "magically aware" of an issue.[28] They distill their awareness into distinct key terms which function like coupling points between disparate events; by using these key terms to search computer data bases they are essentially tracing out the attractor that links random events into coherent, if polymorphous, issues.

Like issues, interest groups may best be understood in terms of chaotic systems. Issues originate with isolated individuals, often as simple dissatisfactions; they gain definition when these individuals locate each other; they gather force and complexity when highly organized lobbying groups get involved. Interest groups often resemble chaotic systems in that such groups are segmented (composed of multiple units rather than a single command center), polycentric (tied to many different leaders or centers of direction), and networked (linked by loose ideological ties).[29] As a result, it may be difficult to locate appropriate leverage points for communication or even to discern what the 'real' issue is. Intel faced such a situation during the 1994 controversy about its Pentium computer chip. Beginning as a trickle of messages posted to an Internet Pentium newsgroup, user complaints cascaded over the Internet, spilled into other newsgroups, were picked up by

reporters, became common knowledge, and profoundly redefined Intel's reputation for cutting-edge technology.

In fact, as an issue evolves it may become so complex that its mature form little resembles, and could not have been predicted from, its inception. For example, Gerlach's description of a gathering environmental movement closely parallels the evolution of a chaotic system. The movement started with a handful of farmers in west central Minnesota who wanted to stop a power line from crossing their land. This local group then attracted

> their rural townsfolk neighbors including local church leaders, then counterculture activists from the cities of St. Cloud and Minneapolis-St. Paul, and many more. These developed not only an ideology of stopping the line, but also of protecting the family farm and rural life, of promoting alternative energy technologies, of challenging big business, and—as women began to lead in the protest—of advancing women's liberation.[30]

As with many technological controversies, the coupling point for these disparate groups was very likely concern about institutional, not electrical, power. Thus the integrating ideology of interest groups acts as a strange attractor: a set of overriding beliefs, assumptions, values, and customs that powerfully govern the behavior of individual constituents. However, the attractor is often clear only after the fact; it would be difficult to discern it in the original complaint, or to identify it along the way by sampling group members' protests. From a practical standpoint, therefore, chaos theory offers little help in predicting the evolution or outcome of interest group activities, but it does suggest that the most efficient way to coexist with interest groups is to look beyond their immediate demands and identify the true attractor. Corporate social responsibility can be understood as an effort to accommodate such attractors by fitting the organization into them rather than by attempting to change them.

In fact, the chaotic nature of interest groups severely limits public relations ability to 'manage' such groups, so that efforts to reshape a group's perceptions, whether through education, negotiation, or coercion, often have little impact. Attractors resist change, regardless of outside pressures, because chaotic systems are inherently reflexive. Such systems follow their own logic; while their inherent instability makes change inevitable, external forces have limited power to affect the timing or nature of the change. For example, Nonaka[31] applied a chaos model to Japanese companies' efforts to develop new products. The companies induced change by placing new hires in departments where they broke the general consensus; in doing so, management hoped over time to build a critical mass in favor of introducing new patterns of thought. However, management did not expect to dictate either the timing or the eventual outcome of the change. In the same way, public relations efforts with special-interest groups are not powerless; the effects of education or negotiation may amplify over time. Even so, organizations may be unrealistic to expect public relations programs to control when or how perceptions change.

A similar dynamic governs the issue that comes out of nowhere, the emerging social concern that comes to dominate public attention virtually overnight. On the one hand, attractors in the form of a dominant ideologies resist change. On the other hand, positive feedback—or accumulated dissonance within the system—constantly works against the status quo. As a result, after a number of symmetrical iterations, a chaotic system becomes vulnerable to destabilization even by very small changes—the classic "straw that broke the camel's back." In a social context, the chaos model shows that issues can develop a critical mass very quickly, so that radical opinion change "does not require that all configurations within a given culture be self-similar; but...when enough of them are, initial perturbation will have large-scale effects."[32]

This vulnerability of chaotic systems to small changes explains why organizations can be caught off guard by initially small-scale events that undergo catastrophic social amplification. Such situations are often dominated by large issues of timing and context against which public relations measures have little efficacy. For example, some ill-conceived words by the Rutgers university president, who apparently had a strong record in affirmative action, provoked a prolonged national outcry over racism. Similarly, the wreck of the Exxon Valdez, though substantially smaller than some other oil spills,[33] remains a touchstone for corporate anti-environmentalism. The chaos concept of cumulative dissonance suggests why these events and not others became catastrophic and chronic: they mark unstable points in social consensus where values appear to be shifting and social outcomes cannot be known. Thus the Rutgers incident occurred during a time of increasing social conservatism and strident debate about genetic factors in intelligence. Similarly, the Valdez disaster formed part of a mid-'80s cluster of technological disasters (along with Bhopal, Chernobyl, the Challenger) that brought into focus several decades of collective doubt about the competence of experts, the reliability of risk estimates, and the ability of institutions to carry out disaster plans. From the standpoint of chaos theory, incidents become crises when they mark bifurcation points in social values: in both cases enough societal dissonance had accumulated for a single event to destabilize social assumptions.

Crisis Management

Chaos theory provides a particularly good model for crisis situations. Typically a crisis forms as a sequence of events that seems, over time, to gather volume and complexity with increasing speed. Its dynamic therefore resembles that of a chaotic system as it iterates through increasingly complex phases toward a disordered state.

At the onset of a crisis, an organization may have power to influence events, but after a certain escalation point, it often loses this capacity. For example, Exxon has been widely criticized for losing the "window of opportunity" to establish physical control over the Valdez spill and mold public opinion more positively.[34] In the days following the spill, the crisis attracted ever more actors, each with their own version of the event and its solution: the Coast Guard, the

Alyeska consortium, legislators, the media, animal rights activists, environmentalists, consumer groups, and so forth. This multiplication of voices and solutions followed a dynamic similar to a chaotic system where, during the initial few phases, some order remains; but subsequently complexity overruns the system and it passes beyond control. At that point, chaos theory suggests that an organization like Exxon cannot 'manage' an outcome but must allow events to sort themselves out while trying to fit into the emerging aftermath. Such major crises mark the loss of an organization's attractor—be it management competence, technological skill, or social responsibility—and are followed by a period of disorder until a new attractor emerges. Media coverage after such disasters typically reflects this groping for a new attractor, with conflicting coverage of facts and competing interpretations of the event's meaning that eventually settle around a new attractor.

Crises therefore act as bifurcation points that permanently redefine an organization in a new and unexpected light. Indeed, some theorists define a crisis as a point in an organization's history which irreversibly changes its culture and business; it is this criterion that distinguishes a true crisis from a mere "bad event."[35] For example, after news of its design defect spread through Internet newsgroups in 1994, the Pentium chip, once a byword for state-of-the-art computing, became a symbol for technological unreliability. After the 1986 Challenger explosion, NASA's image changed permanently from an organization that could do anything to one that could do nothing right.

Nonetheless, chaos theory stresses that these cataclysmic moments are not random, but rather the culmination of accumulated 'noise' within the system itself. Put another way, certain organizations contain flaws within themselves that amplify over time to self-generate crises independent of outside factors. On the one hand, traditional management theory stresses the role of negative feedback, a regulatory mechanism by which organizations preserve their status quo.[36] However, chaotic organizations fall prey to positive feedback in that their managerial shortcomings amplify over time until they breed a crisis that transforms them permanently.

NASA's evolution toward the Challenger disaster exemplifies the effect of such dysfunctional organizational attractors. Writing from a Freudian standpoint, Schwartz argued that the pre-Challenger NASA had become enthralled with an organizational "fantasy" of perfection and invulnerability: "the business of NASA had become the creation of the image of American society's perfection."[37] Indeed, for all NASA employees "the motivational base of organizational life" had become this sense of perfection; in terms of chaos theory, the notion of NASA's infallibility functioned as an organizational strange attractor.

Amplification of this strange attractor through successive shuttle launches led directly to the attractor's sudden reversal. Before the Challenger, NASA managers had repeatedly sent shuttles into space with safety defects, thereby intensifying the sense that the agency could do anything: "it was largely because of its history of success, and the attendant attribution of perfection, that NASA developed the 'can't fail' mentality."[38] Each time disaster failed to materialize, managers would

take a larger risk with the following launch, thereby amplifying defects in successive iterations of the shuttle launches.

The Challenger explosion marked a bifurcation in this cycle of positive feedback. It brought to a head what some researchers have termed the "Challenger-Chernobyl syndrome"—the widespread realization that scientific competence cannot be taken for granted anymore[39]—and thus marked a critical shift in attitudes toward technological expertise. Indeed, the tragedy wholly reversed the space agency's image so that its new attractor became incompetence and bad luck. The power of the new attractor has been confirmed in public notice of NASA's misfortunes since the Challenger: satellite transmission failures, Hubble telescope repairs, and cutbacks in funding. Multiple shuttle launch postponements, meant to signal caution, now appear to corroborate technical incompetence.

Chaos theory also lends structure to ongoing low-level conflicts between an organization and its publics. Often such chronic friction comes from misperceptions that cannot be extinguished permanently, or misinformation that resists all efforts to correct it. Recurrent rumors exemplify this pattern. Typically, as a rumor is reiterated over time, it acquires variations so that each account differs from the next; yet, although details may change in the telling, it retains elements of its original structure. In chaos theory terms, this characteristic suggests that rumors follow their own strange attractors that impose "a recognizable configuration of meaning or action in ever-changing and unique iterations,...unpredictable yet patterned."[40] Such attractors may underlie persistent "urban legends" that express dominant cultural attitudes. For example, Kapferer[41] interpreted persistent rumors about rodents served in fast-food restaurants as symbolizing people's misgivings about the unwholesomeness of 'junk' food.

Organizations often try to combat rumors with facts. However, if rumors are indeed chaotic systems, facts will have little permanent effect against the underlying cultural anxieties that govern response to a given product, company, or technology. For example, the rumor that Procter & Gamble supports Satanic worship has resurfaced repeatedly from 1982 to 1995, despite intensive efforts by the company to explain facts, enlist support from celebrity evangelists, and bring lawsuits against those spreading the rumor. Possibly Procter & Gamble's secretive, remote management style has encouraged hostile rumors that 'explain' the logo.[42] Until the true attractor can be found, the rumors linking Procter & Gamble to Satanism are likely to recrudesce. If rumors' significance—their strange attractors—cannot be specified, it may prove necessary simply to wait them out. Indeed, Kapferer[43] noted that most rumors eventually collapse when their elaborations become too ludicrous for anyone to believe—or, in chaos terminology, when enough deviation has accumulated during iterations for the rumor eventually to self-destruct.

Implications for Managing Public Relations

Riding out storms is not the sort of advice most managements want to hear. From a management standpoint, public relations is above all an effort to mitigate

uncertainty. It can do so either by predicting and manipulating publics' behavior (according to J. Grunig's asymmetrical model) or by achieving sufficient harmony with publics that they are unlikely to react in unexpected ways (Grunig's symmetrical model).[44] However, chaos theory suggests that uncertainty will always dominate relations with publics during volatile times, and improved research and measurement may not in themselves improve outcomes.

Chaos theory implies that events have a life and logic of their own; there is limited room for intervention or, in Bernays' terms, "the engineering of consent." In a chaotic system the power resides in the collective; individual units, especially those external to the system, have little influence. As long as events adhere to a strange attractor, change will be very difficult to implement. However, when sufficient deviance has amplified through the system, change will be very difficult to arrest.

On the face of it, such notions set severe limits on public relations' ability to implement planned change. In fact, the theory counters current efforts to abandon loose, qualitative "seat-of-the-pants" research[45] in favor of management by objectives that achieves scientific measures of accountability. Because it emphasizes lack of predictability and undermines statistical measurement, chaos theory subverts a planned approach to public relations; at an extreme, it implies that public relations should return to an earlier phase of development where precise objectives did not govern campaigns and research did not involve scientific prediction.

Chaos theory also highlights conflicts between public relations and other management functions. Traditionally, managements are goal-oriented and uncertainty-reducing; traditionally, strategy is the outcome of rational progress toward an objective. However, if the behavior of most publics is inherently chaotic, most public relations staffs must operate according to a different paradigm from their managements. Even though public relations practitioners are often criticized for attempting to interpret events after the fact, this may in fact be the most appropriate way to deal with a chaotic system, whose outcomes cannot be predicted and whose structure is manifest only over time. Thus, unlike traditional management, where "the thoughts, analysis and decisions are frequently assumed to precede the implementation or actions," in the chaotic system where public relations operates, "the thought component of strategy consists of framing the metaphors to make sense of the actions."[46]

At their most limiting, chaos models suggest that public relations may have accepted challenges that are difficult to fulfill. Attractors are intransigent: chaotic systems follow their own inner coherence and evolve their own changes, resisting efforts by an external agent such as public relations to influence the system's direction. From this standpoint, rather than attempt to change the attractor an organization may fare better by attempting to fit within dominant beliefs. Monitoring change and interpreting its context may be more realistic public relations goals than prediction or control. And public relations' value to management may come less from attempts to influence audiences' perceptions in a planned direction than from an ability to capitalize on unplanned opportunities.

Nonetheless, some theorists imply that a chaotic system's behavior can be predicted, at least to some extent. For example, some advance the idea that chaos-based models for social behavior can provide "early warning systems" for radical social change.[47] Thus the civil rights movement of the 1960s marked a bifurcation in the American social system.[48] Similarly, an upsurge in social and economic ills—depression, crime, revolution—may mark a bifurcation, a signal that a society is passing out of equilibrium and into a chaotic state where attempts to regulate social behavior cannot succeed.[49] Therefore, even though they cannot control the outcome, issues managers can achieve some degree of prediction by using the fractal scanning approach described earlier in this article.

Some theorists also imply that it might someday be possible to affect the outcomes of chaotic social processes. For example, by identifying the conditions that trigger chaotic behavior, institutions may know "precisely where, when, and how to intervene either to prevent problems of social, economic, political, or ecological 'chaos' from arising, or once at hand, to alleviate or solve them."[50] By analogy, organizational efforts to manage issues early show an effort to adjust initial conditions to avert chaotic social response later—although the outcome of such calibrations is still far from predictable.

In addition, the very instability of chaotic systems means that attractors constantly change, so that "there are no inevitabilities" but rather a multiplicity of choices.[51] It may be possible to influence those choices if one intervenes at the point when a system is about to bifurcate—that is, when dissonances have accumulated to the point of destabilizing the existing order so that rapid change to a new order is inevitable. Thus, "the issue for change becomes one of careful identification of such leverage points and an understanding of the proper application of 'force' (i.e., resources) at such points."[52] From a public relations perspective, practitioners may reserve their resources until a pivotal event—nuclear accident, product sabotage, takeover attempt—destabilizes an existing public opinion attractor. When they act quickly after such an event, they can set the agenda—determine the next attractor for public perceptions. However, if there is no destabilizing event to mark a bifurcation, or if they do not act quickly, they may not succeed in creating an attractor that is congenial to their own organization. Thus Johnson & Johnson's rapid post-Tylenol actions ingrained a consumer-oriented image that resisted erosion during subsequent poisonings, whereas Exxon's post-Valdez inertia served to institutionalize public suspicions of managerial blundering and environmental insensitivity.

Although chaos theory undermines some current trends in public relations management, it implies support for several other trends, including aspects of the symmetrical approach advocated by J. Grunig.[53] From Grunig's standpoint, organizations may practice either symmetrical or asymmetrical relations with their publics. Organizations practicing asymmetrical relationships attempt to impose their own point of view on their publics through persuasion based on scientific analysis; while such organizations may understand their publics well, they do not identify with them or view communication as collaboration within the same framework of beliefs and needs. However, chaos theory would view asym-

metrical communication as the expenditure of resources to change an existing attractor from the outside, a difficult venture given the power of attractors.

By contrast, organizations that practice Grunig's symmetrical communication attempt to adjust their own behavior to accommodate the beliefs and concerns of their publics. They assume that the organization and its publics are working jointly toward the same goals. From the standpoint of chaos theory such an approach does not attempt to control existing attractors but rather, fits into them. The price paid, however, is that the organization accommodates whatever outcome may evolve over time, so that it becomes somewhat problematical to talk about public relations objectives and goals which imply control.

However, accepting chaos does not have to mean outright rejection of traditional models. Indeed, as experiments with social Darwinism made clear long ago, models that work well for the physical universe often have limited efficacy to explain social phenomena: skepticism about both Newtonian and chaotic approaches is similarly warranted. Thus, chaos theory offers a helpful antidote to overly rigorous linear views of public opinion, without being a fully satisfactory replacement. Chaos researchers themselves appraise the new science conservatively and seem unwilling to give up a Newtonian worldview altogether. From a methodological standpoint, either approach can be appropriate depending on whether the problem at hand behaves predictably or not.[54] Some theorists advance the idea that Newtonian and chaotic perspectives should be used in tandem, as a system of checks and balances. For instance, the Greenhouse Effect can be studied as a scientific problem involving the ozone layer, and also as the result of government policies that led to unpredictable results.[55] In a public relations setting as well, both traditional and chaotic approaches can complement each other, but neither may be sufficient. Thus traditional survey analysis can yield evidence about a public's attitudes that can help a company orient its own behavior to the group's attractor, without assuming such findings represent 'laws' to predict or control audience behavior. Similarly, the most successful issues managers are those who combine fractal presentiments about emerging issues with highly goal-oriented surveillance of data bases.

While chaos theory offers few practical guidelines, it does suggest three caveats about intervention with highly unstable publics. First, change has to evolve within the target group itself; it cannot be imposed from outside although seeds of change may be introduced. Second, intervention works most efficiently at crisis points, when a group is well on the road to destabilizing on its own. Third, one should act quickly at such crisis points, lest events take their own shape, one that might be uncongenial to the organization. Future research is necessary to establish whether these guidelines actually offer sound models for organizational strategy.

At this stage, however, chaos theory is more useful as an analogy than a source of practical solutions for relationships between organizations and their publics. It offers help in structuring persistent problem situations "where there is insufficient knowledge about cause and effect relations, and where societal actors are capable of acting in unpredictable ways."[56] In this sense, chaos theory provides rules as

definite as the Newtonian rules it has challenged. The new rules—pluralism, chance, and change—may offer cold comfort to management. However, in many situations chaos theory balances out overly rational management approaches and provides useful reminders that context-sensitivity, patience, and careful timing may effect change where wholesale proactivity cannot.

NOTES

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12. Ibid., p. 331.
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14. Benoit B. Mandelbrot, op. cit.
15. John Briggs & F. David Peat, op. cit., p. 95.
16. N. Katherine Hayles, op. cit., p. 170.
17. David Loye & Riane Eisler, op. cit., p. 56.
18. Daniel J. Svyantek & Richard P. DeShon, op. cit.
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53. See James E. Grunig & Jon White, op. cit.; and James E. Grunig & Larissa A. Grunig, op. cit.
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