INTRODUCTION

The New Science Metaphor and Modern Drama

A Brief History of Western Thought

The first power to come into being was Chaos.
. . . . . .
And out of Chaos black Night and Erebos came into being,
and out of Night then came the brightness of Aither and Day,
whom she conceived by lying in love and mingling with
Erebos

Hesiod's *Theogony*[1]

WORLDS REASONABLY CERTAIN of ontological, epistemological, and cosmological frames produce art that reflects that certainty with a benignity and confidence that assures its public of ultimate order even in the face of apparent disorder. Classical Greece, medieval Europe, Elizabethan England, and Enlightenment Europe are regularly held up to us as paradigms. Try as we might, however, the twentieth century has failed to secure such frames of confidence.

This desire to find meaning and order in the universe has typically taken two forms throughout history. The earliest frames of order were of the sort that acknowledged a necessary interplay between order and disorder, an interplay occupying the realm of chaos. In such frames, there was no desire for the destruction of or control over chaos; rather, chaos was perceived as an essential and integral contributor to life and creative processes. The great systems of the East held to such a belief and were frequently – though incompletely – incorporated into Western thought through the

works of such poet-thinkers as Hesiod (c. 700 B.C.) and through such cult groups as the worshippers of Dionysus.

The second great system – more recent and therefore often considered more progressive or advanced – held that order was to be desired over its mortal foe chaos, that chaos was a force of destruction and decay, or, in moral terms, was a product of the triumph of disorderly evil over orderly goodness. The consequent human goal was to create a world that struggled against chaos and strove to establish order through complete understanding and ultimate control of life's "irregularities." The unpredictability of even a benign, seemingly harmless chaos was undesirable because it precluded human dominion. In the classical Greek world, this overall hunger for dominion culminated in the work of Aristotle – though it didn't exist without challenge – and was revitalized in the early modern Western world through the rediscovery of Aristotle and in the works of such minds as Descartes and Galileo. With very few exceptions, the modern world has continued to see chaos as undesirable, dangerous, deadly, evil. The triumph of order has been established as the goal of modern human thought and has increasingly been seen as an attainable goal.

Generally speaking, the centuries-old Aristotelian empirical process remains today the primary basis of the most commonly subscribed conclusions concerning reality. The world is "out there," the human senses are available for observation of that material, and the mind can be developed to draw objective conclusions about that world. The process itself has rarely been called into question, but particular Aristotelian conclusions often have been. What stands tall is the cornerstone of Aristotelian thinking: the concept of causality. It is a concept that presumes that all natural events have predictable outcomes because of various interactive qualities inherent in the natural world. The ancients called this causality *foederi fati,* the laws of fate. The modern world would come to call it scientific law. The visions are the same, stemming from a growing confidence that humanity has the tools ultimately to understand and then triumph over nature. Simply put, if we could understand nature's laws, we could control them and manipulate nature for our own ends. And if an explicable natural causality in fact rules existence, then our powers of mind and observation should concentrate on fully understanding that causality.

In the classical world of the ancients, one philosopher of partic-

ular note challenged that ontological belief in a strictly explicable causality, attempting to return to the world view of his mystic predecessors but working for less mystical explanations in his pursuit of that return. Lucretius (95–55 B.C.) confronted the Aristotelian models of a world governed by *foederi fati* models. For Aristotelians, "unexpected" events were quite simply events whose causes we had not yet uncovered. Lucretius, however, saw a terrible flaw in such an orderly model. Agreeing with an Aristotelian urge for empirical study, Lucretius used an Aristotelian methodology of reasoned observation to challenge Aristotelian conclusions by observing that if such *foederi fati* conclusions were true, history (natural and human) would merely record an eternal repetition of the same. The world would be void of any potential for genuine newness, void of any significant creative potential, since a spark of creativity could not exist, only a finite combination of recurring, already existent options. Without the unexpected, genuine change and development would be impossible. If Aristotelians accepted such stasis, an observant Lucretius did not. So into the Aristotelian model of finite, ordered, and orderly matter, Lucretius inserted what he called the "clinamen," a force unencumbered by explicable laws of necessity that disrupts orderliness and introduces unanticipated (and unanticipatable) opportunities for diversity. Stable patterns are disrupted, forcing a subsequent reorganization that results in a novelty or diversity that is nature itself. Lucretius observes:

> [I]f all movement is always interconnected, the new arising from the old in a determinate order – if the atoms never swerve so as to originate some new movement that will snap the bonds of fate, the everlasting sequence of cause and effect – what is the source of the free will possessed by living things throughout the earth?[2]

For Lucretius, mechanical laws of fate necessarily interact with urges liberated from those laws to create a dynamic flow that challenges the static linear equilibrium of Aristotelian philosophy. Lucretius speaks of human free will, but he also posits a natural free will that produces natural diversity as human will has produced human diversity. Sparks of genuine change occur within patterns of general stability.

With this fundamental Lucretian shift of focus, as Michel Ser-

res observes, "The creative science of change and of circumstance is substituted for the physics of the fall, of repetition, and of rigorous trains of events."[3] Though anticipating many of the empirical breakthroughs of the nineteenth and twentieth centuries, Lucretian philosophy has gone unheeded for essentially two millennia, Aristotelianism remaining the dominant mode and form of thought. N. Katherine Hayles tantalizingly observes, "Had Lucretius's vision of the clinamen prevailed, the world might be dedicated to chaos rather than order."[4]

But before Lucretian philosophy could be culturally reclaimed in the modern age even only as a tentative option, another mechanical confirmation of Aristotelian causality would be introduced, reinforcing in painstaking detail the general Aristotelian paradigm and the traditional rationalist-causalist's increasing belief that order would finally triumph over disorder/chaos. Isaac Newton (1642–1727) gave the Western world exactly what it wanted: a clear, linear blueprint of natural behavior. He was for centuries to follow, as Ilya Prigogine and Isabelle Stengers observe, "the 'new Moses' who had been shown the 'tables of the law.'"[5] The epitaph Alexander Pope proposed for him speaks in similar terms: "Nature and Nature's laws lay hid in night: / God said, let Newton Be! and all was light."

Except for the magnitude of Newton's influence upon Western thought, one could almost call his a cult following. Social sciences, ethics, philosophy all joined in to create systems modeled on the Newtonian vision of order. Elevated nearly to godlike status, Newton introduced a system that explained all physical behavior, from the microscopic to the macroscopic. Seen as ushering in a new golden age of classical science, Newtonianism[6] itself, say Prigogine and Stengers, "was now applied to everything that dealt with a system of laws, with equilibrium, or even to all situations in which natural order on one side and moral, social, and political order on the other could be expressed in terms of an all-embracing harmony" (*Order Out of Chaos,* p. 29). Like Aristotle's world, Newton's world was a smoothly operating mechanical world, a world of pulleys and simple machines, of bodies subject to the exchange of energy and interaction with gravitational forces. Newton's world placed an emphasis on static behavior energized by linear motion striving itself to return to stasis/equilibrium, only to be re-energized by future causal influences. New-

ton clearly described for us a world focused on the physics of solid bodies, and his followers extended and applied Newton's principles to virtually all natural behavior. As John Briggs and F. David Peat point out, the result was a belief that

> [c]haos was merely complexity so great that in practice scientists couldn't track it, but they were sure that in principle they might one day be able to do so. When that day came there would be no chaos, so to speak, only Newton's laws. It was a spellbinding idea.[7]

In most circumstances the spirit of Newtonianism reigns supreme even today.

However, even as Newtonianism was solidifying its hold on cultural thought, a relatively minor "Lucretian" counterstrain was making itself heard, namely the Romantic revolution of the late eighteenth century, which disassociated itself from scientific stasis/balance/order and asserted a superrationalist organic universe where inescapable causality and tight equilibrium are not necessarily desired conditions. Opposed to a mechanical vision of the universe, Goethe, Wordsworth, Blake, Byron, Shelley, and others engaged the world, creating subjectivist perspectives and inspired, creative interaction. It was a clinamen-like engagement rather than distanced, Aristotelian-based "objective" observation of strict causality. What they saw was that *change,* disorder, and disequilibrium could be viewed as positive rather than negative features of nature. They saw a universal vitality much as Lucretius saw it, as providing vital life-fostering opportunity rather than ordaining destructive disruption and imbalance. Like Lucretius – though like Lucretius, they did not know it – they were advocating nonlinearity.

But while Romantic organicism perhaps captured the intellectual imagination of a notable few, the Victorian juggernaut of scientific and human progress drowned out the essence of Romanticism, adopting at most superficial rather than fundamental Romantic tenets and arguing that Newtonianism still reigned, at least until the scientific process could prove otherwise. Visions of organic vitality, along with Romantic processes of engagement/interaction, would, like Lucretius's philosophy, need to wait for yet another scientific revolution in order to receive confirmation of its perspectives.

Newtonianism took on different particular permutations

throughout the mid- to late nineteenth century with the widespread introduction of steam power into the civilized world's industrial production processes. Though the Newtonian urge for causal comprehension (Newtonianism) persisted, Newton's actual laws were being challenged, as were their optimistic premises, for there evolved an increasing need to account for entropy within the thermodynamic systems that were powering industrial machines. Entropy describes a system of universal decay and predicts eventual cosmic death, whereas Newton's laws presumed a perpetual dynamic activity that was itself, macroscopically, a static given. Motion perpetually occurred within a static universal frame; energy never "died." The world for Newton would never wind down. But entropic theories argued both against Newtonian equilibrium and stasis – the sources of the Enlightenment world view – as well as against the recently developed Victorian vision of a world engaged in orderly *progress,* a concept that even transcended original Newtonian confidence. But both Newtonian balance and equilibrium and the nineteenth-century subscriptions to *advancement* came to be questioned by the entropic model. Unfortunately, this new problem did not immediately effect a fundamental evaluation of human knowledge and its basic assumptions. Rather, thermodynamic entropy confirmed for the Victorians that forces of chaos, identified as part of the entropic scheme, would require redoubled resistance if humanity were eventually to prevail. Humanity would need to struggle against this perceived insidious force of nature, and with an understanding of the natural mechanisms at hand, human success at "improving" nature seemed almost a Newtonian certainty. Humanity was practically destined to prevail.

This redoubled resistance, however, could not ultimately overcome the critical flaw of Newtonianism, despite decades of self-willed effort at numerous levels, social as well as natural. Newtonianism is a linear science, expressing complex ideas in reductive (a "good" term for science), simple terms. Basically, minor causes result in minor effects, major causes in major effects, and so forth. Such a system could not cope with the fact of entropy because there can be no cause "major" enough to reverse entropy. In fact, this general linear thinking process cornered many Victorians into numerous entropically self-destructive actions (most notably World War I). We can temporarily resist the consequences of lin-

ear thought, but without a fundamental attitudinal change of mind, the end is inevitable, and it was not the end the Victorians predicted.

This is where chaos theory and its ally – theatre of chaos – come to the rescue, encouraging different frames of thought and explaining the cosmos, though in ways formerly deemed to be incomplete. Among the many explanations is how order derives from disorder, how life derives from decay/entropy. Nonlinearity is the key, of course, because Newtonianism's measure-for-measure logic cannot account for a more-from-less or something-out-of-nothing (even if it is merely an appearance of something-out-of-nothing) world view. Entropy can be circumvented at numerous junctures along its development, and so can any number of other dilemmas which confounded the traditional Newtonians and disheartened the late Victorians, modernists, and even many postmodernists.

Moving beyond a disheartening Victorian legacy, existent still nearly a hundred years after the collapse of Victorian culture, is the goal of chaos theory and of the theatre of chaos.

Preliminary Thoughts on Contemporary Science

James Gleick's book *Chaos: Making a New Science*[8] argues that "chaos theory" is a recent, 1970s phenomenon, suggesting that questions of orderly disorder, nonlinearity, chaos, and so forth, only recently received the attention of scientists, philosophers, and other visionary minds. What seems abundantly clear is that since Lucretius – and even earlier – subjects relating to chaos theory have been of interest, from simple speculation to full-fledged experimentation. Gleick does make a strong case in seeing the latter part of the twentieth century as sufficiently technologically equipped to pursue chaotics-based questions with a thoroughness previously impossible. However, most science historians today identify Henri Poincaré in the late nineteenth century as the father of modern chaos theory, noting the unfortunate fact that his breakthroughs took a back seat to quantum physics in the early twentieth century and additionally needed to wait for the necessary technology to help advance them to scientific center stage. The computer is the new tool of the chaotician, what Poincaré needed (though some science historians are correct to note that the com-

puter was not critically essential), as revolutionary a tool as the telescope and microscope were in their times.

While credit should be given to Poincaré and other early pioneers, it is probably fair to identify chaos theory as a science formally activated in the 1970s, especially if we consider an important point that Gleick and numerous others have failed fully to make. The point is simple: our contemporary culture has become obsessed with issues of unpredictability and uncertainty at numerous levels – economic, social, political, spiritual. The postmodern world of the late twentieth century is a world of even greater turmoil than the nineteenth-century or early twentieth-century worlds, so its *choice* to recognize and concentrate on such phenomena should be conceived of as something of an appropriate choice. Seeing chaos not as the death of order but rather as the pool of reorganization has become a cultural desire. Cultural desire has in many ways forced science to look at its subject (nature) in ways that can help us to understand our seemingly new surroundings and to move beyond the despairing conclusions our current knowledge has forced upon us.[9]

While necessarily relying on the sciences, we must also be aware that a too heavy reliance is ill-advised. Significantly, scientists argue that "chaos theory" is too inexact a term to describe this new science, to which N. Katherine Hayles, in her study of chaos theory and literature, observes:

> First, a disclaimer: "chaos theory" and the "science of chaos" are not phrases usually employed by researchers who work in these fields. They prefer to designate their area as nonlinear dynamics, dynamical systems theory, or, more modestly yet, dynamical systems methods. To them, using "chaos theory" or the "science of chaos" signals that one is a dilettante rather than an expert. (*Chaos Bound,* p. 8)

Hayles's disclaimer is significant because it ackowledges many scientists' continued desire for an "objectivist's" control over their material; "chaos" is a term entirely too pregnant with "unscientific" connotations to be itself adequately controlled, and so scientists avoid the term – ironically because of its *unfortunate* richness and complexity.

This richness and complexity, however, is precisely what should summon our attention. Hayles makes the following obser-

vation as to why she chooses to keep "chaos" as a central term in her literary study: "part of my project is to explore what happens when a word such as 'chaos,' invested with a rich tradition of mythic and literary significance, is appropriated by the sciences and given a more specialized meaning" (*Chaos Bound,* p. 8). Utilizing the term "chaos" allows Hayles to study the interaction among several disciplines – not the least of which are the sciences – in their efforts to come to grips with "orderly disorder." I would add to Hayles's mythic and literary concerns the matter of philosophical significance as well, and would agree with her that "[t]he older resonances do not disappear" (pp. 8–9) despite the efforts of the scientific community to banish "chaos" from its terminology. Indeed, moving away from dominant thought and reconsidering the anti- or nonrational ramblings of a shaman, a Blake, a Wordsworth, or a Whitman, can open up vistas wherein chaos is a positive force. Chaotics – both the scientific and nonscientific brands – takes that position, forcing its way into dominant cultural discourse and demanding a qualitative re-evaluation.

Interestingly, Prigogine and Stengers, the radical advocates of the perspective arguing that order arises from chaos, and David Bohm,[10] whose theories of implicate order support Prigogine, have often been labeled mystics rather than scientists by the scientific community. More sympathetically, however, Renée Weber argues that scientists like Prigogine and Stengers and Bohm, indeed all the great twentieth-century minds from Einstein to Hawking, confirm that "the search for unity in science itself [is] a spiritual path."[11] With Prigogine and Stengers and Bohm, at least, science has begun to confirm the cosmological assertions first recorded in Eastern mythology, deriving scientific evidence that chaos is the soup of creation from whence order arises. They are using science, in essence, to unearth answers to questions our culture requires for its health and possibly even its continued existence.

Stephen H. Kellert, among others, has addressed the issue of cultural and scientific interactions in his work *In the Wake of Chaos.*[12] Kellert suggests that a key to past cultural dismissals of chaotics is "the social interest in the exploitation of nature, an interest that contributed to the institutionalized disregard of physical systems not readily amenable to analysis and manipulation" (p. 120). The study of disorder was, as Prigogine and Stengers observe,

"repressed in the cultural and ideological context of those times" (*Order Out of Chaos,* p. 20). Without clearly *quantitative* forms of linear-based, precise prediction – rather than the chaotician's *qualitative* "patterning" of events – science fails to provide knowledge that could allow "man a degree of control over his surroundings."[13] More insidiously, perhaps, this scientific inclination toward control supported and was supported by what Karen Warren calls a "logic of domination,"[14] wherein control of nature justified control of other elements – like women and minorities – within social strata.

Perhaps in part because of a growing acceptance of social diversity, the Newtonianist preference for control within the sciences has come under scrutiny in the last few decades. But this shift entails the need for both epistemological, ontological, and cosmological re-evaluation as well. Since chaos theory undermines the assumption of predictability and of any attendant control, this limitation on results challenges our cosmological faith in determinism itself. The challenge that chaos theory faces, as Kellert sees it, is to convince others "to welcome this openness and not see it as a cause for regret" (*In the Wake of Chaos,* p. 48).

While one cannot help but acknowledge that chaos theory has become "dreadfully fashionable,"[15] we must also be forewarned that, as Kellert argues, in many ways "chaos theory is not as interesting as it sounds" (*In the Wake of Chaos,* p. ix). Chaos theory does not precisely undermine or overturn Newtonian laws; it quite simply redirects our viewing of them and of nature so as to appreciate the chaos that was heretofore ignored. It reveals the limitations of Newtonian laws and goals, and it allows us to see the macroworld from a different perspective. We are, as Robert Shaw observed, now at a point where we must confess: "You don't see something until you have the right metaphor to let you perceive it."[16] This is where I see Kellert understating the point. Chaos theory may in fact *not* be a "new" science in ways that will become apparent later in this study. But chaos as a paradigm *is* revolutionary because it asks us to see the world from a different metaphorical stance. It is the metaphor that hits the mark in ways others to varying degrees have not. In fact, often chaos is quite literal and not metaphorical at all. That is how precise it can be.

What there is of "revolution" in this art and this science lies primarily in our willingness to adjust what and how we choose to