Dynamic Fiction and the Field of Action:
Mimesis, Metaphor, Model, and Metachaotics

He remembers now that he forgot to tell her, back there when they were doing love and physics, about the sundry "multiverse" theories that have been popping up lately in scientific journals like . . . well, alternative universes.

. . . .

Ah, so, he ventures. Then, presently: Complementarity *is the nub of it, wouldn't she say?: The key to Father Time's cupboard?*

. . . .

There is (he nevertheless tells her presently) a narrative alternative universe, an alternative narrative universe . . . .

—John Barth, *On With the Story*

Aristotle's suggestion in *The Poetics* that the function of art is to imitate reality assumes that reality and its mimetic counterparts are easily recognized over time, whether in a script, a picture, or a dramatic production. This principle of mimetic representation was challenged by Modernists who saw themselves as being true to a very different notion of what constitutes "the real." This daring twentieth-century artistic movement, which considered itself superior to those preceding it, was dependent upon new ideas about the mind, industrialization, recent technological developments, the principles of new physics, and much, much more that characterized this revolutionary age. It opened doors "to

greater democracy, progressive technology and critical freedom—and also the main vista to cosmic speculation" (Jencks 159).

Although some Modernists were opposed to the encroachments of technology and science, others happily incorporated their images and principles in their art, and this inclusion became one of the issues that helped to shape new conceptions and forms of art. One of the first to announce the importance of the technological to modern letters was Ezra Pound, the chief spokesman for the Modernists, who in *Patria Mia* (1913) not only said that science, technology, and industry were worth incorporating into fiction, but specifically linked the machine to the novel. "It is," he claimed, "the novelist's business to set down exactly manners and appearances: he must render the show, he must, if the metaphor be permitted, describe precisely the nature of the engine, the position and relation of its wheels" (33). Although Pound may have been merely describing society in terms of the rhetoric of the machine, Cecelia Tichi believes that the statement bonds "the novel to contemporary technology per se" (466) even to the point that "the novel [is] a machine" (471). "His definition of the novel as machine," she claims, "shifts emphasis from story to functional design, from narration to construction. The values of modernism, as he and others knew, claimed kinship with those of engineering—functionalism, efficiency, stability, utilitarianism, design, and construction" (476). In a sense Tichi is correct, as indicated by Pound's statements about the poet: "The poet or the artist—and this is a distinction I can never get the prose stylist to recognize—the poet is a sort of steam-gauge, voltameter, a set of pipes for thermometric and barometric divination" (33). Poetic divination here is specifically equated with advanced technological understanding and production. In another sense Tichi is wrong, for Pound's written statement could not have influenced his generation. Although Pound's statements may have been symptomatic, even prophetic, of the writings of early Modernism, this particular manuscript was lost by the publisher until 1950, so its influence can hardly be demonstrated, except as it represents a general cultural awareness beginning to dominate the opening of the century. Pound, however, was only one of several people of that generation in the United States who linked technology to the arts. As Charles Jencks points out, Modernists of all stripes embraced a "machine idolatry" (53), and the so-called "Machine Aesthetic," with all its implications of efficiency and power, especially dominated the field of architecture in the 1920s.

As one of the chief spokesmen for the next wave of American Modernists, William Carlos Williams in his 1948 speech entitled "Poetry as a Field of Action" maintained that though literature continued to be mimetic, the human conception of reality itself had changed because of

recent technological developments. Although Williams articulated this view when Modernism was well into its middle age, his statement sums up much of what had been happening in American literature since Ezra Pound. He argued that poetry, if it was to keep pace with discoveries about the mind and advances in human perception, knowledge, and understanding, should reflect this reality based upon the new physics:

> With the industrial revolution, and steadily since then, a new spirit—a new Zeitgeist has possessed the world, and as a consequence new values have replaced the old, aristocratic concepts. . . . Look at Mr. Auden's earlier poems as an example, with their ruined industrial background of waste and destruction. But even that is passing and becoming old-fashioned with the new physics taking its place. (282)

New representations should reflect the scientific, social, and economic complexities of the world (283) and simultaneously challenge traditional forms of poetry. Thus, Williams asked:

> How can we accept Einstein's theory of relativity, affecting our very conception of the heavens about us of which poets write so much, without incorporating its essential fact—the relativity of measurements—into our own category of activity: the poem. Do we think we stand outside the universe? Or that the Church of England does? Relativity applies to everything, like love, if it applies to anything in the world. (283)

What Williams urged on behalf of poetry was already happening, he argued, with regard to prose. He cites Edmund Wilson's claim in *Axel's Castle* (287, 289), that Proust had earlier incorporated principles of new science and technology into the structure of his fiction, and, indeed, Wilson had made such a claim in three separate instances. The first, dealing with relativity and subjectivity, is one that Williams does not take up: in it Wilson asserts that "for modern physics, all our observations of what goes on in the universe are relative: they depend upon where we are standing when we make them, how fast and in which direction we are moving . . ." (157). Wilson's second point about Proust treats metaphors that have been added to fiction as a result of new discoveries in biology, zoology, and the physical sciences. It was Wilson's last observation, concerning the influence of Einstein's theories on textual structures, that galvanized Williams. In Wilson's words, "Proust, though all his observations seem relative,

does, like Einstein, build an absolute structure for his world of appearances. His characters may change . . . as Einstein's measuring-rods shrink and elongate, his clocks become accelerated or retarded; . . . Einstein's mathematical apparatus enables us to establish certain relations between the different parts of the universe, in spite of the fact that we do not know how the heavenly bodies are moving in respect to one another and no matter from what point of view our measurements have been made . . ." (162–63). Wilson argued that this new Einsteinian understanding of the universe was absorbed directly into textual perspective and structure. Of course, shifts in perspective throughout the arts that had preceded Einstein's theories became part of the Modernist Z*eitgeist*. Indeed, Einstein himself had already suggested as much when he acknowledged that the works of Dostoyevsky were the most important influence on his thinking. According to Leonard Shlain, Einstein's comment means that Dostoyevsky was "the first major literary figure to discuss both a fourth dimension and non-Euclidean geometry" (291). Given Dostoyevsky's dates (1821–1881), Shlain's assertion is a bit excessive, but it nevertheless demonstrates the early compatibility of new theories of science and artistic production.

Although Williams and Wilson pointed to early links with modern science in the French novelistic tradition and Einstein to the Russian, Shlain observed that the Irish *Finnegan's Wake* took the experimentation even further, undoing "the strict linearity of the alphabet" and creating an "*all-at-once* apprehension . . . congruent with the visual principle of Einstein's special theory of relativity, which states that at relativistic speeds an observer can see separated points in space at the same time" (304).

Within American fiction this use of new physics and technology in "the narrativization of experience" (White, "Contemporary Cosmology" 93) was also certainly the case, as James Mellard has argued. He suggests that the "explosions" in scientific thought generated by Einsteinian relativity and quantum physics demolished the traditional novelistic form: "the modernist novel . . . is, then, the corollary of an exploding universe, of pluralism, of relativism, and of indeterminacy" (39). It is not accurate to equate Einsteinian theories of relativity with philosophical relativism, but Mellard does, and his ideas of explosions compares to what Eric White calls "a nontotalizable field of relations" ("Contemporary Cosmology" 97) and N. Katherine Hayles's "cosmic web." A case in point concerning the relationship of early Modernist literature and physics is the fiction of Ernest Hemingway, who, along with John Dos Passos, "reformulated the basis of the novel in accordance with the new paradigm of the engineered machine" (Tichi 477). This new paradigm comprises "the engineering values of design and construction," including efficiency (Tichi 477). Although

Hemingway is not so self-conscious as Williams in linking new science and art, he uses pluralism, fragmentation, relativism, and uncertainty to indicate the links between his work and the new views toward science and technology. *In Our Time*, for instance, reflects the technology of that relatively new medium, film. In "Chapter XIV," one of the vignettes that disrupt the unity of the larger stories and challenge linear narrative, the narrator describes the death of the bullfighter Maera in terms of lens control and film speed: *"Maera felt everything getting larger and larger and then smaller and smaller. Then it got larger and larger and larger and then smaller and smaller. Then everything commenced to run faster and faster as when they speed up a cinematograph film. Then he was dead"* (131). The story's analogy with camera action not only involves technology but also establishes the significance of personal perspective, at once important for narrative, film, and the new physics. Hemingway told Edmund Wilson that he was proud of the book's organization, which he described again in relation to lenses and perception: "Finished the book of 14 stories with a chapter of in our time between each. . . . to give the picture of the whole between examining it in detail. Like looking with your eyes at something, say a passing coastline, and then looking at it with 15x binoculars. Or rather, maybe, looking at it and then going in and living in it—and then coming out and looking at it again . . . . [it] had a pretty good unity" (Reynolds 231–32). This unity in diversity inherent in individual stories is very like, and perhaps even drawn from, that of relativity and quantum mechanics, which move the focus from the particular—the particles—to the underlying entity, the field. The movement of the particles may seem frenetic and chaotic, but order, balance, and symmetry are found in the underlying field. The order drawn from the diversity of perspectives is, however, without a totalizing, hierarchical, or divine vision. Technological developments and the influence of new physics are always implicit, and often explicit, in these Modernist texts. Experiments with artistic and literary forms—pointillism, cubism, collage, pastiche, fragmentation, disruptive language, and more—these were the techniques that set the stage for the defining moments of the emergence of postmodernism and chaos theory as important artistic, literary, and scientific movements of the '80s and '90s. American literature within the twentieth century had begun to change radically as conceptions of reality changed on the basis of technology and science.

When, in the late twentieth century, conceptions of technology and physical science changed still more, it was only to be expected that literary representation would change also, for, as N. Katherine Hayles maintains, science and art come out of the same cultural context: "The postmodern context catalyzed the formation of the new science by providing a cultural

and technological milieu in which the component parts came together and mutually reinforced each other until they were no longer isolated events but an emergent awareness of the constructive roles that disorder, nonlinearity, and noise play in complex systems" ("Introduction" 5). Likewise, Susan Strehle believes that "changes in physical theories inspire changes in a culture's general attitudes, and art both responds to and shapes those assumptions. Physics and fiction inhabit the same planet, however divergent their discourses about it may be" (8). The inferences by Hayles that the progress of science is tied to evolving cultural constructs and by Strehle that science is only one of many roughly equivalent discourses is highly debatable in the scientific community for science is highly structured and constrained.

Both Hayles and Strehle are cited in John Barth's account of the influence of chaos theory on his writing. A key figure in contemporary fiction and theory, Barth makes no secret of the impact of the new science on his writing. In his fiction and essays he cites Strehle and Hayles, and, in musing about his love of writing, he speaks of various factors that render possible the creation of certain pieces of fiction. Among them, he mentions "the art of the novel and literary-aesthetic theory" as well as the interpenetrating "realms" of "history, politics, and the social physical and biological sciences—even . . . mathematics" ("PM" 282). He prefers to call this conjunction of theories about art and external reality "coaxial esemplasy" ("PM" 282). In specifically referring to the influence of chaos theory on his writing and that of his contemporaries, Barth remarks that, "like Claude Lévi-Strauss's structuralism and René Thom's catastrophe theory, chaos theory is an idea too rich, a metaphor too powerful, not to spread 'rhizomatically' out of its original bounds into other fields, like crabgrass on a suburban American lawn" ("PM" 284). Barth's "suburban American lawn" is not unlike Williams's "field of action."

Barth's own writing has shown more than a casual affinity, first for quantum physics and later for chaos theory. It is clearly informed by them, and any criticism of his later work must take them into account. Even his earlier works can profit from analysis based on scientific notions, for example, the presence of random happenstance and accident in *The Floating Opera* and various kinds of recursion and narratival twisting in *The Sotweed Factor*, *Lost in the Funhouse*, and *Chimera*. Equally important is the emphasis on orderly systems, their creation, growth, stability, boundaries, transgressions, and even failures. *The End of the Road*, for example, explores the failure of orderly systems, and *Giles Goat-Boy* invokes systemic complementarity in relating Greek myth and legend to the new technology of the computer and the rapidly developing, massive university systems. Indeed, Barth began to see his own writing not just as a cor-

pus and canon, but as a system with negative feedback, cyclical growth, and certain kinds of erosion. In *LETTERS* he recycles his previous characters, putting them into a situation in which they can interact and develop beyond their original contextual boundaries. Though set into print and "fixed" as a system, Barth's books, characters, settings, themes, and styles keep returning, suggesting the problems with unpredictability in systems and their nearly inexplicable failure. At one time Barth may have envisaged his finished and potential works as part of a "steady state" system, though, given what he has disclosed about himself and his thinking, such a fixate is unlikely. Now that chaos theory has been "named" as a paradigm available to him, one that helps to define the contemporary ethos and consciousness, Barth has used it liberally, as we shall see later, especially in *The Tidewater Tales* and *On With the Story*, to explore order and randomness, habit and discontinuity, static and dynamic, and the similarity or self-identical nature of phenomena across scale, or patterns within patterns from the largest construct to the smallest segment.

The inclusion of quantum theory and chaos theory by Williams and Barth raises the issue of how science is best enfolded and materialized within twentieth-century literature. For Williams, as for most artists of similar opinions and disposition, this was a critical question. In speaking of poetry and its relationship to the new science, he referred primarily (though not exclusively) to new structures, generally including rhetorical organization and page layout, but, more specifically, to musical rhythms and rhymes—his own Einsteinian "relativity of measurements." He especially recommended breaking away from the traditional strict or loose iambic pentameter to which other Modernists such as T. S. Eliot adhered and which Robert Frost had defended so vigorously only a few years earlier in his essay on the new poetics. Traditional rhyme schemes and stanzaic patterns would need to be transformed by more flexible strophes and verse paragraphs, which in some fashion unique to each artist would reflect new scientific thought: "in any case we as loose, disassociated (linguistically), yawping speakers of a new language, are privileged . . . to sense and so to seek to discover that possible thing which is disturbing the metrical table of values—as unknown elements would disturb Mendelyeev's table of the periodicity of atomic weights and so lead to discoveries" (286).

In exploring postmodern fiction, Brian McHale comes to a conclusion close to that of Williams: the structure of some contemporary fiction does indeed reflect the theories of the new physics. Postmodern writing, he says, "turns out to be mimetic after all, but this imitation of reality is accomplished not so much at the level of its content, which is often manifestly un- or anti-realistic, as at the level of form" (38). Tom LeClair and

William R. Paulson, as well as Strehle and Hayles, are among those who have scrutinized such structural changes, widening the argument to suggest the impact of system theory, information theory, quantum theory, and chaos theory on structure. Hayles signals the importance of form in *Chaos and Order* in designating her two key divisions as "Chaos: More Than Metaphor" and "Order: Revisioning Form." Taking her cue from Werner Heisenberg, Strehle argues for the importance of form, especially in her distinction between "the actual" and "the real." Heisenberg has noted, she says, that "at the subatomic level . . . reality is not real, but it is active, dynamic, 'actual'" (7). She then proceeds to use the term *actualistic* to describe structures of contemporary fiction positioned between realism and metafiction, exhibiting a faithfulness to the reality of quantum physics rather than the conventions of realism. She says that "reality itself is no longer realistic; it has more energy and mystery, rendering the observer's position more uncertain and more involved than the solid and rocklike overlook from which the realist surveyed a stable world" (x). She goes on to say that "in the quantum universe, space and time aren't separate, predictable, and absolute, narratives can't steer by the fixed poles that guided realistic fiction" (x). Her term *actualistic* works well as a descriptive term for contemporary fiction marked by discontinuity, energy, relativity, subjectivity, and uncertainty.

The term *dynamic*—also based on Heisenberg's distinction—in my opinion, functions better than "actualistic" to describe the fiction in which chaos theory, complexity theory, or dynamic theory enter structurally as well as through figuration, model, and content. As a case in point, Barth in his short story collection, *On With the Story*, convincingly integrates structure and chaos theory. In this volume he experiments with chaotic structures that are simultaneously particle and wave, random and ordered. For example, at the outset of the narrative he subtly subverts "normal" or expected linear structural sequentiality. He marks this departure strategically by chapter titles: the first chapter is called "The End: an Introduction," an oxymoron that suggests two contradictory but related situations: the end of one career (a retiring professor) and the beginning of another (the person being interviewed for his position); and the end of teaching for the professor and the beginning of his new life in retirement. This disruption of linearity in which "the end" is the same as "the beginning" (a technique he has used many times before, notably in "Frame-Tale," the first story of *Lost in the Funhouse*) is further problematized when, after the second story begins, it and its title ("Ad Infinitum: A New Story") are interrupted by the reappearance of the first story's title in the running head. Though ostensibly a printing error, given Barth's careful attention to detail and his previous play with the technology of print and with titles in

such works as *Sabbatical* and *Tidewater Tales*, it is almost certainly not a mistake. Rather, it seems to exemplify, intentionally, the structure of the so-called chaos sandwich in which an element of disorder or randomness is inserted between layers of order. Even if it were not so clearly intentional, it would still support the view that random elements interrupt and sometimes subvert the established structural order, perhaps creating another kind of order.

Whereas William Carlos Williams stated that the new physics must, in the first instance, affect structure in poetry, his writing also called attention to the use of language within a text. Certainly, one of the most obvious uses of language in relation to the new physics lies in metaphor, and we can expect this figuration of chaos theory in contemporary fiction as well. Some urge that because chaos theory is so holistic and relational, it naturally bridges disparate disciplines: "It is therefore natural for chaologists to extrapolate from one science to another, from the sciences to the humanities, from one art to another, and from the plastic arts to literature. This is what a holistic perspective like period style has always done, and chaos theory provides such perspectives with interesting new concepts and parameters" (Brady 5). This view suggests the degree to which scientific metaphor is relevant to fiction. The use of chaos and order as metaphor is generally appropriate for our perceptions of things falling apart, of coincidentally linked events, and of phenomena that seem knitted together in strange ways. To create an analogy between turbulent conditions in human affairs and, for example, unstable weather systems or water flow, is to lessen the intellectual and emotional distance that separates literature from its readers. Chaos and order conveyed through metaphor serves as a poignant reminder of the complexity in human lives and destinies, which at one moment seem so meaningless and at others so infused with meaning.

Metaphor may itself materialize notions of science. In *The Soft Machine* David Porush argues strongly that metaphor is not only the single most important link between literature and theories of science but is the basis of language and knowledge itself: "all language is based on metaphor and . . . metaphors therefore hold the key to deciphering the code of our knowledge, to mapping the hidden vectors of our cosmologies. Along with many theorists of language, I am convinced that the structures of our beliefs are founded on the metaphors we have chosen" (xi). In exploring the word *cybernetic*, Porush thus argues that it points to a new understanding of knowledge and reality: "I take the word *cybernetic* to embrace not only the information sciences but a metaphor so deeply ingrained in our culture, so silently driven down to the roots of our imaginations, that it achieves the status of an element in a new

mythology . . ." (2). Characters equated with the attributes and functions of machines in this information age are consequently called "cybernauts" and become "incarnations of a metaphor that can be stated quite simply: humans are only machines. Soft machines" (3). The cultural relationship between language, theories of science, and human behavior is thus so deeply embedded and interrelated that literature must of necessity in these latter days treat science through metaphor. Metaphor is the "deep structure" that augments and transforms literary structure in the most meaningful manner. That having been said, however, we should remind ourselves that metaphor, too, has its limitations. As Oedipa Maas fears in *The Crying of Lot 49*, it may have no consistent value: "The saint whose water can light lamps, the clairvoyant whose lapse in recall is the breath of God, the true paranoid for whom all is organized in spheres joyful or threatening about the central pulse of himself, the dreamer whose puns probe ancient fetid shafts and tunnels of truth all act in the same special relevance to the word, or whatever it is the word is there, buffering, to protect us from. The act of metaphor then was a thrust at truth and a lie, depending where you were . . ." (128–29).

Metaphor may be generally allusive in comparing human affairs and conduct with scientific precept, but it may also be calculatedly pervasive and scientifically based. The "noise" and "interference," for instance, that get in the way of attempts to communicate, understand a situation, or realize goals are very effective metaphors drawn in part from everyday experience with noise and in part from information theory. The idea that "life" in a general ecological and personal sense is a system is similarly drawn from experience and system theory, and this metaphor of a system can help us explore the relationship between the conscious and unconscious parts of the self. Indeed, the depiction of this relationship as systemic is arguably more than metaphorical; it is just as likely to be actual. In many cases, the actual and metaphorical converge, and it becomes impossible to separate them. As an example drawn from dramatic literature, John Guare's play, *Six Degrees of Separation*, is positioned upon this convergence of metaphor, structure, and reality. Within a single evening in Manhattan, the main characters in this play descend from comfort and stability into chaotic situations that will forever disrupt their lives. This transition from order to chaos and then to a new order is marked by the various episodes and events within the play, but it is also prefigured by the Kandinsky painting referred to on several occasions. Standing in the apartment of the main characters whose lives are so radically altered, this painting is two-sided, one with easily discernible patterns of order and the other with no pattern to be recognized amongst its confused elements. That they exist back to back and are inseparable becomes visually and

metaphorically meaningful in the play. The arrangement of narrative elements—its structure—is thus inextricably wedded to symbolic representation through stage properties, metaphor, and other critical tools of language, and the matter of the play concerns the relationship between disorder and order, stability and instability in human life.

Writers about chaos theory and literature often base and position their arguments on metaphor. Harriet Hawkins's analysis of Milton and Shakespeare is one such example in which metaphors of order and disorder are taken as the basis and justification for a critical study using chaos theory. Most critics, however, find that the influence of chaotics must affect structural principles as well. Patrick Brady assumes that chaos theory is taken into fiction as both metaphor and structure and supports his position by the example of the rococo in art, in which irregular shapes give way to a principle of order (10). John Barth similarly argues that the literary arabesque is used as metaphor and structure to reveal an orderly arrangement within seeming chaos ("PM" 284–90). N. Katherine Hayles believes that the presence of metaphors alone is insufficient ground for chaos theory to be used as a literary methodology—or for literature to affect scientific theory. She argues that modes of articulation and rhetorical discourse are far more complex and far-reaching than metaphor alone might suggest when language "shapes even as it articulates thought. There is," Hayles says, "an impressive body of work exploring how metaphors, narrative patterns, rhetorical structures, syntax, and semantic fields affect scientific discourse and thought" ("Introduction" 5). Although, for a scientist, a theory is assuredly more than a metaphor, this interaction between language and science at the level of metaphor may indeed be of special importance.

From some scientists' points of view a transference between language and concept is extremely likely to occur, changing the dimensions of physical theories. David Ruelle points out that when mathematical symbols are self-consciously connected to physical reality, we obtain a new physical theory that alters our perceptions. He also adds that "jumping from one theory to another [through language] is an important part of the art of doing physics" (*Chance* 12). Links of literary symbols and constructs to physical reality and theory are equally important and valid, certainly for the writer of fiction as well as the critic, and, strangely, perhaps for physics itself. It is, after all, the philosopher Lucretius—to whom present theoreticians of chaotics defer as one who in the earliest period of Western civilization had insight into the nature of chaos—whose metaphors lie behind much of the terminology of present-day science. Although literature is dependent upon science and technology for tropes, some argue that those very tropes in turn alter scientific knowledge:

> Literature is as much a product of the technological and scientific milieu as it is of the artistic one. Some of the large ideas, call them theories or metaphors—that humans are machines, that the observer affects the phenomenon observed, that information can be quantified—alter the way work is done in art. Metaphors invented by artists imply new ways of seeing, demolish mere logic, provoke alternatives, and lead to new theories in science. (Porush x)

Closely related to the use of structure and language as means of presenting conceptions of complexity theory in fiction is the use of models and modelling. Thomas Kuhn in *The Structure of Scientific Revolutions* maintains that science is built upon and presents itself in terms of models or paradigms, which construct meaning through assumptions, procedures, conventions, and cultural perspectives, though he later changed this argument, recognizing that science is not so subjectively based upon relativistic cultural models. Nonetheless, according to his original argument, a shift in language thus signals a fundamental change in perspective, which may seem revolutionary or merely part of an ongoing process of finer organization or "speciation" (*Trouble* 19). The twentieth-century novel's preoccupation with new perspectives and faculties of perception leads to an emphasis on "the roles of modes, models, and paradigms, including such literary concepts as genres, types, and archetypes" (Mellard 38). Indeed, this rhetoric of paradigms and models informs several modern literary studies, and Frank Palmeri for one argues that "myths and literary genres, like scientific paradigms, serve as conventional models of explanation. Just as normal science and periods of crisis alternate in the history of science, literary history consists of works that . . . combine or invert them" (979). Hayles acknowledges the importance of models but notes "the difficulty of translating [an] intuitive vision into an articulated model" (*Cosmic* 55) in both science and literature. She demonstrates the difficulty of such models when discussing D. H. Lawrence's treatment of the ineffable and nonlinear in *The Rainbow* and the nature of a successful treatment in *Women in Love* (*Cosmic* 95–97).

Scientific theories have already been used to create models in fiction. In *The Art of Excess*, Tom LeClair argues that many writers of "novels of excess" (those huge, unmanageable novels of the late twentieth-century such as *Gravity's Rainbow*) deliberately choose their monstrous baggy forms to model and replicate systems. He claims that "systems theory or systems sciences influenced . . . [such] novels, and that systems theory provides the best way to understand and appreciate all of these ambitious and sometimes neglected works" (13). He acknowledges that systems the-

ory in its original conception was primarily concerned with the dynamic processes of living systems (e.g., the ecological system), mechanical systems operating on the principles of cause and effect, and, later in the century, with computer systems, but asserts that it also investigates other versions of the world having to do with operations research, organizational planning, and "Newtonian business practices" (*Excess* 12). These latter "systems" concern certain applications or models of entire social, cultural, commercial, ethical, and juridical systems and explore relationships of the parts to the whole. Various subsets of these systems, such as the human body, are also often considered. Consequently, the use of weather and traffic are among central considerations, but cognitive processes and the activity of the brain are also of primary concern as metaphor, structure, and model. Indeed, psychologists have modelled the chaotics of the brain and self-identity. Part of the need for systems theory, LeClair contends, is to enable us to recognize uncertainty and incompleteness. As a result, when notions of systems are embedded and modelled in fiction, they involve uncertainty and incompleteness as well as showing the relations of the various parts to the whole. LeClair comments that systems novels defamiliarize the world and the text; "often possessing a deconstructive element," they are, however, "primarily reconstructive, showing how orders and forms in the world (and not just in the artistic text) can arise out of seeming chaos" (*Excess* 21). Within fiction this modelling is likely to be about human culture, patterns of activity, and various systems of information, which can be represented through various changes in structure and style, to say nothing of the content.

Palmeri argues that in *The Crying of Lot 49* Pynchon creates models of the sort that LeClair describes: Pynchon is concerned, he says, "with the extent to which scientific and literary paradigms determine what we perceive. . . he juxtaposes competing paradigms in search of possible alternatives" (980). Pynchon's interest in the use of models becomes readily apparent when Oedipa is asked by John Nefastis to try her luck as a "sensitive" with Maxwell's "Demon." When Nefastis says that "entropy is a figure of speech . . . , a metaphor. It connects the world of thermodynamics to the world of information flow" (*Lot 49* 106), the book quite explicitly indicates that the experiment in which she takes part shows the problems with competing notions of energy and work in various models of systems. In a living, biological system, energy is replaced naturally so that the systems continue to function, whereas in a closed mechanical system energy must be artificially imported to ensure the machine's operation. If energy is not imported, the system will use up the available energy, leading to "heat death," a cessation of the production of heat or "work." In a closed system the loss of heat results in entropy: that is, stagnation and sameness

or randomness and chaos. By referring to both organic and closed systems in Oedipa's encounter with this "demon," Pynchon demonstrates that this term *entropy* is not entirely at one with itself in science and points to the difficulties of systems and models. To complicate the issue, in information theory the term is used to describe the system's tendency to ever more elaborate levels of organization. The term *heat-death* does not apply to information theory, though a highly elaborated information system may crash because of its increasing levels of complexity and will need to be reconfigured in new and simpler ways. Oedipa is herself a kind of "model," who is unable to create "work" out of energy or to code and use all the information that washes over her. Although she hopes for some final revelation, a particular way of sorting information to realize a worldly or transcendental truth, the novel ends before that cherished hope is realized. By alluding to models, Pynchon demonstrates that systems do resemble one another, and that similar concepts and terms may apply, but ultimately that open, living systems and closed mechanical systems differ significantly from information systems. Pynchon suggests that models of any sort are means for human beings to strive to find or construct meaning, though such meaning can never be known either by a single model or through a comparison of models. The book, then, as Palmeri reasons, is about models of reality even while it serves as a model.

Whereas LeClair and Palmeri assume that fiction in general and systems novels in particular create various and often conflicting models to replicate, assess, and critique social and personal identity, and whereas writers such as Pynchon question such modes of discovering meaning in models, others such as Jean Baudrillard view models as potentially more harmful. In "Simulacra and Simulations" and *The Illusion of the End*, Baudrillard examines the loss of the "real" in contemporary society, maintaining that models are always only self-referential, self-mirroring models of models. Television is a case in point for Baudrillard, who finds that its programs and commercials are not, in fact, mimetic representations of life and its patterns but only replications of signs or artificial images previously put forward by the entertainment industry. In thinking about "the precession of models over the real," Baudrillard argues in *The Illusion of the End* that chaos theory represents an attempt to fill a void left by the disappearance of a metaphysical destiny:

> Chaos is a parody of any metaphysics of destiny. It is not even an avatar of such a metaphysics. The poetry of initial conditions fascinates us today, now that we no longer possess a vision of final conditions, and Chaos stands in for us as a negative destiny. . . . *Destiny is the ecstatic figure of necessity. Chaos is merely the*

metastatic figure of Chance. Chaotic processes are random and sta-
tistical in nature and, even if they culminate in the hidden order
of strange attractors, that still has nothing to do with the fulgu-
rating notion of destiny, the absence of which is cruelly felt.
(113)

For Baudrillard, chaos theory positions itself on a void, and literary "sim-
ulation" only models illusions, images, and discursive signs lacking a self-
critiquing quality. Arguably, then, "simulative fiction" about complexity
does not present models of life as life itself, but life as previously modelled
in systems and fiction. Such an assumption characterizes the highly pop-
ular *Jurassic Park* as written text and as film (including its sequel *The Lost
World*). Scientists can only guess what the Jurassic world might have been,
but the book and films present a world that seems complete in every
respect, partly based upon some scientifically founded assumptions but
more generally upon previous books and films about the prehistoric earth.
In the text of *Jurassic Park*, the story of this fabricated world stands side by
side the various interchapters or "iterations" that explain parts of chaos
theory, making certain that the reader understands the implications of the
model. Oddly, then, the most nearly "real" aspect of the book is the theory
about complexity embedded in the iterations, whereas the narrative is by
and large mere simulation.

Arguably the most interesting use of complexity theory in literature is
in the nature of content itself. This phenomenon occurs in two significant
ways: through a text that demonstrates the chaotic patterns and effects in
the lives of the characters and in the progress of the plot, and through a
"metachaotic" text that self-reflexively uses chaotics and comments on
that use and the theory itself. As with the systems novels discussed by
LeClair, actualistic fiction considered by Strehle, and cybernetic fiction
taken up by Porush, the "dynamic fiction" of complexity often uses a par-
ticular premise of chaos theory on which to construct the plot and moti-
vate the characters and, often, to comment on the theory itself, whether in
a playful or serious manner. A novel, for instance, may be posited on the
basis of a sensitive dependence upon an initial condition and then follow
that through to the extreme turbulence of its conclusion. Dynamic fiction
is also able to explore and utilize human biological processes and, by
extension, mechanistic designs and social processes. Explorations of
chaotic conditions in the natural world can be extended to the human ani-
mal and its activities, which are so closely related to other forms of natural
activity and patterns—and indeed to the entire environment. Although
these are serious issues, not all works have to be inherently serious, as cer-
tain metachaotic texts demonstrate.

Cormac McCarthy's *All the Pretty Horses* deals with complex and non-linear systems, boundaries, and transgressions in a demonstration of the force of the operation of accident and random chance in life and the magnitude of the unforeseen results. It calls into question certain understandings of complexity and suggests that iterations with useful feedback are not always possible. The evocative title of this book, drawn from the traditional nursery song "All the Pretty Little Horses," highlights the complementarity of complex multiple systems and recursions which this book considers. Some of these complementarities are decidedly ironic and others are used in a straightforward way. Certainly the title of the nursery lyric coupled with the account of the main character is ironic. Given its associations, the title of the nursery rhyme at once implies the desire for, and refusal of, fulfillment. Meant to soothe and put a fretful child to sleep, the nursery song promises plenitude:

> Hushabye, don't you cry,
> Go to sleepy, little baby;
> When you wake, you shall have cake,
> And all the pretty little horses.
> Black and bay, dapple and gray,
> Coach and six white horses.
> All the pretty little horses.

As a sixteen-year-old, the hero John Grady Cole might seem to have had few disruptive experiences and to have cherished hopes for "cake" and "pretty horses." Raised on a ranch by his grandfather, he has had a relatively protected life and opportunities to enjoy the outdoors. The image commencing the book, the candle flame caught in the pier glass of the door opening on to a corridor hung with portraits of his forebears, implies a privileged life of relative stability and order, though the flame suggests destructive potential as well. Similarly, his proposed trip to Mexico on horseback seems to offer similar plenitude, hope, and diversion for the young protagonist whose companions are the almost equally young seventeen-year-old Rawlins and the thirteen-year-old Jimmy Blevins.

To conflate the meaning of the nursery lyric and John Grady's life and present them as complementary does not work, however. His story is not a soothing bedtime lyric of plenitude, but one of surviving increasingly insurmountable difficulties and odds. Idealized childhood "reality" is not

identical with his life, for his mother abandoned him as an infant, his father spent time in prison, the family ranch was lost after his grandfather's death, and he was forced to seek other possibilities. His trip to Mexico on horseback with his friend Rawlins was to have given him an alternative, evoking male companionship, links with the land, and romantic kinship with the "lost nation" of the Comanches and other tribes whose paths he follows and who represent the "dream of the past" (5). Perhaps even Mexico itself evokes this dream of the past. John Grady's actual journey, though, emphasizes his loneliness and the violence he shares with the human race and nature itself: the Indians' fondness for "the blood and the heat of the blood that ran" in horses; the blood and violence of his own white family; and nature itself encapsulated in the "red wind blowing out of the west" and the sun sitting "blood red and elliptic under the reefs of bloodred cloud before him" (5). Various manifestations of violence thus replace complementarity in levels of order.

His hubris in ignoring the forces of another culture which results in violence, however, has some rough parallels in his own ancestral experience, and this complementarity suggests homologous kinds of violence or systemic chaos. John Grady Cole's grandfather was the only member of his family to have died naturally on the ranch; others died in various violent circumstances after the land was seized by whites from the Indians. John Grady's father alludes to the arrival of the white man two centuries earlier, and the fear that the Comanches must have felt constantly as their heritage was stripped from them (25–26). Indeed, this regional and familial pattern of violence echoes other such episodes in American social history, as reflected in the time of the story itself, the months of September 1948 to December in 1949, though most of the action transpires between John Grady's departure from San Angelo around the closing date of the property settlement in June and his return in December. The year 1948 serves as a reminder of the war waged against Mexico almost exactly a century earlier by the United States to increase its territory in the Southwest. The treaty of Guadeloupe Hidalgo of February 2, 1848, marked the final stage of the U.S. policy of Manifest Destiny and resulted in the acquisition of the territories of California and New Mexico, almost two-fifths of the Mexican lands lying to the south and west of the American border. The book suggests yet another colonizing incursion when mentioning that one of Grandfather Cole's brothers had been killed in Puerto Rico in 1898. This battle was part of the Spanish-American conflict which saw such Spanish colonies as Puerto Rico and the Philippines appropriated and colonized by the Americans. Still another period of national bloodletting must be taken into account. Since World War II had ended shortly before the story's beginning, it is remarkable that no men-

tion of the war appears in the text. Such backgrounding must call attention to itself through its very absence, especially since the war was fought because of the cultural and military intrusions of Germany into parts of Europe and Africa and of Japan into Hawaii and China. The United States had hardly more justification for its invasion of Mexico than did the axis nations in Europe and Asia, and both attempts were rooted in the desire of one person, tribe, or nation to deny another its identity, integrity, and space. Bloodshed repeats itself, then, in endless recursions from the most personal and familial level to superpowers and international alliances, with the motivation and effects being appallingly similar in each case even though the cultural circumstances and people differ. In this book whose time and setting mark a centenary memorial of the conquest of Mexico, McCarthy may be suggesting that bloodshed is itself the common, recursive denominator, the real basis of complementarity, in the human experience and often results from the most trivial of causes.

The boys' attempt to "conquer" the Mexican culture south of the Texas panhandle is on a much smaller scale than ancestral battles against the Indians or the conflict of nations, but it arises from a similar thoughtlessness and disrespect for the territory, customs, and culture of others, and, on its own microcosmic level, is equally tragic. It is tragic for several reasons: John Grady and Rawlins intrude upon the aristocratic family of a young woman, nearly lose their own lives, are in some sense responsible for the death of Blevins, and cause the death of other men. These endlessly iterative cycles of bloodshed involving a legacy of conquest and reprisal have surely marked these various individuals, tribes, and nations with the sign of Cain.

What is it that sets off such catastrophes? In the case of Cole's ancestors, the United States, Germany, and Japan, it was generally the desire for more land, but that motive does not necessarily account for a particular occasion or event. For John Grady the directly attributable cause might well be his mother's decision to sell the ranch, or perhaps his father's failure either to contest his mother's petition for a divorce or to make sure the ranch would revert to John Grady, or perhaps some other, even less significant reason. Perhaps it is love itself, for it is his falling in love with Alejandra and agreeing to her overtures that goes against the family code and so enrages her father and aunt. Indeed, a particular cause, whether large or very small, may not be discernible in the creation of such large-scale effects, and, as Patrick Corcoran has previously noted, the "disproportion between cause and effect" (62) is a sure sign of the use of chaos theory in fiction. As Rawlins himself says when the boys are talking, "Somebody can wake up and sneeze somewhere in Arkansas or some damn place and before you're done there's wars and ruination and all hell.

You don't know what's goin to happen" (92). This view is reiterated in different form by the Duena after John Grady's release from a Mexican prison, when she remarks that "human decisions [are connected to, but] more and more remote from their consequences" (230). When John Grady is thrown into prison in Mexico, is it the result of causes in Texas, or his acquiescing to Alejandra's overture on the Mexican ranch? It might be any one of these more or less personal and seemingly insignificant causes or the cumulative effect of all of them. What is at work is a typical butterfly effect, in which a minor incident precipitates uncontrollable turbulence and results in large-scale catastrophe. Or it might also be that multiple seemingly insignificant causes result in temporarily uncontrollable turbulence leading to unforeseen results.

John Grady Cole's dilemma is an example of steady-state activity and order suddenly thrown into disorder and turbulence, and, while one might tend to think of turbulence as characteristic of natural biological or physical systems, certainly turbulence is an inherent part of human life as well as physical nature. Cole's rapid transition from order into chaos and back to a new kind of order in this period of four months may seem bizarre and grotesque, but it typifies a system that radically and rapidly changes from order to chaos and then either remains in a chaotic state or moves to another order—but that will never be the same as it was. And the book is a good example of dynamic fiction in which such premises of chaos theory are woven into the fabric of the rhetoric itself.

Whereas *All the Pretty Horses* is an apt example of a narrative positioned on one or more aspects of chaos theory, here of sensitive dependence upon initial conditions and complementarity, John Barth's *On With the Story* illustrates a postmodern, metachaotic text that simultaneously uses chaotics and draws it self-consciously to the attention of the reader. In *On With the Story*, John Barth uses the quantum and chaotic notions of particle and wave to structure his story cycle and to play with and provide comments on that use throughout the narrative. This self-consciousness leads in Barth's case to self-reflexivity and self-referentiality, which Hayles believes are mutually defining features of the postmodern text and "post-Newtonian science" (*Cosmic* 41).

Although Barth is known mainly for his novels, he has written a number of short stories, which are organized around certain themes and structural devices and which consequently become novelistic in their own right. Consisting of twelve numbered and titled tales with another twelve unnumbered but titled interchapters, *On With the Story* creates one cycle, or perhaps two interlocking cycles, simultaneously unified and separated by the uncertainty principle, nonlinearity, particle-wave duality, and time. Structurally, the short story cycle especially supports the wave-particle

duality insofar as a short story is in and of itself a unique and separate piece of fiction, but, as a cycle, the stories share in a larger unity. They are indeed the equivalent in fiction of John Briggs and F. David Peat's description of the particle-wave paradox:

> Physicists learned, for example, that an elementary unit of light can behave schizophrenically like a wave or like a particle, depending on what the experimenter chooses to measure. The theory also proposed that if two quantum "particles" are separated by several meters with no mechanism for communication between them, they will nonetheless remained [sic] correlated in some mysterious fashion. As recent experiments show, a measurement performed on one such particle is correlated instantly with the result of a measurement on its distant partner. (*Turbulent* 29)

Barth's stories do behave independently, but also behave like a wave through their related stylistic features, structures, themes, and characters. This "communication" between the stories does not, however, mean that they are related in a linear fashion. Indeed, Barth skips about, creating hypertextual possibilities, a feature that he self-consciously introduces: "There are, to be sure, ways of paying one's bills by brilliantly defaulting on them: apparent non-endings that are in fact the best of endings, anyhow the most appropriate." He includes among these the "roller-towel ending/rebeginning" and the "recombinatory 'replay' ending," but he also alludes to the hypertextual novel that "may be entered, transited, and exited at any of the many possible points and waypoints" (17).

Of course, Barth does not invent the device by which the short story is simultaneously a thing in itself and part of a larger cycle, that is, a particle-wave duality; this phenomenon is basically a feature of twentieth-century Modernism which arises out of the same cultural milieu as the new physics. An important aspect of this phenomenon is a dismissal of Newtonian cause-and-effect thinking, and an embracing of uncertainty. Wave-particle theory, for example, suggests that it is impossible to determine whether light is a wave or a particle because paradoxically it is neither and both. So, too, with Barth's stories. In one of the first, "Ad Infinitum: *A Short Story*," Barth's title playfully suggests an irresolvable paradox between something short and attenuated and something long and endlessly open-ended. What Barth suggests in this particular story, he also indicates across the collection as a whole: although the reader expects these stories to be self-contained—and in a sense they are—they have an open-endedness to them, so that they seem incomplete and,

indeed, leak into others. In story number 11, "Ever After," for example, the direction of the story suggests that the main female character is about to be raped, but that narrative line is dropped and another picked up. The possibility of the rape is hinted at, but not resolved, in the final story, which leaves the reader uncertain about any ending: "'The end,' she'd say. No way, 'd say he: There're narrative options still unforeclosed, other storyworldlines wormholing through the multiverse" (256). Indeed, the book is positioned on the uncertain: the stories lack a conclusion, the title of the final story ("Countdown: *Once Upon a Time*") suggests infinite beginnings, and the title of the first story refuses its opening status ("The End: *An Introduction*"). In terms of structure and content, endings and beginnings (as well as births and deaths) cannot be seen as singular and independent:

> Of the End of Art we have been hearing ever since this century's beginning, when Modernism arrived on the stage of Western Civ. Picasso, Pound, Stravinsky—all felt themselves to be as much terminators as pioneers, and where they themselves did not, their critics often so regarded them: groundbreakers, yes, but perhaps gravediggers as well, for the artistic tradition that preceded and produced them. (14)

The metaphors in and subject matter of these short stories are also self-consciously quantum and chaotic. In "The End: *An Introduction*," Barth alludes to Zeno's paradox which is sometimes viewed as one of the first allusions to fractal-like phenomena. According to Barth's account, Achilles could never catch a tortoise in a race "for in whatever short time required for him to close half the hundred yards between them, the sluggish animal will have moved perhaps a few inches; and in the very short time required to halve that remaining distance, an inch or two more, et cetera—ad infinitum, inasmuch as finite distances, however small, can be halved forever" (26). Not content to let that allusion stand as a simple suggestion, Barth goes on to assert that "history is a Mandelbrot set, as infinitely subdivisible as is space in Zeno's paradox. No interval past or future but can be partitioned and sub-partitioned, articulated down through ever finer, self-similar scales like the infinitely indented coastlines of fractal geometry" (28). The narrator's mentioning of these links, of course, sends the readers scurrying to see how such sets and scales might work in the fiction and, given Barth's playful and metafictive spirit, they are hardly disappointed for this is a story and an entire collection about repetition of irregular patterns across large and small scales, or what has come to be called self-similarity across scale.

Another story in the collection, "And Then One Day. . . ," resumes this narrative, but with a twist: the story is partly about the memories of the main character Elizabeth and her dead father, their inherent untrustworthiness, their ability to keep someone's "life" going, and their function in art. Memory, then, raises serious questions about time and linearity: is Elizabeth's father really "dead" if he is alive in her memory, or how can life be "measured" if there is a half life in memory? It also raises a question about "some small quantitative increment precipitating a significant qualitative change" (47)—the so-called butterfly effect—as it relates to the idea of death triggering Elizabeth's act of imagination. So, while the story notes that her father had an "unstable homeostatic system" (36) and that all "general systems wear out" (34), the narrativization of memory provides renewal. Indeed, the story works toward a model of narrative that suggests that human entropy paradoxically is transformed into and creates informational energy, thus providing a theory for the basis of all creative writing. As the story itself notes: *"In the jargon of systems analysis . . . , the unstable homeostatic system is incrementally perturbed by the you-know-whom and anon catastrophically restored to a complexified, negentropic equilibrium"* (40).

Still another tale, "'Waves,' by Amien Richard," directly raises the issue of the particle-wave paradox when Amy, one of the two main characters, asks her partner Richard, "Are we particles . . . or waves" (106). Almost immediately, the narration reemphasizes the importance of quantum physics in adding that "With wet fingertip Amy taps her borrowed *Scientific American*. 'Says here that photons behave like particles sometimes and other times like waves. I'm wondering how it is with us'" (107). In a very metafictive manner, the characters assert that they "are decidedly in the Particle Mode: particles particles particles" (119), but the story brings in several uses of waves, among them: the "rogue wave" that nearly destroys their sailboat and marriage (as recorded in another story, "Preparing for the Storm"); the porpoises playing in their "bow wave"; and Hokusai's woodblock print *The Breaking Waves Off Kanajawa* (120), which is famous as an example of fractals (Briggs and Peat 112, 198); Lucretius's notion of flux and flow in water and waves; the fans' raising their arms at baseball games in a gesture called "the Wave"; and waves of fear that overcome Amy and Richard at certain moments. These various usages incorporate the real, the pictorial, and the metaphorical, suggesting multiplicity and raising questions about singularity.

Amy's question about whether she and Richard are particles or waves is particularly relevant because they are floating in the water in Grand Bahama, and she wants to understand her environment as well as she can. She also raises the question because she and her husband are trying to decide whether to call a collaboratively written short story " Waves" or

"Particles." This becomes a wry, metafictive comment because the nom de plume they use for their collaborative efforts is "Amien Richard," and the title of the story is "'Waves,' by Amien Richard." Metaphorically, the question also helps to establish the nature of Amy's relationship with Richard: they are individuals but at the same time a couple trying to keep a marriage intact despite certain pressures; they write independently and yet collaborate on fiction and nonfiction, with Amy as the "brains" and Richard as the "voice." This construction of their identity around "the quantum," however, gives way to chaotics per se. Their identity as writers and as a couple may well be described as wave and particle, but the nature of their relationship, like the particle and the wave itself, is chaotic: they have had a serious disagreement and realize that, while their marriage will likely continue, it has altered because of the turbulence, though it may be enriched by it, even as "this present trough between waves of prosperity is exactly the time to buy into the distressed market" (118). An assessment of the stock market based on chaos theory thus resembles their marriage, which, in turn, resembles the flux and patterns of nature. Citing Lucretius, they note that atomic particles "unaccountably *swerve* from their parallel paths, bump their neighbors, and thereby initiate the ongoing catenation of collisions, couplings, and decouplings that generate stars and planets" (131). One of the most powerful symbols in this tale is a small conch, which at the story's conclusion Amy picks up and hides, a small conch "whose exposed surface has been abraded by wave-action to reveal the delicate, self-replicating inner volutes" (140). However, the story does not stop there, subtly pointing to order within disorder, but wryly comments on such stories that raise the question about the chaotics of relationships: "Does that not imply that A&R's marriage . . . that, indeed, all human relationships, are waves? Sure it does: the same wavish partners, by and large . . . but even in the stablest of instances the dynamic of their relation is ever in flux, continually disequilibrating and . . . continually returning toward equilibrium" (143). By raising and exploring the question of waves and their implications in physical nature, human relationships, and fiction, Barth's metachaotic construct eschews a simple, orderly resolution, parodically uses and abuses the concept, and ultimately erodes the boundaries between physical science, human nature, and literary constructs: that is to say, between chaos as a fact, a concept, a literary structure, and a metaphor.

All of these—fact, concept, literary structure, and metaphor—are later invoked in the title story of the collection. This curious story involving the acts of living, writing, and reading uses framing techniques and *mise en abyme* to suggest the inherent difficulty of separating art from life or even of admitting that art is derived from life. This story suggests that art

contributes to life and that, indeed, life may draw some of its central precepts and modes of action from art itself. If literature (both the reading and writing of it) and life reciprocally influence each other, then it is impossible to arrive at a simple notion of linear cause and effect. What we normally consider causes may be effects and vice versa; an effect may be the result of an infinite number of causes; or one cause may result in an infinite number of effects. This story, then, creates a story and universe of infinite complexity, which is governed or held together by certain irregular patterns or strange attractors. The narrator self-consciously raises the possibility of attractors by noting that "the great Virgo Cluster . . . is apparently rushing en bloc at a staggering near-million miles per hour (950,724) toward some point in interclusteral space known as the Great Attractor" and an "Even Greater Attractor" called the Shapley Concentration (82). Underscoring the sense of determinism that underpins chaos theory, this comment refers to various governing late-twentieth-century ideologies (the Freudian psychology, Marxist philosophy, and quantum mechanics of "Love Explained") as well as texts and films identified in "On With the Story" that have become magnets and tools for the imagination. In fact, "On With the Story" suggests that attractors for human beings over time have not so much been the various ideologies as the various forms of narrative inherent in literary productions. It is, then, the embodiment of imagination in narrative that provides focus and impetus for human beings, not unlike the Great Attractor in space. Imagination may have false starts and it may sometimes seem beset with problems, but there is an irresistible drive—like life itself—which impels writer and director as well as reader and viewer ever onward toward narrative.

Barth's text also argues that such order and magnetic power arise partly from the interaction of the various systemic elements of fiction itself and the viewer's response as such. As "Love Explained" notes, *The observer is as essential to the creation of the universe as the universe is to the creation of the observer*" (102). The observer may be the narrator of the fiction who has ostensibly witnessed certain events and "translated" them for the readers or the observer may be the reader.

Although the complexity theory represented within such literary texts as McCarthy's and Barth's is textually intriguing, its implications for some readers are unsettling. These implications are especially controversial in textual comparisons of people and their society to systems and chaotic processes, as if the individuals concerned were manifestations of a goal-seeking natural process or a mechanized closed system. The difficulties with this perception concerning determinism are implicit in certain scientific theories themselves. When Richard Dawkins writes in *The Selfish Gene* that the process of natural selection is one of symmetry and logic based on

"the gene's law of universal ruthless selfishness" (3) and the *"survival of the stable"* (13), he is stating that the basic development of life, with its cyclical recursions and iterations, is a deterministic pattern. In other words, the proliferation of life forms owes itself to a selfish gene that wishes to ensure the development and continuation of life. All the rest—environmental conditions, individual selection or group selection, and, in the case of human beings, the importance of choice—is only masquerade.

Although Richard Dawkins's genetic determinism is the subject of considerable controversy within the scientific community and is not favored by most biologists, his comments raise one of the most vexing questions about literature in this age of new theories about life: they suggest that much of life may be deterministic consisting of some innate pattern or shape that serves as a magnet, drawing everything toward it. Hence, although people think of themselves as living independently and making individual decisions, that independence paradoxically serves larger structural purposes, some strange pattern of attraction. This theory is heavily deterministic, but it does not deny that human beings still make certain kinds of choices and need to live out their lives in responsible ways. In a sense, the philosophical implications of complexity theory and dynamic fiction are in line with the particle/wave theory, suggesting that people are simultaneously both free agents and part of a larger pattern or structure. Differing considerably from some of the existential philosophies of the early part of the century, which stressed free choice and individual human responsibility, or some of the naturalist fiction before that, which stressed social and biological determinism, chaos theory with its complicatedly paradoxical notion of free will and determinism is simultaneously exhilarating and disturbing.