

INTRODUCTION

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Any alteration in man's physical position in the universe must correspond to an alteration in his intellectual and affective position, thus of literary discourse, which is the sum of all these coordinates.¹

Michel Rio

Alterations

A generation of writers was born into the world according to Einstein and Bohr, the world of the new physics whose questions and concepts and names, let alone proofs, the old physics never knew or imagined. This world has black holes and antimatter, quasars and neutron stars. At the subatomic level, Heisenberg's uncertainty principle rules, with the resulting absence of absolute predictability, and experiments, thought- or real, from Einstein to Aspect, test theories of quantum "ghosts." This world allows for Schrödinger's reading of quantum measurement, which makes whether a cat exposed to cyanide is dead or alive dependent upon the observer, and for Everett's tree of multiple realities, parallel universes that are physically disconnected but equally real, and for the notion of quantum-mechanical nonlocality, a kind of permanent memory or mysterious imprint and

¹ Unless otherwise noted, all translations in the introduction are my own.

instantaneous communication between once-linked particles, even when they are separated far in space.² In the old physics, Newtonian theory, every atom moves along a trajectory that is uniquely determined by the forces that act on it, forces that in turn are determined by other atoms in a rigid network of cause and effect. Newtonian mechanics is seen as permitting, in principle, the accurate prediction of everything that will ever happen, from the tiniest jiggle of a molecule to the explosion of a galaxy. As Pierre-Simon Laplace explains it, if a mind could know all the forces of nature in any given instant, the future could be read like the past; before the observer's eyes would be the totality of history.³

But where is "history" in a world in which space and time are not absolute and universal but rather elastic, not flat and obeying the usual rules of Euclidean geometry, but rather curved or warped; not fixed but rather dynamic, "stretching, shrinking, even stopping altogether at a singularity";⁴ a world where one cannot speak of the past or the future, where time no longer "passes" but is laid out as part of a four-dimensional structure, space-time? What happens to the individual, made of history and of memory? What happens to morality in the absence of predictable cause and effect? Or to such ancient debates as free will versus determinism? On the one hand, through quantum theory, the new physics would seem to prescribe for the individual observer an extraordinary role, one never dreamed of by Newton: *influencing* the very nature of physical reality. On the other hand, there is relativity, banishing the notion of universal time, of an absolute division into past, present, and future, conjuring up an image of a future that in some sense already exists, "and so cuts from under our feet the victory won with the help of the quantum factor. If the future is *there*," physicist Paul Davies asks, "does it not mean that we are powerless to alter it?" (Davies, 135).

Conceptual changes of this magnitude obviously affect, as they were affected by, society at large. A way of thinking, an entire vision of the universe and of the self, is altered; the questions posed, and the language in which they are posed, must be invented or reinvented. "The common

² Some of the concepts to which I refer are a source of debate among physicists themselves, and "mainstream" physicists are quite disparaging of many of the stranger notions put forth. My intention, obviously, is not to enter into the debate of quantum theory but only to catalog some of the ideas that it has put into circulation.

³ Pierre-Simon Laplace, *Essai philosophique sur les probabilités*, 5th ed. (1825; reprint, Paris: Christian Bourgeois, 1986), 32-33.

⁴ Paul Davies, *God and the New Physics* (1983; reprint, London: Penguin, 1990), 121, 123.

division of the world into subject and object, inner world and outer world, body and soul is no longer adequate," Werner Heisenberg insists.⁵ In effect, one could claim that the new physics relegates to "antiquity" the very notion of "third person" and "first person." Or as Bertrand Russell observes, "It has begun to seem that matter, like the Cheshire Cat, is becoming gradually diaphanous and nothing is left but the grin, caused, presumably, by amusement at those who still think it is there."⁶ And I have not even touched upon the implications of fields such as biotechnology, genetics, cybernetics or, for that matter, computer science that in itself has changed our very notion of an educated person, no longer measured by the books in one's library. French author Michel Rio has rebuked literature and literary critics, urging them "to stop pouring out the kind of specialized stupidity that says 'After Proust, Kafka or Joyce, we can't write the same way,' and sooner say 'After Copernicus, Newton, Darwin, Planck or Einstein, . . .' and by this means establish a new relation between the writer and the world, solitude and the collective, or reawaken an ancient one."⁷

That relation, new or ancient, is suggested by Rio through a hired killer. The protagonist of his 1991 novel *Faux Pas* enters the "safehouse" of his prey and, while waiting for the man he will execute on contract, undertakes an examination of the library. The organization is simple: physics and astronomy, followed by biology and ethology, then history, and, finally, literature; this order, we are told, offers "a fairly representative sample":

It starts from the broadest discipline, from the point of view of the scope, space and time of its object of study, and finishes in the narrowest, each ensemble containing in principle that which follows: physics, biology, history, literature. . . . For moving back up the chain, one can say that the imaginary is no more than

⁵ Werner Heisenberg, *Physics and Philosophy* (New York: Harper & Row, 1958), cited in Davies (112). Quantum theorist David Bohm makes further observations along these lines in Bohm, *Wholeness and the Implicate Order* (London: Routledge & Kegan Paul, 1980).

⁶ Bertrand Russell, cited in Alastair Rae, *Quantum Physics: Illusion or Reality?* (1986; reprint, Cambridge: Cambridge University Press, Canto, 1995), 67.

⁷ Michel Rio, "L'essentiel et l'accessoire," in *Rêve de logique: essais critiques* (Paris: Editions du Seuil, 1992), 88.

one of the cultivated fields of consciousness, consciousness an accident of the animate, and the animate an episode of matter.⁸

The fiction with which I am concerned in this volume climbs that chain. It explores the fields of culture, consciousness, and matter and speculates on the shifting levels of relation among them.

Relation and Residue

The word “relation” is key here, and is implicit in my introducing a kind of fiction through reference to matricide by the natural and social sciences and the impact on thought of the new physics. The question in all of this is the relation between bodies of knowledge and imagination, and this leads me back to a specific moment in contemporary intellectual formation. France in the 1960s and 1970s, a “new” perspective takes hold: structuralist theories and method, the basic tenets of which had been laid out in linguistics by Ferdinand de Saussure a half century before, then by Roman Jakobson in the 1920s, become the central intellectual issues of debate.⁹ Two phenomena within the structuralist enterprise particularly color the period: after the schismatic cloistering of disciplines born of scientific specialization in the mid- to late-nineteenth century, the embracing of an interdisciplinary perspective, eloquently illustrated by the varied disciplines of the leading structuralists themselves; and the “sciencing” of the humanities, in reality a subphenomenon of interdisciplinarity and inseparable from structuralism’s being a *method*.

“Sciencing” comes now to social anthropology, where G. P. Murdock and Claude Lévi-Strauss insist upon the importance of the “mathematization” of the discipline. Both use the method of models, Murdock with simple statistical models, and Lévi-Strauss with more complex algebraic

⁸ Rio, *Faux Pas* (1991; reprint, Paris: Editions du Seuil, Points Roman, 1993), 18.

⁹ As early as 1907 Saussure had called for the “scientific” study of language based upon its systematic nature and had defined linguistic elements in terms of relation and function. Jakobson was already employing the term *structuralism* and calling for the scientific study of language as a system in 1929. For ease and simplicity, I have limited my general references in these paragraphs to one of the standard texts on structuralism, contemporary to the movement I discuss: *Introduction to Structuralism*, ed. Michael Lane (New York: Basic Books, 1970). The collection includes essays by, among others, Roland Barthes, Claude Lévi-Strauss, Jakobson, and Saussure.

ones. Lévi-Strauss, moreover, will hold that the most important line of future advance in the field, the development of laws of transformation, can come about only if anthropologists are able to formulate their structures algebraically. Similarly, other scholars, Georges Guilbaud and H. Hoffman among them, begin applying logico-mathematical techniques and expressions to complex social phenomena (Lane, 34). In linguistics, Noam Chomsky's generative grammar puts forth the theory of an innate, genetically transmitted and determined mechanism that acts as a structuring force in man, a theory that finds general, if implicit, acceptance among structuralists such as Lévi-Strauss, Jakobson, Jean Piaget and, in biology, François Jacob. Of course, linguistics also provides the impetus for the literary domain, where it manifests itself in an attempt to be treated as a science of language applicable to languages that *use* language, that is, to literature. Criticism does not deal with the world but with discourse. Roland Barthes writes: "criticism is discourse upon a discourse; it is a second language, or a *metalanguage* (as the logicians would say), which operates on a first language (or *language object*)."¹⁰ When Barthes speaks of *jeux de figures*, the conceptual equivalent of Lévi-Strauss's models, and of *combinatoire*, a calculus of combinations, "analogous to laws of transformation" (Lane, 37), literature is being "scienced": "mathematics" comes to literary study. Edgar Allan Poe is proven right: out of mathematics, poetry is born.¹¹

The euphoria does not last. Reactions, a number of which structuralism had foreseen, and even accounted for within its own methodological framework, set in. By the 1980s, in academia, poststructuralism, then deconstruction, have taken firm hold. But there are residues, and structuralism's underlying tenets have fallout which, in my view, has been underestimated in the development of a certain kind of fiction produced in the following decades. The fallout takes the form of a number of easily observable cultural events, any discussion of which risks painfully belaboring the obvious. My tour of the terrain will be brief, and determined by my specific concern, the production of fiction.

¹⁰ Roland Barthes, "What Is Criticism?," in *Critical Essays*, trans. Richard Howard (Evanston, Ill.: Northwestern University Press, 1972), 258.

¹¹ See, for example, Edgar Allan Poe, "The Philosophy of Composition," in *Edgar Allan Poe: Essays and Reviews* (New York: The Library of America, 1984), especially 15–16. Originally published in *Graham's Magazine* (April 1846).

History, philosophy, and science dwelled together comfortably, or at least cohabited, before their separation into specialized disciplines in the mid- to late-nineteenth century. In the aftermath of the structuralist debate, the dialogue among them reopens in a different form and finds its welcome not in France but primarily in the Anglo-Saxon world. As an academic discipline, that new dialogue bears the label History and Philosophy of Science, its name evoking a trinity.¹² As a field of study it is interdisciplinary, opening up in a number of directions by bringing together historians, philosophers, and scientists, albeit at times to debate which of them should be working on the history and the philosophy of science. In practice it stresses the relation between general culture and scientific development, the relation between John Stuart Mill or William Whewell's choice of scientific models of the universe and their political philosophy, for example, or the relation between the discovery of electromagnetism and the rise of Romanticism. Of central significance is the fact that this field creates awareness of the total interdependence of cultural phenomena in the development of what for long were taken to be "objective" and exact sciences. Stephen Jay Gould, who in addition to evolutionary biology and geology teaches the history of science—a fact wholly pertinent, I believe, to his success as a popular science writer—insists on this:

All great theories are expansive, and all notions so rich in scope and implication are underpinned by visions about the nature of things. You may call these visions "philosophy," or "metaphor," or "organizing principle," but one thing they are surely not—they are not simple inductions from observed facts of the natural world.¹³

History and Philosophy of Science also recognizes specifically the importance of language in scientific discovery. Discovery brings with it a need to name, a need for coinage (as a philologist Whewell was regularly consulted by scientists for this purpose); and persuasion, or argumentation, based on the use of written language, can play the critical role in the fate

¹² History and Philosophy of Science is the British subject title. In the United States it is often simply called "History of Science."

¹³ Stephen Jay Gould, *Time's Arrow, Time's Cycle: Myth and Metaphor in the Discovery of Geological Time* (1987; reprint, London: Penguin, 1988), 9.

of a theory. "Science self-selects for poor writing," Gould notes, and serves up an example in nineteenth-century geology's uniformitarianism-catastrophism debate (Gould, 107). While defending James Hutton, on the one hand, against the unkind charge of being the worst writer in the history of science, Gould notes that the standard exposition of Hutton's theories, both then and now, comes not from Hutton's own book, but from that of his friend John Playfair, a superb writer. Charles Lyell, on the other hand, trained as a barrister, owes his reputation, and the success of his uniformitarianism concept of geology, as much to his mastery of language in brilliantly arguing his theories as to the theories themselves. Rhetoric, textual analysis, questions of style, and modes of expression are recognized in *History and Philosophy of Science* as crucial to the life of scientific concepts. "Literary" considerations are thus brought to the unfoldment of scientific theory.¹⁴

Language matters in another direction as well, for contemporary *History and Philosophy of Science* is largely responsible for making scientific material accessible to nonscientists, not only because of its global perspective, but because it talks about exact science in the languages of both the social sciences and the humanities. This is a form of translation, and translation is a good thing. But its perils are well known: *traduttore, traditore*, and this kind of interdisciplinary "translation" opens up a Pandora's box of questions regarding loss of meaning, or the exactitude of meaning, when concepts are translated from the unambiguous language of mathematical equation into the murkier world of the word. Nonetheless, this translation is a critical feature of the decades that follow the apogee of structuralism, and if *History and Philosophy of Science* resides in universities, it springs off-campus what I call "upscale popularization," or science as best-seller. A scattering of names suffices to illustrate the phenomenon: in addition to Gould, John D. Barrow, Jean-Pierre Changeux, Paul Davies, Richard Dawkins, Freeman Dyson, Martin Gardner, Stephen W. Hawking, Douglas R. Hofstadter, John H. Holland, François Jacob, Robert Jastrow, Steve Jones, Stuart A. Kauffman, Alan Lightman, Jacques Monod, Roger Penrose, Steven Pinker, Alain Prochiantz, Hubert Reeves, Carl Sagan, Isabelle Stengers, Lewis Thomas, Jean-Didier Vincent, Steven Weinberg, Edward O. Wilson. All are scientists writing in nonscientific language and for educated, but not necessarily

¹⁴ Gould's own superb science writing is subjected to rhetorical analysis in *Understanding Scientific Prose*, ed. Jack Selzer (Madison: University of Wisconsin Press, 1993).

specialized, publics, opening up to them topics that fifty years ago remained in the closed domain of experts. They are published by commercial presses as opposed to university presses or journals (where they publish their scholarly work). Their topics range from the earth and life sciences to physics and cosmology to history of science to sociopolitical essays, and their book titles are illuminating: *Late Night Thoughts on Listening to Mahler's Ninth Symphony* or *The Enchanted Loom* or *La Chair et le Diable* (Flesh and the Devil).¹⁵

Within this upscale popularization, a subcategory should be reserved for a new class of speculator scientists. To the question "What do you believe?" Molière's free-thinking Dom Juan answers: "I believe that two and two make four."¹⁶ These speculator scientists, usually found in quantum physics or cosmology, that is, in disciplines where large quantities of observational data are less available than in others, cannot offer such a reply today, and for some, the frontiers between logic and reverie begin to blur. Cosmologists, faced with the unimaginably immense, pushed back to the origin of the material universe, cannot answer the question of original cause, and are reduced to repeating that time and space being born with the "Big Bang," physicists do not speak of "before." Yet the question cannot be escaped so easily, and some make leaps of faith, sound like poets moving toward the cosmological, and, together with philosophers, muse in print as well as in private about the existence of God, in works such as *God and the Astronomers*, *God and the New Physics*, *Dieu et la science* (God and Science); *The Tao of Physics*, *Beyond the Cosmos*, *La Mélodie secrète* (The Secret Melody); or *Quarks, Chaos and Christianity*.¹⁷ Quantum physicists, partaking of the bizarre subatomic world that I evoked at the

¹⁵ Lewis Thomas, *Late Night Thoughts on Listening to Mahler's Ninth Symphony* (New York: Bantam Books, 1984); Robert Jastrow, *The Enchanted Loom: The Mind in the Universe* (New York: Simon & Schuster, 1981); Jean-Didier Vincent, *La Chair et le Diable* (Paris: Odile Jacob, 1996).

¹⁶ Molière, *Dom Juan*, in *Oeuvres complètes*, ed. Georges Mongrédien (Paris: Flammarion, GF, 1965), 2:382.

¹⁷ Robert Jastrow, *God and the Astronomers* (New York: Norton, 1978); Davies, *God and the New Physics*; Jean Guitton, Grichka Bogdanov and Igor Bogdanov, *Dieu et la science* (Paris: Grasset, 1991); Fritjof Capra, *The Tao of Physics* (Boston: Shambhala, 1975); Hugh Ross, *Beyond the Cosmos: What Recent Discoveries in Astronomy and Physics Reveal About the Nature of God* (Colorado Springs: Navpress, 1996); Xuan Thuan Trinh, *La Mélodie secrète* (Paris: Fayard, 1988); John C. Polkinghorne, *Quarks, Chaos and Christianity: Questions to Science and Religion* (New York: Crossroad, 1995).

beginning of this introduction, observe and accept events that in another century would have been taken as the equivalent of declaring that $2+2\neq 4$; for instance, that something can be both a wave and a particle, or at least sometimes behave like each. Forced to deal with such facts, faced with the unimaginably minute, deprived of total predictability, or freed from it, some sound as if they were speaking from through the looking-glass (Lewis Carroll himself, of course, was a man of science, a mathematician, a professor of symbolic logic). "Da Vinci was both a prodigious scientist and an artistic genius!" affirms the artist Laurence Richardson in a contemporary French novel. "Da Vinci, like all his contemporaries, did not know very much. At the very least, his knowledge allowed a considerable dose of imagination," responds the scientist Henry Sterne.¹⁸ Today, for a section of modern physicists, what they *do* know, as much as what they do not know, opens up an enormous field for imagination. Again, language is informative, and when coinage is necessary, where the new physicists have not formed neologisms based on Latin or Greek (*muons, hadrons, mesons, pions, baryons*), they have had recourse to terms such as *quark, charm, beauty, truth*, appellations that sound almost fanciful.

Whether informative or speculative, the upscale popularization of science has today assumed functions once belonging to other disciplines, not the least among them a central function previously held by literature, that of holding the "true" keys to the world and its mysteries.¹⁹ Contemporary science has become a veritable mythology of knowledge, and this mythified science is today looked to for clear answers that were once sought in ancient elucidating fictions. The authors of these scientific works have never made claims to such clarity. On the contrary, they as often multiply as resolve fundamental philosophical questions, working with a kind of knowledge which, built upon its own ruins, flaunts the instability of theory and accepts the paradoxes, at times the contradictions, of experimental evidence. But it matters little that the legend is contradicted by its own actors. Scientific publication has become the preeminent space for discovery, possesses the strongest hold on denotation, and constitutes the core of modern philosophy by reason of the epistemological and

¹⁸ Rio, *Les Jungles pensives* (1985; reprint, Paris: Editions du Seuil, Points Roman, 1989), 53. Cited from *Dreaming Jungles*, trans. William R. Carlson (New York: Pantheon Books, 1987), 47–48.

¹⁹ The ideas expressed in this paragraph follow Rio, "L'essentiel et l'accessoire," in *Rêve de logique*, especially 83–84.

metaphysical questions which, wittingly or not, it raises. Without hesitation I state my conviction that the literature that is discussed in this volume's collected essays would not have been the same had this upscale popularization not made of scientific publication the privileged space of discovery.

But there is also downscale popularization, finding its element not in universities and bookstores but in the mass media, and here too there is high and low. On the high end are daily press reports of advances and discoveries in science and medicine; weekly health and science pages in the general written press; educational television where David Attenborough introduces life on earth, Jacques Cousteau life underwater, Carl Sagan walks through a larger-than-life model of the brain, and cartoon characters initiate young children into the mysteries of science. On the low end, the downside of downscale, is the unbridled mediaization of science, not science as best-seller but the selling of science, or science for selling, its habitat the readily for-profit mass media and T-shirts. Popularization becomes utter commercialization: consumer products, from medicine and laundry detergents to cosmetics, sold with the "guarantee" of a science created piece by piece in the laboratories of advertising agencies, or "genius hype," the sale of a scientific image having symbolic value (Einstein, packaged in gift shops and malls, sticking out his tongue on posters or metamorphosed into a cuddly "Albeart Einstein" teddy bear, complete with cardigan sweater boasting the inscription " $E = mc^2$ ").²⁰ Undoubtedly the height of current "genius" exploitation today, resembling more a sideshow than a physics show, is Stephen W. Hawking, and on occasion it becomes difficult to distinguish the scientist from the object of radical mediaization: *A Brief History of Time*, the upscale popularization by an important physicist, from its multimillion-volume sales or from *A Brief History of Time*, the movie; or the selling of Hawking, whose computerized voice hails British Telecom over the airwaves.²¹

²⁰ I can only applaud turning a great scientist into a popular hero, for once favoring intellect over beauty, muscle, or military might; nonetheless, much of this smacks of what one could call, paraphrasing Gould on dinosaurs, "the Einstein rip-off" ("The Dinosaur Rip-off," in *Bully for Brontosaurus: Reflections in Natural History* [New York: Norton, 1991]).

²¹ Stephen W. Hawking, *A brief history of time: from the big bang to black holes* (London: Bantam Books, 1988).

If I have gone through this list of items that we all know and see in our daily lives, it is to make this point: Despite (or perhaps because of) specialization and the sheer complexity of late-twentieth-century science, despite the emergence of scientific laboratories centered upon astronomically costly instruments of research, which places certain kinds of knowledge not only beyond the reach of the layman but beyond that of scientists outside of their own specialized domains, there is a concurrent and opposite movement, an integration of science and the general public. Formed intellectually at the emergence of interdisciplinarity, a generation of authors today writes in a world where science, whether scholarly, popularized or vulgarized, is everywhere present. The proliferation and promulgation of intelligent and intelligible scientific publications, and public interest in them, have allowed for the return if not of the early-nineteenth century's amateur natural philosopher, at least of the eighteenth-century's *honnête homme*, in the fashion of Buffon, naturalist and poet, who urged before the French Academy the simple proposition that man make use of all of his faculties; and today's "canon," that prescribed number of things that *Homo sapiens, faber, and ludens* must possess, once again embraces knowledge of the functioning of the physical universe in which he lives, while with the return of speculation to science, the object of inquiry into the unknown is not merely a *how to* in the applied sense, but a simple, and deeper, *how* and *what*, and for the most speculative, *why*.

The Sum of the Coordinates

Where is literary discourse in all of this?

"Welcome to the twentieth century, Mr. Wilmot; we all have some catching up to do. Amazing things are coming out of European physics. Time is the fourth dimension, it turns out, and slows down when the observer speeds up. The other three dimensions don't form a rigid grid; space is more like a net that sags when you put something in it, and that sagging is what we call gravity. Also, light isn't an indivisible, static presence; it has speed, and it comes in packets—irreducible amounts called quanta. . . ."²²

²² John Updike, *In the Beauty of the Lilies* (1996; reprint, London: Hamish Hamilton, 1996), 78–79.

"All these strainings of our common sense are facts," the clergyman Thomas Dreaver concludes. "We don't any more merely investigate reality . . . We make it, . . ." (ibid.). Dreaver is the moderator of the presbytery in John Updike's 1996 novel *In the Beauty of the Lilies*; his remarks are directed to the newly faithless minister Clarence Wilmot. In the earlier *Roger's Version* (1986), Divinity Professor Roger Lambert, a man comfortable with the theological assertion that "*The god who stood at the end of some human way would not be God*,"²³ faces an upstart computer-whiz-cum-cosmologist who insists that physicists, having "pared things down to the ultimate details," now find that the "last thing they ever expected to happen is happening. God is showing through" (9). Facts are facts, he sums up, the case of "people in the religion business . . . at last is being proven." "What kind of God is showing through, exactly?" Lambert questions (ibid.); and therein begins the sparring match, with jabs of biochemistry, paleontology, biology, biophysics, quantum physics, "Big Bang" theory, astronomy, mathematics, theology, and, this is after all John Updike, sex.

In Tlalpan, Mexico, Ernest Rutherford, Max Planck, Niels Bohr, Wolfgang Pauli, Albert Einstein, and Werner Heisenberg stare out from a rogue's gallery of Nobel physicists in Carlos Fuentes's tumultuous novel *Cristóbal Nonato* (1987; Christopher Unborn).²⁴ Oppenheimer, Fermi, Watson, Crick, de Broglie, and Pauling join them later. Cristóbal's (Christopher's) grandparent-scientists, the "Curies of Tlalpan," work with applied science to alter matter; the scientists in their portrait gallery worked with fundamental science whose discoveries relative to matter would alter minds and contemporary man's way of viewing the world. Need it be said? The dimension of the conceptual changes provoked by the new world of the new physics uncovered by these scientific mentors can be likened only to the dimension of that event that constitutes the point of departure of the entire novel: the confrontation between Christopher Columbus and the new world he discovered, or first invented.

In France, Michel Rio publishes a novel with the title *Le Principe d'incertitude* (1993; *The Uncertainty Principle*).²⁵ Rio's uncertainty starts

²³ Updike, *Roger's Version* (1986; reprint, New York: Fawcett Crest, 1987), 42. In a note on the copyright page, Updike acknowledges the role of popularized science writing in the formulation of the ideas in this novel.

²⁴ Carlos Fuentes, *Cristóbal Nonato* (Mexico City: Fondo de Cultura Económica, 1987).

²⁵ Rio, *Le Principe d'incertitude* (1993; reprint, Paris: Editions du Seuil, Points Roman, 1995).

where Fuentes's leaves off, looking out over the sea from an old world in the direction of a new. Rio's protagonist is not a Mexican scientist but a French writer, and he is not as optimistic as the Curies of Tlalpan: "I believe that death is not a transformation," he says, "but a complete disappearance of the essential, and that consciousness, along with all its products—identity, memory, invention, feeling, logic, morality, aesthetics—dies with the cell from which it came" (38).

The speaker is Jérôme Avalon. He is sitting in the garden of an aging movie idol, a private domain that he has violated because of its perfect aesthetic of uncertainty, an "exemplary piece of universe" (22–23). The two men, owner and intruder, have begun a conversation.

"So you see no intention, no project, no finality? No motivated universal intelligence?" the aging actor Dan Harrison asks. "In other words, no God?"

"Which God are you speaking of?" replies Avalon, and he proposes several: the God of believers, the God of metaphysicians, the God of physicists, each with His or Her own qualities and limitations (38, 41).

But Harrison's concern is the universal versus precisely the individual. And so he protests:

"Even if history is an 'accident of geometry,' as Hawking says, or matter's attempt to understand itself, as you say, it has scandalous consequences to the extent that I am part of that accident or that attempt . . . and the fact that my atoms will return to a more normal destiny does not console me in the slightest for the loss of their present identity, made up precisely of consciousness and history." (51)

"In your case then I can only think of a fourth God," Avalon says (53). And so this fiction writer offers up the God of mathematicians, and with Him the mathematical foundations of the freedom of disorder within constraints, a sort of deterministic chaos well known to physicists. He proposes Bernoulli's distribution, which ends up with a paradox applied to the probabilities of Harrison's own passage from transitory to definitive without loss of consciousness, a paradox in which relative 0 is worked into equaling 1, an ostensible contradiction in terms (*ibid.*).

"Are you reassured?" Avalon asks the actor (55).

And the reader? How reassured is he when in the seemingly "literary" act of picking up a work of fiction, he finds himself faced with

explanations of chaos theory, of the relation among the natural sciences, the social sciences, and artistic creation; when, along with Bernoulli, he sees parade before him Laplace, Newton, Poincaré, Pythagorus from the world of mathematics; Alfvén, Arnold, Einstein, Galileo, Hawking, Heisenberg, Lerner, Moser, Prigogine, Schrödinger from the world of physics; Darwin from biology; Keynes and Marx from economics; Aristotle, Descartes, Heidegger from philosophy; not to mention a movie mogul named Cronk (Australian slang for “crook”) who insists that his business is so wildly successful because he has understood something that is neither capitalist, nor communist, but Darwinian. I might add that the players in this mixture of physics and cinema, cosmology and flesh, all appear in the first 99 pages of a novel that in total contains 124, leading some to accuse Rio’s work of having the approximate density of a black hole.

Across the Channel, a narrator of Nicholas Mosley’s *Hopeful Monsters* (1990) studies physics at Cambridge with Paul Dirac; his girlfriend, later his wife, is an anthropologist.²⁶ His friend Donald is a student of Ludwig Wittgenstein. The Larmarckian–Darwinian debate, the question of the transmittal of acquired characteristics, the nature of the atom and of atom splitting all enter the novel. Natural science is joined by social science, by anthropology and history. This is Europe between wars and on the brink of war: Stalin’s Russia, Rosa Luxemburg’s Germany, the rise of the Nazis, the explosion of Spain’s Civil War. History meets science directly when the student of physics becomes a physicist working on the Manhattan Project. In this epistolary novel, the protagonists’ actions and thoughts, and so their letters, seem to be in relation, to communicate, even when the two writers are far apart in space and the letters do not coincide in time. Having once been together, there is permanent relation and memory. Otherwise put, the theory of quantum-mechanical nonlocality, just being developed at the time, and discussed by the characters, serves as a fundamental metaphor for the movement at all levels of the text, from the romantic bond between the two protagonists to the novel’s very structure.

Elsewhere in the British Isles, Graham Swift’s *Waterland* (1983) is narrated by history teacher Tom Crick, not a forebear of the Nobel

²⁶ Nicholas Mosley, *Hopeful Monsters* (London: Martin Secker & Warburg, 1990). Both Max Ackerman, son of a Cambridge biologist specializing in genetic inheritance, and Eleanor Anders, daughter of a Jewish disciple of Rosa Luxemburg, are first-person narrators; until the final chapter, a postscript, the novel is told through their alternating first-person texts.

biophysicist, but the son of simple Henry Crick, whose life he relates through a kind of comprehensive research, a storytelling discourse on *historia* in all its variations, from inquiry to narrative, natural history to the nature of history; world and regional history, social and industrial history, family history, his history; historiography and the teaching of history.²⁷ At the center of Swift's *Ever After* (1992), the life course of the nineteenth-century surveyor Matthew Pearce is indelibly altered by two events, separate in time but related in thought: He sees an ichthyosaur and he reads Charles Lyell, then Charles Darwin. His twentieth-century descendant reads Pearce's Notebooks, Lyell's *Principles* (and his *Elements*) of *Geology*, the 1853 edition (revised, he specifies), and adds his own appraisal of the author of *On the Origin of Species by Means of Natural Selection*.²⁸ In Ireland, John Banville writes imaginary but historically-informed biographies: *Kepler* (1981), *The Newton Letter* (1982), *The Book of Evidence* (1989).²⁹ In Nicaragua, priest, poet, and political figure Ernesto Cardenal writes his *Cántico cósmico* (1989; *Cosmic Canticle*), treating, among other subjects, cosmology, astrophysics, relativity, quantum mechanics, chaos theory, thermodynamics, biology, evolutionary theory, and paleontology.³⁰ In Manhattan, Joseph McElroy writes *Women and Men* (1987),³¹ and while dealing with the relation explicit in his title, passes through an encyclopedic range of subjects from the economy and space exploration to planetary meteorology, using chaos theory as a model for the relation between big and small, near and far; he is, in the words of Tom Leclair, "the preeminent American artist of the Age of Systems."³²

On a campus in Illinois, Richard Powers writes *The Gold Bug Variations* (1991).³³ Amid references to Poe's story and Bach's music, four

²⁷ Graham Swift, *Waterland* (London: William Heinemann, 1983).

²⁸ Swift, *Ever After* (London: Picador, 1992).

²⁹ John Banville, *Kepler* (London: Martin Secker & Warburg, 1981); *The Newton Letter* (London: Martin Secker & Warburg, 1982); *The Book of Evidence* (London: Martin Secker & Warburg, 1989). Banville's *Doctor Copernicus* was published in 1976 (New York: Norton). This earlier novel first appears in paperback in 1993, and this, along with the fact that all of Banville's novels have been extensively reprinted in the 1990s, perhaps suggests a heightened interest in his subject matter corresponding to the period I discuss.

³⁰ Ernesto Cardenal, *Cántico cósmico* (Managua: Editorial Nueva Nicaragua, 1989).

³¹ Joseph McElroy, *Women and Men* (New York: Knopf, 1987).

³² Tom Leclair, "Joseph McElroy: expérimentation et technologie," *Magazine littéraire*, no. 281 (October 1990): 104; and, introduction to *Plus*, by Joseph McElroy (New York: Carroll & Graf Publishers, 1977), vii.

³³ Richard Powers, *The Gold Bug Variations* (1991; reprint, London: Abacus, 1993).

characters, all researchers, twist about each other as if in a double helix formation. Paragraphs in this novel read:



“Cryptanalysis” (239) is a central activity, as is love. Science and desire mingle. Discussions turn around the target enzyme and codon table and the assignment of CAG to glutamine; the four basic notes of the Goldberg variations are played and replayed, analyzed and reanalyzed in the search for this “self-generating, self-defining system—residing nowhere, unknown by any of its constituent parts” (270–71). What is being sought (coveted) is nothing less than a model for reading the entire genetic code on the basis of the four nucleotides. Fascination with self-generating systems continues in *Galatea 2.2* (1995), where now a (the) writer with a formation in physics, the “humanist-in-residence,” spends a year at a “Center for the Study of Advanced Sciences,” and between neural physiologists and algorithmic formalists enters into the connectionism debate centering on the work of Dr. Philip Lentz.³⁴ Neurons, axons, dendrites, synaptic connections, Boolean operators, algorithms and a nonalgorithmic system, and a stimulus vector and a response vector: The vocabulary is from this novel (71), where around a “machine” named Helen, and between networks and poetry, a writer named Richard Powers confronts the question of where consciousness begins.³⁵

³⁴ Powers, *Galatea 2.2* (New York: Farrar, 1995).

³⁵ A name that might have appeared here but for the fact that he is not principally a writer is Nobel Prize chemist and poet Roald Hoffmann. In contrast both to the speculator scientists to whom I have referred, who write essays, and to the literary work of scientists such as Fred Hoyle and Isaac Asimov, who write science fiction, Hoffmann works on a literary form that is lyrical, stressing chemical data and emotional response. (Interestingly, Fuentes expresses his gratitude for the help of “Professor Roald Hoffmann[n]” at the beginning of the novel I have cited above, *Cristóbal Nonato*). See Hoffmann, especially *The Metamict State* and *Gaps and Verges* (Orlando: University of Central Florida Press, 1987 and 1990; respectively); also, *Chemistry Imagined* (Washington, D.C.: Smithsonian

The Old World and the New. The list supersedes borders and national identity. All are works of fiction by living authors. All are published in the contemporary period, the 1980s and 1990s, as this century of alterations draws to a close.³⁶ The degree of knowledge among these authors and the use they make of it varies greatly; disparate, they cannot be reduced to their interest in “nonliterary” disciplines. Yet the common ground is evident, and my sampling is only to suggest a fact: A generation after the heyday of structuralism, literature crosses disciplinary borders, brings the social and natural sciences back into the construction of fiction, the direct line drawn by Italo Calvino from Dante to Galileo, “the notion of the literary work as a map of the world and of the knowable, of writing driven on by a thirst for knowledge.”³⁷ These works require a dose of real knowledge beyond knowledge of one’s self and beyond the utilitarian “tools” of the trade, the technical knowledge of detective stories, sociological knowledge of a milieu, geographic knowledge of placement, psychological knowledge of character; their “action” in substantial degree is centered around debate.³⁸ This is not science fiction, not applied knowledge but speculative. Thought is not isolated but has a determining impact on the thinker, on his vision of the world, and on his affective relationship to it. This is literature with an intellectual utility. This is elucidating fiction.

Institution Press, 1993). Another case is physicist Alan Lightman, turned fiction-writer with *Einstein’s Dreams* (New York: Pantheon Books, 1993).

³⁶ A group of authors also knowledgeable about the physical world published in the immediately preceding decades, among them, Italo Calvino, Primo Levi, Luis Martín-Santos, Nicanor Parra, and Raymond Queneau; Jacques Roubaud and Don DiLillo produced major works in the 1970s; Jorge Luis Borges continued exploiting mathematics, Severo Sarduy delved into speculation (although in essay form), Thomas Pynchon into aviation and chaos theory; McElroy’s *Plus*, while more science fiction than the works I consider, appeared in 1977, and a number of authors span the decades. Yet in many cases these earlier authors used their knowledge differently, in my view, and if “explication” is the mark of the later fiction, perhaps “questing” marks the earlier works (one can also note the greater abundance of trained scientists among these authors). My interest here is the later literature, in part because it is later and nonconcurrent with structuralism, in part because it defines, necessarily, the “state of the art” as the century ends.

³⁷ Italo Calvino, “Two Interviews on Science and Literature,” in *The Literature Machine*, trans. Patrick Creagh (1987; reprint, London: Picador, 1989), 32.

³⁸ From this common factor, not surprisingly, spring others. A disproportionate number of these novels, if one were to calculate simple probabilities, are set in universities or research centers, reconsider God, at least as a factor in debate, and, in an almost revised form of Platonic dialogue, make extensive use of argumentation, whether face-to-face or in epistolary or journal form.

It is possibly also power fiction. The question put a generation earlier to the structuralists can be reformulated today: Are authors of fiction seeking to share in the power and authority that contemporary society accords science?³⁹

Mythologies of Knowledge

Here is a fiction that opens up the opportunity for a different critical approach, and a broader one. The methodology that I experiment with in this volume is of a simplicity bordering on the self-evident: the grouping of specialists in a wide range of disciplines around a common work. While fully compatible with other interdisciplinary approaches, it differs from them by way of a clear shift in direction, a shift that can be expressed as three divergences. All three have in common my intention to move toward a more comprehensive and more inclusive interdisciplinary practice.

1) Rather than bilateral this methodology is multilateral, reading a work of fiction not solely through a second discipline, be it science or history or philosophy or indeed any other separate discipline. Criticism that reads a work of fiction through a second discipline or theory brings an added perspective that can brilliantly illuminate the text; this is the case, for example, of N. Katherine Hayles's reading of Thomas Pynchon's *Gravity's Rainbow* in terms of chaos theory.⁴⁰ It can also be reductionist, however, seeing a work in the light of a particular discipline or theory only, without giving proper weight to the rest of what is, in the end, a total vision; this is the case of Hayles's reading of Jorge Luis Borges in terms of Cantor set theory.⁴¹ The methodology that I use here goes in another direction; rather

³⁹ Mihai I. Spărișu discusses the involvement of power with science in *Dionysus Reborn: Play and the Aesthetic Dimension in Modern Philosophical and Scientific Discourse* (Ithaca: Cornell University Press, 1989). The issue was also brought to my attention by Professor William Rowe at the University of London during a talk I gave at King's College, "Working with Science and Literature," 10 May 1996.

⁴⁰ N. Katherine Hayles, *The Cosmic Web: Scientific Field Models & Literary Strategies in the 20th Century* (Ithaca: Cornell University Press, 1984), 168–97.

⁴¹ *Ibid.*, 138–67. My disagreement with Hayles is not with what she says, which can be extremely interesting, and I applaud her for taking the care to document that Borges was indeed familiar with Cantor set theory. Rather, I am concerned with what is not said, for there is the danger, particularly for a reader who cannot himself fill in the gaps, of reducing Borges to this single concern.

than multiple works of fiction being read or seen through a second discipline, I propose multidisciplinary perspectives on one test body of fiction.

2) A corollary of the first divergence is that this methodology demands knowledge of multiple disciplines of no *one* reader. Serious interdisciplinary criticism, as differentiated from dabbling, has thus far been restricted, necessarily, to a certain kind of critic or reader, often one with a bidisciplinary formation; again, Hayles, with advanced degrees in chemistry and English, can serve as an example. It is not a method for everyone, either in the doing or in the evaluation of the result. I have no argument with this, and to a degree it is the inevitable outcome of in-depth specialized analysis. But I would rather not leave interdisciplinarity in the sole hands of the interdisciplinary, so to speak, where it risks becoming restrictive rather than expansive. There are evident limits, and I think a few dangers, in a focus that can only be practiced or enjoyed by a certain eye. I have preferred to return to an earlier, and in some ways more generous, interdisciplinary methodology and project: the encyclopedic tradition, which I apply to a kind of contemporary fiction that in many ways itself is encyclopedic. Inevitably, my methodology shares in the strengths and weaknesses of that tradition.

3) Inseparable from the previous two is a third divergence. This methodology calls not for literary critics to invoke another specialized discipline in the reading of literature, but for literature to be read also by, and from the perspective of, *specialized scholars in other disciplines*—disciplines well-within and beyond the so-called boundaries of the humanities.

These are the things that I wanted to do. There are others that I did not want, pitfalls and perils of the frontier that I sought to avoid. I did not want fusion or the melting down of all disciplinary borders. Nor did I want unbreachable borders, parallel essays never connecting. I did not want scientists as amateur literary critics. I did not want reductionism. I did not want what Richard Powers calls “trend-surfing.” I did not want a little bit of knowledge to be a dangerous thing. And there was one final thing I did not want. In an oft-quoted essay, Borges recounts finding hints of Kafka in Zeno, Han Yu, Kierkegaard, and Browning, and concludes that an author creates his own precursors: Had Kafka never written, or had Borges never read a line of Kafka, he would likely never have put those disparate authors together.⁴² May Borges forgive me; I did not want

⁴² Jorge Luis Borges, “Kafka y sus precusores,” in *Otras inquisiciones*, 6th ed. (Buenos Aires: Emecé, 1971), 145–48. Originally published in *La Nación* (19 August 1952).

to contribute to another suspicious list of precursors. I did not want Carlos Fuentes's portrait gallery or Michel Rio's novelistic title to lead to Heisenberg being a precursor of either. I did not want the uncertainty principle itself or definition by wave collapse to become fused with Borges's art of reading.

Today science is influencing not only the writing but the reading of this or any other page, in some cases creating pages of analysis that sound like a Borges story itself. While one can speak of "ideas in the air" that manifest themselves in diverse domains in any given period, caution is needed in attributing a specific theory to a specific author. Lautréamont is now studied with regard to entropy; Julio Cortázar, and almost everybody else, is studied with regard to chaos theory and fractals; certain authors of fiction are credited with scientific theories that mere scientists arrived at only belatedly, if at all. In this atmosphere my questions risk being iconoclastic. Superimpositions of this kind make a clear contribution to the art of reading, but are they a contribution to knowledge? Does a coincidence between a certain vision of the world and certain scientific theories alone suffice for linkage? For the moment at least my personal answer is that I would not have discussed any of the works I have cited in terms of a specific discipline or theory had the author not explicitly introduced that discipline or theory into the work of fiction. This is not a retrogressive bow to authorial intention. Rather, it is the humble suggestion that not every work of art that moves from order to disorder is doing so necessarily in recognition of the second law of thermodynamics.

The universal laws of physics are called "universal" because they are universal, which means that applying them anywhere and reading them everywhere brings us indeed very close to Borges's contention that all books are the same book. The play in a literary work between the universal and the individual is perhaps Leibnitz's combinatory art, but a work of art cannot be reduced to universal laws precisely because the individual at the center of artistic creation cannot be reduced to a mathematical formula. In other words, beware if not the Jabberwocky at least the Ettelson effect—that Hassidic doctor cited by French critic Jean-Jacques Lecercle, who uses Humpty-Dumpty's very own methods in the questionable enterprise of proving that *Through the Looking-Glass* is nothing other than a secret Talmudic text.⁴³

⁴³ Jean-Jacques Lecercle, "Lewis Carroll et le Talmud," in *Epistémocritique et cognition 1, Théorie, Littérature, Enseignement* 10, ed. Noëlle Batt (fall 1992): 169–87.