AESTHETIC SCIENCE AND THE ENCYCLOPEDIC NOVELS OF JOYCE, PYNCHON, DELILLO, AND POWERS

by

Richard V. Dragan

A dissertation submitted to the Graduate Faculty in English
in partial fulfillment of the requirements for the degree of
Doctor of Philosophy, The City University of New York

2006

UMI Number: 3187802

ProQuest Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

This manuscript has been read and accepted for the Graduate Faculty in English in satisfaction of the dissertation requirement for the Degree of Doctor of Philosophy.

Date	Professor Norman Kelvin, Chair of Examining Committee
Date	Professor Steven Kruger, Executive Officer

Professor Gerhard Joseph

Professor Edmund Epstein

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

AESTHETIC SCIENCE AND THE ENCYCLOPEDIC NOVELS OF JOYCE, PYNCHON, DELILLO, AND POWERS

by

Richard V. Dragan

Advisor: Professor Norman Kelvin

This study examines the relationship of science and aesthetics in the fiction of four major novelists using a new analytic category: *aesthetic science*. An introductory chapter defines this term, situating it against traditional aesthetics and the encyclopedic novel. Aesthetic science argues that scientific matter can be adapted for new tropes and ideas of formal beauty. This study also speculates on the tastes of 'common readers' who have gradually accepted scientific ideas in fiction.

Chapter Two begins with the serialization of *Ulysses* in *The Little Review*, including letters from ordinary readers. The "Ithaca" episode uses an exaggerated notion of classical science which obscures readerly understanding and menaces the characters of Bloom and Stephen. This chapter engenders a sense of beauty and an updated Kantian Sublime through scientific allusion.

Chapter Three turns to Pynchon's story, "Entropy" and an essay by C. P. Snow in *The Kenyon Review* to show how science was once opposed to literary

production. This chapter examines how *Gravity's Rainbow* appropriates different kinds of science and how its confusing later chapters can be read using recent physics, the postmodern Sublime, and Jameson's cognitive mapping.

In Chapter Four, DeLillo's stories set in the Bronx are read as examples of his early work. Essays in *Epoch* magazine show how DeLillo moved from local settings to postmodern concerns, leading eventually to *Ratner's Star*. In this encyclopedic text, which appropriates mathematics and science, DeLillo articulates a fear of bodies contrasted against a pristine beauty of the main character's mathematical thinking. Finally, DeLillo's *Underworld* is read as a 'failed encyclopedia,' one that echoes Joyce in its later Bronx sections.

Chapter Five looks at Powers' *magnum opus*, *The Gold Bug Variations*, and his other novels to demonstrate how biology, chaos theory, and other science appear in his fiction. The role of the amateur scientist is important for understanding this encyclopedic text. This chapter also examines how bodies are often depicted as limited and damaged within Powers' novels. The responses of readers from online reviews suggest that science has become acceptable for literature. A conclusion speculates on how aesthetic science might apply to other recent writers.

Acknowledgements

Thank you to the members of my committee for their suggestions and support throughout the dissertation process: Professors Norman Kelvin, Gerhard Joseph, and Edmund Epstein provided many valuable insights and ideas. Also thanks to Edward Mendelson, for the inspiration for this study, and the generosity to read the finished product.

I have been fortunate to have had several generous mentors. David Walker at Oberlin College was my inspiration for studying Modernism; he believed in my writing before anyone did. So did Raymond Kennedy at Columbia University, who helped me find my voice for writing fiction.

I would like to dedicate this study to my mother, who taught me to love words, and my father, who taught me to appreciate science.

Finally, this study could not have been possible without the love, patience, and support of my wife, Diane.

TABLE OF CONTENTS

CHAPTER 1

Introduction: Aesthetic Science in Twentieth-Century Encyclopedic Narratives

In *Against Nature* (1884), J.-K. Huysmans' ultimate aesthete, Des Esseintes, holes himself up in his house in the suburbs of Paris and undertakes a series of aesthetic experiments: music, scent, food, and general artifice, such as the decoration of his jewel-encrusted turtle, which dies under the weight of its ornament. In time, all of Des Esseintes' experiments prove quite futile, and he is forced back to the society of Paris with a bad stomach, on the advice of his physician.

A striking moment in *Against Nature* is when Des Esseintes rhapsodizes about a certain kind of physical beauty, that of two women, named Crampton and Engerth, who turn out to be not what they seem:

> One of these, the *Crampton*, an adorable blonde with a shrill voice, a long slender body encased in a brass corset and the supple, nervous resilience of a cat, is a stylish golden blonde whose extraordinary grace is almost frightening as [...] she sets in motion the immense rosaces of her elegant wheels and leaps forward, a living thing, at the head of an express or a train bearing the day's catch!
>
> (Huysmans 20-1)

This strange and witty moment celebrates the complete artifice of the dandy, like Des Esseintes' impossible artificial flowers bred from (one supposes) toxic chemicals and the like. This passage also celebrates modern technology in the form of the two locomotives, which represent sleek speed and travel, which Huysmans' narrator cannot undertake, and when he does, it is in the made-up environment of his suburban house.

In the day-for-night world of Des Esseintes, the reader should be suspicious of his notions of beauty. Yet the influence of this novel, which largely eschews plot, offered a brave experiment for later British aestheticists. This gesture toward technology, however ironic in intention, offers a suggestive early moment of the aestheticizing science—that is, borrowing ideas from science for new tropes—in an early, influential text outlining an important 'aestheticist' sensibility. Indeed, the traditional concerns of the nineteenth-century novel—plot, setting, a 'thick' portrayal of characters, a social space and community—are thwarted, even denied, by the narrative strategies of this novel. To take one example, *Against Nature* is unlike *Middlemarch*, in almost every way. The writing is often as statically beautiful as a Moreau painting, as Huysmans describes Des Esseintes' adventures in sensibility with music, smells, tastes, often using techniques of synesthesia, further blurring the normative experience for the

reader, who is used to more straightforward sensations usually depicted mimetically.

Often enough, aesthetic writing has sought new realms of experience for fiction. Huysmans' novel minimizes plot, and almost all other characters save for Des Esseintes, while presenting a new organizational scheme for a novel. Chapters are organized by the various attempts of Des Esseintes to find contentment in different realms of the senses. All are, one by one, found lacking until eating food becomes impossible, and Des Esseintes is forced to return to the city.

The traditional concerns for fiction that Henry James pointed out in "The Art of Fiction" (also published in 1884)—the dispersal of "prizes, pensions, husbands, wives, babies, millions, appended paragraphs, and cheerful remarks" (190)—have no place in the ending of such a text as *Against Nature*. Finding an odd beauty in two locomotives, which are re-conceived fancifully as women by Huysmans, is only a small, single thread in *Against Nature*, but it is suggestive for my purposes here because it points out that what is 'aesthetic' changes over time. Even in a relatively early aestheticist text, a notion of science or its application in technology can argue for beauty of a particular sort.

This study concerns itself with examining how the raw materials of science have been appropriated by more recent novelists in twentieth-century

cultural history and what this means for our understanding of the larger categories of scientific and aesthetic experience. In arguing for such "aesthetic science," I will examine how the raw stuff of science in the hands of ambitious writers becomes a means of engendering aesthetic pleasure. Moreover, I want to suggest that recent science has, like previous generations' fascination with myth or Nature or Art, become a source for some of the most ambitious novels in the twentieth century by Joyce, Pynchon, DeLillo, and more recent writers such as Richard Powers.

Science and the Encyclopedic Text

We enjoy writing that provides a ready source of images and language. In an encyclopedic text, a genre in which narrative creates the illusion of a complete realized world in all its excess, profusion is a source of narrative energy, whether in catalogues, lists, or meticulous descriptions of real places and events. In his *Philosophical Enquiry* (1750), Burke wrote that "a great profusion of things which are splendid in themselves, is *magnificent*" (71). Yet Burke's advice for using "magnificence" in works of art was to tread carefully. "Unless you can produce the appearance of infinity by your disorder, you will have disorder only without the magnificence," he writes (71-2). Indeed, in the most ambitious encyclopedic texts, different rhetorical modes compete with one another for our attention. The

quintessential example of this would be *Ulysses*, of course, with the shifting styles in its later chapters. In aiming to represent a plenitude of things, authors risk disorder. Such excess can be delight, or it can lead to confusion and even readerly disorientation. However, one can make sense of such excess using several critical concepts that help explain away the apparent distractions of such "extraneous" material, such as Menippean satire, Bahktin's heteroglossalia, or encyclopedism, the last of which will be important to this study.

Twenty-five years ago, Edward Mendelson proposed a canon of encyclopedic texts, including *Gargantua and Pantagruel*, *Don Quixote*, *Moby-Dick*, *The Magic Mountain*, *Ulysses*, and *Gravity's Rainbow* (161). Mendelson attempts to make sense of a complex and seemingly all-encompassing novel published in 1973, by a still relatively young Thomas Pynchon. The controversy concerning Pynchon's mammoth, difficult, and provocative text in the early seventies, surely echoes the controversy surrounding another sprawling difficulty and ultimately canonical text, Joyce's *Ulysses*, published in 1922. However, although *Gravity's Rainbow* won the National Book Award that year, it was denied the Pulitzer on the grounds that it was "obscene." As for *Ulysses*, until the Gabler edition of 1984, the well-known Judge Woolsey decision was usually printed at the beginning of *Ulysses*, framing any new reader's first encounter with that novel as a text once alleged to be obscene.

Both Joyce and Pynchon have largely prevailed against their early critics. That did not seem obvious in 1975, of course, and Mendelson's brave and intelligent defense of Pynchon arguably needed writing. The terms of this defense are important for my study here. In the early seventies, the *donnée* of *Gravity's Rainbow*, a world of rocket science, ballistics, and inorganic chemistry, was undoubtedly still suspect as a world suitable for letters. Moreover, the novel's obfuscations, especially the later chapters, which largely deny a mimetic sense of plot and setting, had caused the book to be considered a confused mess by some reviewers.

Mendelson offers a different strategy, one rooted in the genre of the novel, that of a difficult, all-encompassing encyclopedic text. In this essay, Mendelson asserts that "all encyclopedic narratives include a full account of at least one technology or science" (164). As an encyclopedic novelist, one with antecedents in Homer, Cervantes, Sterne, and Melville, Pynchon is free to represent the science of his day, including quantum mechanics, which is necessarily difficult, inaccessible, and rooted in the indeterminacy of the New Physics. Gesturing toward the encyclopedia—which necessarily includes "everything" in the world—is a plausible reading, one which goes a long way to explain away the surface difficulties of Pynchon's text.

Writing in *The Dial* in 1922, Ezra Pound defended *Ulysses* on surprisingly similar grounds, quoting the Goncourt brothers' preface to their naturalist text *Germinie Lacerteux*, in which the writers argue that the novel is a sort of "social inquest, for psychological research and analysis," one that "impos[es] on its creator the duties of science" ("Ulysses" 408). In fact, earlier in the pages of *The Little Review*, Pound had printed this preface in its entirety, without even bothering to translate it for his readers, who were bewildered by *Ulysses* as it was serialized in the magazine from 1918 to 1921 ("Joyce" 416-7). To Pound, Joyce's novel was rooted in the naturalism of Flaubert and the tradition of the "experimental novel" as formulated by Zola. The novelist-as-scientist is a trope that occurs here, and it too is an argument that permits the novelist to include everything—including the potentially obscene—just like a social scientist or physician ("Ulysses" 408).

For every age, of course, the leading science of the day is quite different. In the nineteenth century, the arrival of Darwinism and a concern with social sciences, whether sociology or psychology, would open new frontiers for exploration and serious thought. By the 1970s, quantum physics was still new in the public mind, though Einstein's relativity might be well known. By the end of the twentieth century, other fields—information theory, the realm of the digital and the computer, and also a new emphasis on genetics and chaos theory—were

surely pre-eminent. The "science of the day" changes also in Thomas Kuhn's sense of paradigm shift. Quantum mechanics and chaos theory replace Newtonian physics. But also what is readily available for scientific understanding in the popular, public mind of a reading audience surely changes too.

This study aims to examine encyclopedism and the "encyclopedic impulse" as a defense against meaninglessness. One thinks of George Moore's initial response to *Ulysses* when he said, "'It is absurd to imagine that any good end can be served by trying to record every single thought and sensation of any human being. That's not art. It's like trying to copy the London Directory'" (qtd. in Ellmann 529). In profusion, there may be delight, but not always. Critics have resorted to encyclopedism and other genres such as Menippean satire to explain away difficulty and excess found in some of the novels considered here.

Encyclopedism, as well as Menippean satire, is also profoundly democratic. Everythingness can, by definition, not restrain what is represented. In some respects Menippean satire is even more respectable as it is a classical genre (though its actual instances may have been lost to us). In her initial introduction of Bahktin to French and English readers, Julia Kristeva appeals to Menippean satire as a formulation for explaining and accepting Bahktin's ideas of a many-voiced, dialogic work (82). Encyclopedism, with its link to the

encyclopedia, the focus of eighteenth-century efforts to rationalize and catalogue all of human knowledge, is the focus of my study here.

Beyond encyclopedism, other critics have attempted to explain how 'low' and 'high' styles became acceptable to later writers. Linda Dowling reminds us in *Language and Decadence* that late Victorian poets struggled with the opposition between high and low literary styles, a debate that goes at least as far back to Coleridge's response to Wordworth's *Preface to the Lyrical Ballads* (1800). The opposition here is between a common spoken voice advocated by Wordsworth, and a literary voice, a dialect only written, not spoken, espoused by Coleridge. Dowling finds that late Victorian writers such as Arthur Symons and John Davidson mined the language and imagery of the dance hall and the street for their poems (215, 222). These poets put this material into play for later writers like Eliot, whose early poems—the "Preludes", for example—mix details from world of the street and high culture as never before.

The tension of high and low rhetoric plays out in *Ulysses* in many chapters. One notable example is the mock heroics in "Cyclops" of the bombast of The Citizen juxtaposed against the common speech of the narrator. While this is certainly not the most flattering depiction of ordinary speech, this encyclopedic text has no trouble representing gentrified speech of the journalists in "Aeolus," Stephen's hyper-educated musings on the origins of Hamlet in

"Scylla and Charybdis," and all the intelligent, but ordinary, musings of a day in the life of Leopold Bloom that permeate the book. The mythic method in *Ulysses* is also part of this mixing of modes: the Homeric parallel that underpins the novel is juxtaposed against the nearly obsessive catalog of detail drawn from everyday Dublin life.

For Pynchon, too, critics have noted the juxtaposition of the "street" vs. the "hothouse" especially in criticism of *V*., his first published novel (Chambers ix). *V*. presents a series of impending revolutions, engendered, it is intimated, by the figure of V. in all her guises, whether in Florence, Malta, or Saudi Arabia. The world of Stencil and his intrigues with diplomats and government figures is in clear opposition to the world of Benny Profane and friends, the so-called Whole Sick Crew. In *Gravity's Rainbow*, we are privy to the goings-on of the inner workings of the British government and armed forces, particularly in the world surrounding the White Visitation, but also the carnivalesque escapades of a young American soldier, Tyrone Slothrop, which run throughout the novel.

I propose a new term—"aesthetic science"—to encompass how various branches of twentieth-century science and its application in technology, whether psychology, quantum mechanics, chemistry, computer science, genetics, or chaos theory, have been appropriated and often enough aestheticized in several major twentieth-century texts. The resonance with the history of aesthetics as the study

of aesthetic feeling is intentional. The mapping of High (and literary) and Low surrounding the appropriation of science for literature is also worth examining for the category of an "aesthetic science," as I am proposing here. If we turn to the Romantics, especially Shelley in *Prometheus Unbound*, we see the purveyor of fire and technology fastened on his rock. Prometheus is a figure for Romantic and human struggle, a rebel who resisted Zeus and assisted humankind with his gift. However, we never suspect that the poet here is less important than the person of science.

In the tradition of Western aesthetics, poets are the real inventors, while scientists only discover pre-existing natural laws. If one takes the development of science from the Enlightenment onwards, at least through the nineteenth century, building a scientific catalogue is much more a matter of discovering and cataloguing specimens in nature, for example, butterflies, rather than inventing theories anew. Perhaps the most devastating scientific discovery of all for the Victorians was Darwin's evolution, and even this was predicated on revealing what the fossil record already held. The tension between literary and scientific thought lasts at least through the New Criticism of I. A. Richards. In a simple reading, poems were found to have an inner logic and truth, apart from mere "scientific" knowledge. As John Guillory reminds us, New Critical reading strategies opposed "the epistemological tyranny of science" to pseudo-statements

in poetry (159). Reading a poem offered a different sort of truth, apart from the scientific. To posit such a split between scientific and literary truth mirrors the organization of the British university system, which had left scientists and humanities professors unable to talk to one another. This split was the genesis for C. P. Snow's formulation of "The Two Cultures" in 1960, which I will use as a starting point for a discussion of Pynchon's work in Chapter 3.

Situating a new term against the history of aesthetics, we can stake out what this idea will mean for the present study. Ever since Alexander Baumgarten proposed to define the term "aesthetics" as the "science of feeling" in his *Reflections on the Study of Poetry* (1735), the realm of science has provided the method, but not the subject, of what can be aesthetic. Baumgarten's original work begins to formulate why certain sounds and images in poetry can be considered pleasing. "Aesthetics" was the study of effective poetic forms and the combinations of sound and images (or "sensate representations") (78). Already here, implicitly, is an investigation of how readers respond to language and the selection of what type of images are suitable for poetry. While Aristotle's *Rhetoric* would begin the study of persuasive effects, whether in figures of people or logic, Baumgarten looked toward what was pleasing to what we can see as a typical community of readers. Baumgarten gestures toward science in this enterprise. At the end of this text, as he proposes his new term "aesthetics," he

cedes the study of the persuasive power of language to Aristotle and his rhetoric, and then carves out a new area for study in something else: the "science of perception," which, though inferior to the logical faculty, is still a rationally definable enterprise (78).

No investigation into aesthetics can be attempted without considering Kant's *Critique of Judgement* (1790) and his definition of the Sublime. A nominal definition of the Sublime as "inspir[ing] awe or reverence" has traditionally been associated with Nature and the infinite (*New Princeton Encyclopedia* 448). For Kant, the Sublime has to do with the contemplation of nature, but in quite a specific way. In reflecting upon a great mountain or a violent storm, we realize the fragility of our own being put up against something far greater. It is Nature in its larger canvas that has this hold over the viewer because of its power, instilling a sort of terror in us (Kant 120-1). For Kant, things in nature mimicked by art are merely beautiful, and, interestingly, mere imitation is not good enough. We would soon grow bored with a person who could mimic a nightingale's song exactly (89).

While Kant makes no mention of works of art instilling this feeling of awe and terror, later critics have looked in this direction. In Adorno's *Aesthetic Theory*, the glimpse of transcendence, offered and denied, and humankind's ceaseless striving against the universal give great works their power, such as a

late Beethoven quartet or the Serialist works of the Second Viennese School. Affect is still involved in aesthetic feeling, however, even if it is not exactly terror. In contemplating our limitedness in history and time, and feeling our desire toward the infinite and the transcendental in works of art, Adorno writes of the necessity of the "feeling of being overwhelmed" in the presence of successful works of art (79). For Adorno, while that objective can perhaps never be attained, in the striving there is some kind of aesthetic beauty, something of the "primordial shudder" (79). Throughout Adorno's *Aesthetic Theory* is his admiration for works of formal beauty and a continual distrust of simple affect and 'mere' beauty, in the tradition of thinking about aeshetics engendered by Kant. Indeed, Adorno is no fan of works of mass culture. For example, his attacks in this posthumously published last work show his distrust of jazz and rock-and-roll music, which he termed "barbarism," and this opinion certainly marks him as a critic rooted in a High Modernist tradition (320-1).

Yet the distrust of easy affect and sentimentality is surely a theme to consider when approaching "aesthetic science." In the work of these encyclopedic novelists, borrowing a trope from science will never be a source of easy accessible emotion, but rather a cooler sort of intellectual contemplation, *jouissance* in a minor key, so to speak, in the way that the style of "Ithaca" is hyper-rational and over-cool, separating figurative fathers when we desire so

much to see Stephen and Bloom clearly as they meet at the latter's home in Eccles Street. This is very different from a scene in Dickens, as for example, the deathbed scene between Magwitch and Pip in *Great Expectations*, like Bloom and Stephen, also figurative father and son. For more recent theorists of postmodernism, the notion of such "cool affect" is indeed appropriate.

For Fredric Jameson, the appeal of the conspiracy novel, of discovering the interconnectedness of everything instills a kind of blunted affective response in the reader, who can only partially glimpse these paranoid connections (38). Several critics have read the novels of Pynchon, and to a lesser extent, DeLillo, as "paranoid" works, which expose a world where a conspiracy of interlocked details adds up to some greater design.[1] As we read these and other novels, we feel the accretion of detail. However, the valence of such a response in the reader is something past simple awe or terror.

While Kant's bird or birdsong could never take part in the dynamic of a true Sublime, what if we could contemplate the mathematical rules of the bird's song or, better yet, the genetic code that created the bird? The rules of recent science are certainly far more complex than any single individual. Contemplating how the individual fits into a wider scheme of scientific design

[1]See Tony Tanner's largely negative review of DeLillo's *Underworld* in which he describes current critical thinking on DeLillo and Pynchon as "paranoid" writers ("Afterthoughts" 48-9).

can engender a feeling of our limits—while highlighting a human notion of striving to understand the wider order of things. While it may not proscribe a set of images or the prosody of language and what might be beautiful in the original sense of the aesthetic, twentieth-century novels considered in this study choose different models of science as a frequent source for tropes.

By being scientific we can understand pleasure, but of course defining what is pleasurable in aesthetics has proved a richly dialogic enterprise. As Terry Eagleton reminds us in *The Ideology of the Aesthetic*, the category of the aesthetic has proved remarkably powerful and resilient as an analytic tool throughout modern thought (2). In his study of the thought of a tradition of aesthetics from Baumgarten, Burke, Shaftesbury, and Kant on up through the twentieth-century thinkers like Benjamin and Adorno, it is clear that the aesthetic is often what is bracketed away from political realities (and ideology) in Eagleton's readings at different points in cultural history.

Turning once more to Kant, we can see in the *Critique of Judgement* an early split between science and the aesthetic when Kant contrasts scientific genius, as typified by Newton's science, to poetic or artistic genius. Figures like Newton can distill natural and mathematical phenomena into succinct formula and laws, which can be explained clearly to others (170). While minds like Newton's can be assumed to be able to distill new scientific truths, the forms of this type of

scientific thinking will remain essentially the same. However, in poetic genius, the old forms are never enough. It is the mark of a real genius to reinvent new types of poetry, sculpture, and music (171). There are correspondingly no rules toward making new modes of art. Nor is it possible for an artistic genius to explain just how a new idea struck, whereas for Newton, this clarity of justifying newly derived rules or laws is precisely the scientist's gift.

Up through Darwin and the late nineteenth century, and even through the early twentieth century, a gradualist notion of science predominated. With the advent of statistics in the social sciences, geography, and the physical sciences, we might observe that scientists believed that scientific laws would be refined and made more precise. Even the American Pragmatist C. S. Peirce, who argued for the role of chance in evolution, believed that as better data became available in the sciences, a more refined model of scientific understanding could be derived.[2] There would be fewer and fewer surprises in store as science matured and measurements became better over time.

---

[2]In "The Architecture of Theories" (1891), C. S. Peirce argues against a theory of scientific evolution that is wholly deterministic. He writes that there is:

> an element of indeterminacy, spontaneity, or absolute chance in nature. Just as we attempt to verify any physical law, we find out observations cannot be precisely satisfied by it, and rightly attribute the discrepancy to errors of observation, so we must suppose far more minute discrepancies to exist owing to the imperfect cogency of the law itself, to a certain swerving of the facts from any definite formula. (*The Essential Peirce* 288-9)

We now know that scientific progress depends upon reinterpreting existing data in new ways. Brian Greene, a current populizer of recent work in physics, notes that "one of the most exciting things about physics is how the state of knowledge can change literally overnight" (325). For a good part of the twentieth century, our understanding of scientific change as "revolutionary" has become the norm. Newton's classical mechanics still work much of the time in everyday physics, explaining readily observable interactions, although recent chaos theory places even these observations in brackets.[3] The so-called New Physics was invented in the margins of electromagnetic phenomena—light, radio waves, and thermodynamics. Einstein's relativity was developed in thinking about traveling great distances nearly at the speed of light. Heisenberg's indeterminacy in quantum physics occurs inside the atom at a level unthinkable in the nineteenth century.[4]

However, readily observable science gave way to the description of the astronomically large or infinitesimally small. Recent cosmology offers the rich

---

Although Peirce implies that chance will and should never be banished from scientific thinking, it is clear that the movement is toward evermore solidified theories verified with every greater observational precision.

[3]For an approachable guide to 'classical' physics of Newton, see Bernal, pp. 212-216. Bernal points out that Newton's *Principia* was a kind of encyclopedia, a "bible of physics" outlining the complete state of the science as it was known in its day.

[4]For a good description of the history of quantum physics and its philosophical implications, see Kraghe, pp. 206-218. Kraghe is especially good at outlining Einstein's intellectual challenge to quantum theory represented by Heisenberg and Bohr.

paradox of thinking about the first slivers of time in the Universe, where none of the "intuitive" and observable laws of three-dimensional space and time seem to apply, introducing a range of thought that moves from the structure of galaxies down through to structures infinitely smaller than atoms.

A characteristic figure for the new cosmology is the black hole, an area of the sky that is, by definition, not visible, the result of the collapse of a star that seems to violate even some of the latest thinking in physics (Greene 321-2). Black holes are observable only because of the absence of light from surrounding objects in the sky, and the presence of X-rays around the edges of the vortex. At the edge where light cannot escape, the "event horizon," theorists do their work, explaining the paradoxes—and limitations—of earlier theories. Here is another area where the limits of the New Physics and 'standard Model' become apparent, where the rules of Einstein's relativity intersect with quantum mechanics at the microscopic level of matter (Greene 127-9).

Today, we are accustomed to seeing the truth of Kuhn's description of scientific paradigms: each model of science gives way to its successor only after a minor revolution in thinking. Only by better explaining earlier data—even the difficult material, such as time and space on an astronomical or subatomic scale, or the complex contradictions of black holes—can a new scientific theory triumph. In the grand tradition of Western science, Newton begets Einstein, who

begets Heisenberg, whose thought leads eventually to the current generation of physicists and cosmologists who are out to explain "everything," literally, with string theory. The Grand Unified Theory (GUT) or the Theory of Everything (TOE) is the quest of physicists today, the chance to unify explanations for the four fundamental forces: the gravitational force, the strong and weak nuclear forces, and the electromagnetic force (Greene 10).

To reiterate: instead of merely cataloging what already exists and refining theories through statistics (the gradualist notion of science), the advent of the so-called New Physics marks a turning point at which scientists become revolutionary model-makers as never before. Moreover, they seem to deny the evidence derived from ordinary experience. With the arrival of computer modeling and digital simulation, science has moved even further away from the 'real' toward the virtual. Digital simulation is used in every aspect of science today. In fact, it is not uncommon for physicists to run simulations to check the validity of new ideas in the way that earlier generations of scientists turned toward the test tube or the particle accelerator, although these older tools are still available.

The attempt of recent novelists to represent "everything," which here includes different models of understanding, also responds in kind to different types of science. What is encyclopedic necessarily evolves as well. *Ulysses'*

extensive catalogues of things in the world, highlighted with the hyper-rationality of scientific catechism of "Ithaca" derives from a nineteenth-century notion of science. It also exposes the limits of such an enterprise. Thomas Pynchon includes several different branches of science within *Gravity's Rainbow*, including physics, though it is intriguing to note that the "New Physics" was already plagued with contradictions and even superseded by more recent theories by 1973 when the novel first appeared. Richard Powers' encyclopedism is of a different kind, turning to the realms of molecular biology and chaos theory in *The Gold Bug Variations*, artificial intelligence in *Galatea 2.2*, and digital computer simulation in *Plowing The Dark*. Other more recent novelists are pressing against the glass looking in on these developments. Jeanette Winterson's *Gut Symmetries* plays on the latest quest for a Grand Unified Theory (GUT), a title that engages the somatic pun in the name of such a quest. Over time, even the latest and greatest scientific theory becomes 'historical,' a claim that is not without controversy as we shall see below. Writers who are important to this study fix such scientific models of understanding into the fabric of their novels. They record the best that has been thought and said in some of the science of the day as suitable worlds for fiction. Further, they do this aesthetically, that is, in the tradition of bringing a formal beauty and order to the

their world with new tropes and possibilities for the novel, employing a dynamic that could be called "aesthetic science."

Paradigmatic Science and Literary Critics

Literary theorists have had a tough time of it over the last ten years or so when writing about science. By arguing for the use of a term like "aesthetic science," I hope to produce a way of talking about scientific metaphor in ambitious modern and postmodern novels. A certain school of French theory, in the work of such major figures as Lacan, Kristeva, and Baudrillard, borrows key terms from quantum theory and chaos theory without understanding the real science or mathematical underpinnings.[5]

According to its most radical theories, scientific "truth" embodies itself in linguistic constructs, products of history, and culture like other expressions, some of which have been devised and then abandoned over time, determined by

[5]In *Fashionable Nonsense*, Sokal and Bricmont read how theorists like Lacan, Kristeva, Luce Irigaray, Bruno Latour, Baudrillard, and Deleuze and Guattari borrow mathematical and scientific terms and ideas. Their argument against Kristeva is typical of their approach here. "These paragraphs are meaningless, though Kristeva has very ably strung together a series of mathematical terms" (43). They repeatedly point out that terms borrowed from mathematics or science when used by a theorist are inappropriate or "meaningless" when removed from their original contexts. Their critique of the simple appropriation of "uncertainty" from quantum theory is particularly unconvincing, especially as Kraghe notes that the discovery of Heisenberg's uncertainty principle led to all sorts of philosophical speculation by physicists (*Quantum Generations* 209). The membrane between science and literary theory is for Sokal and Bricmont apparently unbreachable, at least for theorists from the humanities.

unseen and shadowy power relations. In this strongly constructed view of science, which I believe is demonstrably false, there is no truth beyond what can be linguistically expressed, which is a product of biased forces in scientific debate. However, whatever the influence of historical or cultural forces, measurable and verifiable empirical evidence marches on, enough to convince most of us to make a phone call, use a computer, submit to medical advice, or get on an airplane, all of which depend upon a host of scientific assumptions as what is reliably true or not.

It is impossible to dissuade those who are committed to the strongly constructed view of science as only a social product, just as it is to tell a physicist trained in mathematics and the scientific method that terms borrowed from his or her discipline can serve as the raw stuff of metaphor. For example, terms from physics made their way into the fiction of Thomas Pynchon, and arguably govern the early reception of his work as we shall see in Chapter 3.

A deeper reading of Pynchon shows that he dramatizes how different models of science compete for explicative truth. There is a tension between different and overlapping models of understanding in *Gravity's Rainbow* beginning with the classical physics of Newton in the title of the novel itself; gravity describes the ballistics of falling bodies in the *Principia*. This model of understanding competes with statistical/mathematical or even occult

explanations of a rocket's fall. The most elaborate metaphor in the text is the convoluted (and comic) notion of classical Pavlovian conditioning in Tyrone Slothrop and his response to falling V-2 rockets. Pynchon dramatizes the process of scientific investigation in The White Visitation as an important thread within the novel. More important, the appropriation of science in Pynchon's work serves as the stuff of some of his most ambitious and beautiful writing.

In my opinion, both Don DeLillo in *Ratner's Star* and Richard Powers in *The Gold Bug Variations* go even further than Pynchon in representing the process of scientific innovation and discovery. DeLillo's novel dramatizes—and satirizes—the process of decoding the meaning of a message by a group of widely diverse scientists and mathematicians assembled at a huge facility in the Far East. Powers' novel turns toward the messages embedded in every living cell. A singular achievement of this novel is to present the actual process of discovering the transmission of genetic information from DNA into coded enzymes as a kind of scientific quest. Not only is the reader given an encyclopedic primer on genetics and molecular biology itself, but we see the lives of American Cold War biologists at work in a large Midwestern university, and how scientific teams operate.

It is a testament to the writing of all these novelists that some of the drama of scientific discovery is elaborated for the reader. In early chapters of *The Gold*

Bug Variations, the reader has been educated in the science of how genetics work and so can participate imaginatively at least in a discovery, presumably worth a Nobel Prize, in the moment when Stuart Ressler, the biologist and main character, realizes how DNA actually creates proteins from a raw genetic sequence. This is a thwarted achievement as Ressler gives up science after a failed love affair with one of his co-workers. He turns toward music, instead of science, for the rest of his life. We eventually discover why. Like *Gravity's Rainbow*, the novel offers a quest of sorts for the reasons behind its protagonist's actions. The behavior of Pynchon's hero, Slothrop, has to do with another "chemical" mystery, that of Pavlovian conditioning to the Imipolex G molecule as an infant.

When critics borrow the terms of science for greater purchase on the "real," or even to dismantle the notion of a single, stable reality of scientific truth, the results can indeed run roughshod over the sensibilities of scientists. In this study, I will argue that a careful reading of the work of writers like Joyce, Pynchon, DeLillo, and Powers shows that each is fascinated with science in a different way, yet they never deny scientific truth as radically as do recent poststructuralist literary critics.

It may well be that borrowing a scientific term or process or entire school of thought is less risky for writers of fiction than for recent critics. In fiction,

outdated, historical, or just plain wrong ideas about science can compete with the latest scientific terminology, even within the same work. Novel writers can mine the raw matter of science for new metaphors without challenging the underpinnings of science. The attacks by scientists on literary theorists writing about science point out some egregious misprision by theorists, but also fail to show the metaphorical thinking—and the possibilities for new thinking about the world—in some of these attempts at translation between the Two Cultures. The potential for these metaphors to create a certain kind of beauty is what I hope to demonstrate by reading aesthetic science in the texts considered here.

A reading of aesthetic science, then, can perhaps point the way for realizing once more the metaphorical possibilities of science and technology, which is itself moving away from the readily observable (ever since quantum theory) but even more so in its furthest vanguard. This extreme point in twentieth century science has to be quantum mechanics, and later, the arrival of the digital, which has revolutionized every branch of scientific investigation today in that computer simulations are now used to model many traditional experiments. Current "best thinking" about the organization of the very small—at the tiniest units of the universe—and very large—the astronomical—posits 11-dimensional mathematical models using strings, which are, some physicists would argue, not testable or experimentally verifiable like the physics of earlier

generations (Greene 383). With the arrival of computer modeling and digital simulation, science has moved even further away from the 'real' and toward the virtual. The response of recent novelists in representing "everything" which here includes different models of understanding, also responds in kind to different models of science. What is encyclopedic necessarily evolves as well.

Already, literary critics have overread indeterminacy in the discourse of quantum physics, whether in critiques of science or in the early reception of Pynchon. At its leading edge, then, science moves toward model-building that is counter-intuitive, non-observable, and disruptive of commonsense notions and everyday understanding. This open-endedness and potential for metaphor is undoubtedly available for recent fiction writers to adapt, with some provoking results. It should come as no surprise that recent critics have applied the same terminology to overread the ordinary world, especially if scientists are engaged in the same project. Each side does not see that science approaches myth, in the sense of "myth" as a founding principle or shared set of assumptions.

"Common Readers" and Aesthetic Science

I am always struck by Eliot's essay on poetic creation "Tradition and the Individual Talent," which argues for impersonality while borrowing a metaphor from an undergraduate chemistry class. Like the strip of platinum that provides

the catalyst for a chemical reaction, the poet's own personality, according to Eliot, is merely a catalyst for a chemical reaction that is poetry: "The mind of the poet is the shred of platinum" (41). It is mildly shocking to compare the genesis of a poem to the creation of a chemical compound. However, I do not believe that the readers of this essay are meant to be made comfortable by such a comparison. This metaphorical act is itself distancing, in an essay that argues for the de-personalizing of poetry.

There is a point in cultural history where writers turn toward science and applied science, technology, for a source of metaphor and imagination. The raw stuff of science becomes suitable for ambitious literary texts, including the encyclopedic novel. This dynamic invites speculation about what typical readers would accept, and even enjoy, in ambitious works of fiction. Over time, what is acceptable for literary production includes the raw stuff of science and technology. I will refer to this dynamic as "aesthetic science."

In 1945, scientific understanding was more or less the rhetorical and institutional opponent to New Critical reading strategies of poetry. In 1960, in *The Two Cultures*, C. P. Snow could point out that no scientists he knew had read any literature (save possibly Dickens or Shakespeare) and no literary intellectual could quote the Second Law of Thermodynamics (12-15). In 1973, quantum theory needed defending in *Gravity's Rainbow*. Yet by 1993, a slender book,

Einstein's Dreams, by Alan Lightman, a practicing physicist, reached the *New York Times* bestseller list with no excuses for its appropriation of the scientific for a successful novel of style. Clearly, some kind of middle-class readership had evolved to accept the raw stuff of physics as suitable for ambitious writing.

The evolution of British and American middle-class taste since the end of the nineteenth century has been treated as an important aspect of Jonathan Freedman's *British Aestheticism*, *Henry James and Commodity Culture*. Freedman suggests that the impulse to aestheticize common household objects leads directly into commodity culture in both the U.K. and America in the advertising of early mass-market periodicals and in new products, such as Tiffany lamps or other merchandise for the House Beautiful (81).

The evolution of taste here also has economic underpinnings, in the emergence of a managerial middle class. One remembers that the seminal *Yellow Book*, published by John Lane from 1894 to 1897, was popular enough, though hardly mass market, to reach a middle class in England. These readers would not have attended universities, but would need and want to be educated, so that they might be accepted, perhaps, among educated circles.

It is, of course, difficult to speculate on what comprises a "typical" reader for a magazine, a quarterly, or an encyclopedic novel, but I hope to describe the changing tastes of readers for the texts. For *Ulysses*, there is a good deal to

consider in the pages of *The Little Review*, where the first fourteen episodes of the novel were serialized. Hardly a popular magazine, *The Little Review* is remembered for publishing many of the major figures of British and American Modernism, including Eliot, Stevens, and Pound.

However, what makes *The Little Review* a fascinating cultural document is its revelation of readerly tastes in its editorial pages. It often featured letters to the editor in its "Reader Critic" section, which appeared regularly in the magazine from 1914 to 1921. Here ordinary readers could sound off about the direction of the magazine as it veered from being a rather parochial Chicago-based publication until 1916, when it moved to New York and became, under Pound's remote tutelage as foreign editor, modernized and, to a large extent, Europeanized. For *The Little Review*, its salient event in cultural history was its commitment to publish *Ulysses* as a masterpiece, against increasingly greater odds. It was the court case against the novel which effectively ended the magazine's regular publication in America, although *The Little Review* was published intermittently until 1929 from Europe. In the reactions, increasingly hostile it would seem, to subsequent chapters of *Ulysses*, we see something of the reading strategies of ordinary readers, and something of their expectations for advanced writing.

The 'implied' reader, as treated in reader-reception theory from Iser to Stanley Fish, is always something of a chimera. However, in the pages of *The Little Review*, we can speculate as to what expectations readers actually had as they were told that this 'masterpiece' was indeed that, and not a mishmash—one that was increasingly hard to grasp without the Linati schema detailing the Homeric parallel—if not actually obscene within the norms of American writing in the years after W.W. I.

Today we have online discussion forums, where 'ordinary' readers can voice their opinions on books. We can glimpse the ideas for commonsensical reading strategies from these non-specialist forum contributors. For this study, I will draw on several early short stories published in smaller magazines, which presumably are aimed at a middle-class, educated audience. With this evidence, we can gain a glimpse into the evolution of readers' sensibilities. Using such evidence as online contributions—in effect, letters to the editor in another key—and early short fiction in magazines, we can see how the reception of aesthetic science has evolved in twentieth-century cultural life.

Moreover, this vein of recent work is popular enough with reviewers and middle-class audiences outside of the Academy. This study hopes to engage the evolution of middle-class taste as well, which will necessarily be a speculative enterprise. Wherever possible, I will make use of popular publications for

authors' works—and the reactions of common readers where available—which can give a sense of what appeals—or sometimes repels—a middle-class readership. The status of science in late twentieth-century life has largely gone unchallenged: to oppose technology is to deny mass culture in many of its forms. Perhaps in turning to science, recent novelists have succumbed to an ideological aspect of postmodernity. Perhaps they are still trying "to make it new"—in Pound's terms—for contemporary writing. It seems that that all aesthetic writing soon exhausts its tropes from one literary generation to the next. In the face of rapidly evolving science and especially the arrival of digital simulation in the latter half of the twentieth century, there are many new ideas and tropes to explore in fiction. Inevitably, the newest models of science become fossilized. Many scientists might argue that few "revolutionary" models are in store for us, now that we have evolution, genomics, chaos theory, and a cosmology that examines the most infinitesimal intervals of time in the Universe. It would seem that science as a source of tropes for a new kind of aesthetic writing is not inexhaustible. Already, some of the most ambitious and successful novels of the twentieth century have made use of changing models of science in their efforts to represent the real world, and for creating fictional worlds that find genuine resonance with their audiences.

In the second chapter of this study, I will examine *Ulysses* as an encyclopedic text, using evidence drawn from the editorial pages of *The Little Review* which published its first fourteen episodes and provided readers with a forum in which to register their reactions to this often bewildering text. I will also examine the novel's use of science, in particular, Pound's defense of the novel, which made use of a model of science espoused by nineteenth-century social science in the tradition of Zola and the experimental novel.

In this section, I will propose a reading of "Ithaca" as an exaggeration of an Enlightenment catalogue or traditional encyclopedia. *Ulysses'* extensive catalogues highlighted by its style of hyper-rationality evokes and responds to a older notion of science from the nineteenth century, as well as challenging the classical worldview of Newton. The style also exposes the limits of such an enterprise by obscuring, rather than revealing, a humanistic, mimetic truth of the meeting of Bloom and Stephen at Eccles Street. *Ulysses* draws from the universe of Dublin for its "endless" details. In Joyce's accretion of scientific and catechistic detail in "Ithaca," a sort of encyclopedic, Jesuitical intelligence stands between our understanding of the characters of Bloom and Stephen Dedalus, precluding an easy—and perhaps even sentimental—meeting of these two figures as might occur in a traditional Victorian novel. "Ithaca" was Joyce's favorite chapter, according to Ellmann, and this episode employs a different rhetoric, one imbued

with a popular-minded scientific worldview, in describing Dublin to the last imaginable detail.

In Chapter Three, I will review how Thomas Pynchon's work has been read as embodying the tenets of the New Physics, especially the contradictions and indeterminacy of quantum mechanics. We will see that the world of the novel actually dramatizes competing models of science, and even pseudo-science. The importance of the New Physics to the reception of this novel has arguably been overstated. However, in examining this dynamic of classical/post-classical science in the novel, we can learn a good deal about the relationship of the recent literary theory to science. I will look at Pynchon's scientific allusions in *Gravity's Rainbow*, which include Newton's ballistics, Heisenberg's quantum mechanics, ideas from inorganic chemistry, psychological Pavlovian conditioning, and discontinuous mathematical functions.

Pynchon is a strong test case for developing a new analytic of "aesthetic science" because it is with his work that the raw stuff of science becomes the main source of his work's most ambitious allusions and tropes. I will also examine the appearance of an early Pynchon short story, "Entropy," in *The Kenyon Review*. This story makes clear use of science for its structure and tropes

(principally the Second Law of Thermodynamics) and marks a rupture in sensibility for another readership used to what was proper for fiction and poetry. Published in 1960, this story clearly engages the challenge laid down by the scientist and practicing novelist C. P. Snow in his book *The Two Cultures* (also published in 1960), in which he argues that no literary intellectuals he had met could even explain the basics of the Second Law (14-5). *The Kenyon Review* engages in this debate quite directly; it published an essay by Snow in the same year, as well as sponsoring a symposium entitled "Communication Between the Arts and Sciences" in Fall 1961, in which Snow was a participant.

If we accept that there is an encyclopedic impulse in the cultural history of the twentieth-century novel, we must also ask what happens when a novelist fails to execute an encyclopedic novel. Necessarily we might suppose, every encyclopedic text is a failed enterprise. Novels, no matter how massive their collection of detail, must always draw from the world metonymically. This is true of every text, it would seem. In Roman Jakobson's binary opposition of metonymic and metaphoric texts, the encyclopedic novel may be seen as a sort of gryphon; it is metonymical but stands on its own as a self-contained world, more so than traditional novels.[6]

---

[6]Jakobson's formulation of metonymic versus metaphoric language and texts was derived from his work with aphasics, those who have lost different areas of brain function. His brief reading of literary schools engages both terms:

In Chapter Four, I will read Don DeLillo's early short fiction as a response to the changing literary landscape in the 1960s and 1970s and the new value placed on science. I will then argue that *Ratner's Star* (1976) is a good example of an encyclopedic text that adopts various models of science. DeLillo appropriates scientists and mathematicians as characters in this mature work. Turning to DeLillo's most ambitious novel, *Underworld* (1997), I hope to explain why and how this novel is a "failed" encyclopedia, although one that exhibits the same impulse to document "everything" in mid- to late-twentieth-century American culture. I hope to situate *Underworld* among his other novels and show the limits of an encyclopedic text in the late twentieth century. Also I will examine the novel's ending, which turns toward cyberspace in a utopian gesture, which I will read in terms of my proposed dynamic of aesthetic science.

> The primacy of the metaphoric process in the literary schools of Romanticism and Symbolism had been repeatedly acknowledged, but it is still insufficiently realized that it is the predominance of metonymy which underlies and actually predetermines the so-called Realist trend, which belongs to an intermediary stage between the decline of Romanticism and the rise of Symbolism and is opposed to both. (111)

Of course, I realize that the Jakobson's opposition between metaphor and metonymy cannot be undone by the works from the genre of the encyclopedic; only that such works present traits from both categories.

The work of Richard Powers in Chapter Five deserves its own reading because this novelist is clearly engaging the dynamic of how science can be aesthetic in ambitious and demanding new ways. Moreover, Powers seems to be a writer rooted at first in the 'novel of style.'[7] His first novel, *Three Farmers on the Way to a Dance* (1985), takes a quintessentially aestheticist enterprise of reading an old photograph, and imaginatively renders it for the reader.

In *The Gold Bug Variations* and several more recent books, Powers has taken on our current science head-on. This latter novel looks at the underpinnings of genetics, molecular biology, and chaos theory. *Galatea 2.2* and *Plowing the Dark* examine the worlds of artificial intelligence and digital simulation, respectively. I will argue that *The Gold Bug Variations* is an ambitious encyclopedic novel, one that makes continuous use of aesthetic science for some of its most effective tropes and novelistic technique. *Plowing the Dark* exposes the contradictions in an ever more digital science as practiced near the end of the twentieth century, and engages the dynamic of virtuality and the lack of bodily experience in digital life. By powerfully juxtaposing a narrative of a Westerner trapped in a room as a hostage in Lebanon, with nothing except mind and

[7]For the purposes of this study, the term 'novel of style' should be taken to refer to a tradition of the novel derived from James, Huysmans, Pater, and similar figures. Of course, there is a style associated with any novel, but at the turn of the twentieth century, the tension between naturalism and aestheticism outlined a preoccupation with style in texts that descend from the latter movement in cultural history. Today, a fiction reviewer might use the term 'novel of style' as a shorthand for a novel that creates a distinctive voice and favors brevity and economy over a sprawling rhetorical surface that derives from the tradition of realistic or naturalistic texts.

imagination to struggle against "naturalistic" bodily injury and extreme deprivation, this novel powerfully dramatizes the contradictions in virtual (and postmodern) life, a problem outlined by Terry Eagleton in his most recent work, *After Theory* (2003) when he writes of how "inconvenient" bodies are denied in postmodernism (164).

As this study concludes, I hope to suggest how legitimate scientific tropes have become, so much so that the raw details of science may now be divorced from an encyclopedic impulse. In 1970, we might speculate that only those with formal training in quantum physics would have been likely to care for the nuances of Pynchon's presentation of Tyrone Slothrop as quantum particle, an entity which has gone missing by the end of the novel. However, by 1993, the *New York Times* bestseller list would include Alan Lightman's novel *Einstein's Dreams*, written by a recognized physicist, one of several novels that make use of recent science with surprising frequency. Recent artists such as Jeanette Winterson make use of recent science for the *donnée* of their work. Physicists and other scientists appear as central protagonists in novels concerned with style. Recent science, it would seem, is no longer a risky matter to be included in novels. Moreover, audiences are expected to know and appreciate these forays into science, and by and large they do. These texts and others are well-reviewed

and though by no means popular in a mass-market fashion, have not been overlooked. Aesthetic science facilitates stylistically ambitious texts.

In the progression of these novels, we can see a dynamic of aestheticizing science, which has proved an acceptable and indeed popular strategy for serious fiction, anchoring the aesthetic for contemporary readers. Surely, this is a far cry from the aesthetic writing of Huysmans, Wilde, or Pater, but it still suggests new ideas of order and beauty for an audience. Moreover, the move to appropriate science for new fictions in new ways suggests how close recent science has become a new type of myth for twentieth-century American and British culture, one that is accepted for its suggestive and metaphorical possibilities for new tropes, rather than for its hard, denotative meaning. Of course, the realistic novel has always represented science, as a part of the world. But more recently, in the texts examined in this study, science becomes a central thematic focus as never before. Extraordinarily few of us will ever know and understand the mathematics and finer points of particle physics, molecular biology, or digital-computer simulation, but in the hands of some of the most ambitious novelists, this raw scientific matter achieves a new way of seeing and understanding our ordinary world, which is what the best metaphorical and aesthetic writing has aimed for in earlier periods.

One could argue that poststructuralist theory is consciously anti-aesthetic, that pleasure is certainly to be distrusted, and that pleasurable writing has often held no place in this theory. In creative fiction, you cannot easily dramatize a deconstructionist aporia, a moment where a poem gives out under the weight of its rhetoric, or a novel undoes its assumptions about everyday binary oppositions. Yet new models of science allow for precisely this sort of metaphor-making. Plays by Michael Frayn and Tom Stoppard, novels by Richard Powers and Jeanette Winterson, as well as other recent works, readily partake of a new aesthetic, one which aspires to an ambitious writing that is concerned with style. However, instead of being rooted in older forms of Nature, they are able to borrow the matter of recent science for their characters, settings, and plots, and to embody the paradoxes, complexities, and rich contradiction of physics, biology, and digital life.

Finally, in this study of aesthetic science and its relation to the encyclopedic text, different notions of science predominate at different points in cultural history. I am particularly interested in the status of science as a privileged mode of understanding. As I will argue throughout these chapters, ambitious writers are now able to write aesthetically once again beyond the well-made novel precisely because they are borrowing from science, which legitimizes

their stylistic ambitions. In the 1890s, an aesthetically minded writer might have looked toward Art or, as in the case of Huysmans, obscure, sensual arcana. A Romantic might have turned toward Nature for inspiration. Something in the twentieth-century condition legitimizes the turn toward science, as rendered aesthetically. The echoes of Kant's statements on beauty—that the Sublime be difficult, even terrible—are perhaps still with us. Aesthetic science does not promise easy emotional delight as much as it demands an appreciation of a more difficult, more formal category of beauty. Like the reader of "Ithaca," we may want more of the humane in the field of scientific fact or model-building, but this cool affect is what our present sensibilities perhaps require. It is to Joyce's modernist masterpiece that I will now turn to see how its encyclopedism makes use of an older, nineteenth-century model of science within the framework of the quintessentially modern encyclopedic novel.

CHAPTER 2

Common Readers and the Science of "Ithaca" in the Modern Encyclopedia

In July 1918, an ordinary reader of *The Little Review* expressed considerable confusion and even outrage at the initial chapters of *Ulysses*, which had been serialized in the magazine beginning with "Telemachus" a few months earlier:

> Dear Editor, how could you!! Turn the beautiful *Little Review*, that once bid fair to be one of the finest publications in America, into a thing of freaks and fakes, of posterists and squeaking egoists!! The much bepraised Joyce's 'Ulysses' is punk [...] and Ezra Pound is punkiest [...] I cannot see that the drivel that passes for conversation in the Joyce atrocity is improved by the omission of quotation marks. Joyce's pleasing[!] habit of throwing chunks of filth into the midst of incoherent maunderings is not at all interesting and rather disgusting. (Stuhlman 64)

This irate reader goes on to warn that "no freak magazine can last long [if] it depends on shock to taste and convention for its success" (64).

Early reactions of common readers, like the above, drawn from a presumably middle-class readership in a small, but influential, literary magazine edited by Margaret C. Anderson, Jane Heap, and Ezra Pound, its "foreign editor,"

reveal a sense of frustration at encountering a novel that was advertised as a "masterpiece" by Anderson on the back cover of the magazine in January 1918 even before its serialization had begun.[1] The magazine, which had begun publication in Chicago in 1914 and had concentrated largely on American poetry and emerging trends like Imagism, arguably left its readers in the lurch and without the means to understand a high modernist, encyclopedic novel like *Ulysses*.[2] Under the aegis of Pound, the magazine moved toward Europe and much more difficult terrain even before March 1918. Taking on the American censors—and angry readers like the above—is surely a singular achievement for which Anderson and *The Little Review* are deservedly remembered today. It is good to be reminded, however, of the difficulty in encountering Joyce's novel in

[1]The "Announcement" appearing on the last page of *The Little Review* in its January 1918 issue was obviously written by Margaret Anderson, who quotes Pound (by implication) in his views of Joyce as a sort of Irish Flaubert:

> I have just received the first three instalments[!] of James Joyce's new novel which is to run serially in The Little Review, beginning with the next number. It is called *Ulysses*. [...] So far it has been read by only one critic of international reputation. He says: 'It is certainly worth running a magazine if one can get stuff like this to put in it. Compression, intensity. It looks to me rather better than Flaubert.' This announcement means that we are about to publish a prose masterpiece. ("Announcement" 66)

[2]Aside from publishing Imagist poets like H. D. and Richard Aldington, *The Little Review* helped its readers with several essays and reviews that explained the new poetry. This was before Pound arrived on the scene and began espousing European (British and French) voices, a move which generally did not sit well with its established readers. The letters to the editor in the "Reader Critic" section garnered praise after the women editors ran an "American Number," briefly suspending the serialization of *Ulysses*, which had caused a considerable stir.

the reactions of readers from 1918. From the very first appearance of the novel, imagining the role of the "plain reader," the non-academic, general reader who needed assistance in understanding Joyce's difficult writing, would become a distinct—and enduring—category within Joyce criticism. Indeed, early commentators, like Charles Duff, in his *James Joyce and the Plain Reader*, or early readers' guides by Frank Budgen and Stuart Gilbert have sought a place for such ordinary readers.[3]

Ninety years later, we have an ample critical apparatus to understand the quintessential modern encyclopedic novel. In particular, the schemas given by Joyce to Carlos Linati in 1920 and Stuart Gilbert in 1931 have certainly remained important touchstones for comprehending the apparent "everythingness" in the novel, which often arguably threatens to overwhelm the first-time reader (Ellmann 521).

More recently, Danis Rose's 1999 "Reader's Edition" of the novel, which controversially added punctuation to "Penelope" among other alleged

[3]Ellmann notes that Joyce worked with Frank Budgen and Stuart Gilbert as "authorized" guides to *Ulysses* around 1933 (665). Charles Duff also contributed an early book, *James Joyce and The Plain Reader* (1932), which partakes of the dynamic I have in mind here: trying to prove that Joyce was accessible to almost anyone. The preface is perhaps emblematic: Duff writes, "Dedicated without malice[!] to the plain reader" (5). The adversarial nature of the ordinary reader and Joyce is certainly in play here.

"improvements" to readerly understanding, is another example of negotiating a role for the ordinary reader.[4] The very recent (and much milder) controversy surrounding the suggestion by Roddy Doyle and John Banville, two contemporary practitioners of the Irish novel, that the centennial anniversary of Bloomsday in 2004 celebrated in Dublin would be needlessly commercialized when actually very few people have read and understood the novel is another example of a debate over the place of non-academic readers in the reception history of *Ulysses*.[5] These developments remind us that the position of the non-academic reader in reception history has always been contested ground. Before Joyce took root in academic criticism, it was not entirely certain that he really belonged to the common reader, after all.

Of course, it is difficult, if not impossible, to recover the shock of the new in a contemporary reader's first encounter with *Ulysses*. By now, we are so accustomed to a body of criticism that allows us to understand and more deeply appreciate Joyce's achievement that it would be unthinkable to go it alone, so to

---

[4]Among other changes, Danis Rose's 1999 edition puts punctuation in "Penelope," in a controversial edition that generated a lawsuit with the Joyce estate. For the American edition, Rose reverts back to Joyce's original unpunctuated version in the main text, but prints his "improved" version in an appendix.

[5]Paddy Doyle and John Banville, both prolific contemporary Irish novelists, commented separately on the commercial aspects of the Dublin Bloomsday Centennial celebrations of 2004. Doyle, in particular, generated controversy by suggesting that *Ulysses* is a novel that few have read or understood. He also suggested he thought that Joyce's novel had been overrated on the same principle. See Justin Beplate's discussion of this controversy in the ongoing role of difficulty of *Ulysses* with ordinary readers, which continues today (6).

speak, reading the novel as is. Moreover, there is perhaps no other author for whom a vast critical apparatus is inextricably linked. Joyce's novel demands to be read hand-in-hand with its criticism, to expose its shape, to explicate its allusions, to access its inner structure.

There are, nonetheless, many difficulties in encountering *Ulysses* for the first time even with such help. *Ulysses* is encyclopedic as few other texts are, representing the world of Dublin on June 16, 1904 with a beautiful—and sometimes frustrating—meticulousness. Yet even in the first chapters of "Telemachus," there are difficulties to comprehension, principally in Joyce's innovative technique of interior monologue. This experimental novelistic technique aside, however, the content of the initial style serves as anchoring point for the reader's experience of the entire novel. "[The initial style] is the tonic or fundamental, Socrates' doorstep, home plate: it is the place we begin, the place that forms our expectations, the place we remember when we are away from it, and the place we end" (French 55). If it were not for the new technique, these first chapters might set up the expectation of any late Edwardian novel as three young men about town, Buck Mulligan, Stephen, and the Englishman Haines, exchange banter over breakfast in the tower at Sandycove in "Telemachus." Their repartee might be comprehensible to a nominal reader of the age. Yet the response of the befuddled reader of *The Little Review* quoted

above suggests otherwise. To him, this "banter" is only "drivel" that pretends to be dialogue.

Based upon the reaction of ordinary readers in *The Little Review* who sounded off in letters to the editor (in its "Reader Critic" section) we can see that the initial style is probably not very simple, after all. Though it is impossible to know how selective or representative these letters actually are, as a record of the readerly experience encountering *Ulysses* head-on for the first time—devoid of any of the critical apparatus that arguably assists new readers today—this selection of responses is a unique record of a moment in middle-class taste. The experience of reading the novel without any tradition of criticism or guide asks a fundamental question: what is it like to encounter the novel without knowing the Homeric parallel, or to see the novel as a pure documentation of Dublin at a certain point in history?

However, the narrative technique—interior monologue, borrowed from Édouard Dujardin's *Les lauriers sont coupés*, is what is on display here. In Stuart Gilbert's 1938 translation, obviously a homage to his master, it is intriguing to see that he renders Dujardin's first-person musings as the main character wanders

down the street in a style that resembles the tenor of Bloom's voice in *Ulysses* so closely.[6] Reading the translation second, the reader is hard-pressed to recall that Dujardin employed the technique first. The resistance to putting on the mind of another is clear in the reaction of early readers of *Ulysses*.

The anxiety of interior monologue evoked in the reader is that of a meaningless all-inclusiveness. The author is free to say anything. Just as in psychoanalysis, the truth is in the margins of a flow of uninterrupted words. Moreover, if the writer of such freeform thought is a High Modernist Artist,

---

[6]Gilbert's translation might well be read as an attempt to co-opt a moment of the anxiety of influence between the master Joyce and an early precursor, who invented the narrative technique for the "initial style." However, as Richard Ellmann notes, the two writers were quite comfortable with the literary influence, and Joyce even helped Gilbert to translate Dujardin's book into English (665). Here is a typical passage of the inner thoughts of its protagonist:

> Sounded reproachful. Now why shouldn't I sport a bowler. That's the sort of chap he is, thinks that trifles like that count if one wants to look smart. The concierge's den; there's never anyone there; rum sort of house this is. Surely Chavainne will come a little way with me. But he's a tiresome fellow, always wants to go straight home. In the street now; a carriage waiting at the entrance; shopfronts flashing sunlight; in front the Tour Saint-Jacques; we are going to the Châtelet.
> —How is your love affair getting on?
> He wants to know; I'll tell him.
> —Much as before.
> We are walking side-by-side. (Dujardin 9)

Leon Edel's introduction to the New Direction edition of 1938 explores the influence of Dujardin, walking a line between acknowledging the source of the "monologue intérieur," but careful to show Dujardin as a type of dandy himself who merely "scribbled" the novel in 1887. "One imagines his pointed beard held high in the air, a flower in his buttonhole, a long-stemmed cigarette holder in his month," Edel writes (x).

perhaps truly anything goes. Yet, there is actually little danger of this occurring in *Ulysses*. Even beyond the first chapters of *Ulysses*, the narrative is absolutely bound by time and place. To take just one example, Stephen's allusions to German Continental philosophy on the beach at Sandymount in "Proteus" are undoubtedly difficult, but the selection of details is always bounded by the narrative framework of the Homeric parallel. We are in a specific place and time, and we have just an hour. Even if we cannot decipher everything about Stephen's experience and inner musings on the beach, we garner the basics: he is an over-thoughtful young man who is afraid of dogs and who muses about his displacement from his home by Haines and about his own deceased mother.

If Stephen muses on *nacheinander* and *nebeneinander*—concepts from the eighteenth-century philosophy of Lessing, according to Thorton Weldon, referring to poetry and the visual arts, respectively (42)—and other philosophical concepts, his inner thoughts are interrupted by the real facts of the beachcombers, a sailing ship, the dead dog's body, memories of his lost mother, real facts, and impressions of recorded sensations. They are external stimuli, inviting internal speculation. There is no danger, at least early on, of today's reader getting lost in the river of interior monologue because Joyce always subsumes the pursuit of meaning and allusion to his characters moving through space and time, in a narrative grid meticulously prescribed by the Homeric

parallel. There are no genuine madeleines early on in *Ulysses*. Joyce is never indulgently discursive in *Ulysses'* early chapters as are some writers of stereotypically 'bad' experimental, stream-of-consciousness writing. Of course, it is obvious now that *Ulysses* is meticulously planned, but this is with the benefit of hindsight and a huge critical apparatus. However, for the unfortunate first readers of *The Little Review*, caught without any context for reading this advertised "masterpiece," one can see the possibilities for confusion and, indeed, frustration. This statement seems to me to be self-evident today: the details of *Ulysses* resolve against the real, historical Dublin. Additionally, many of the details, like Bloom's "throwaway," or the cloud that passes the sun, viewed by both Stephen and Bloom, are internally consistent.[7] Particularly in the initial style of the novel, there is an economy of meaning governed by the strictures of the Homeric parallel, which helps to rein in any extensive digression.

Narratively speaking, Joyce's encyclopedia is relentlessly set in the present in a way that few texts are. Only Virginia Woolf, I would argue, is able to capture the rhythm and vibrancy of an intelligent character thinking aloud in response to external stimuli. There is a resonance with the flaneur here—

[7]A 'paranoid' text, which builds a system of correspondences that enacts a sort of paranoia in the reader, has been suggested for readings of Pynchon's *V*. and *Gravity's Rainbow*. The notion of tightly woven web of correspondences certainly plays out in *Ulysses*, as well. I am thinking of the way the expressionist drama of "Circe" re-circulates many of the details found earlier in the book, with even inanimate objects, such as Bloom's soap getting a speaking part. (See *Ulysses*, p. 360).

whether it is Bloom strolling in Dublin to check up on a newspaper ad or Clarissa Dalloway walking through London to get her flowers for her party in *Mrs Dalloway* of 1925.

The early defense of *Ulysses* had to take place on two fronts: against the charge of incomprehensibility, a sort of meaningless all-inclusiveness and, of course, its sexual content, its alleged obscenity. In Judge Woolsey's well-known 1933 decision, which until the Gabler edition of 1984 greeted a new American reader of the novel, the charges of the first kind helped defuse charges of the second. The difficult surface of the novel obscured any sexual themes.[8]

In 1918, Ezra Pound defended *Ulysses* in light of his own preoccupations with an important development in cultural history. This is the tradition of French naturalism inherited from the Goncourt Brothers, through Zola, then on to Flaubert. Readers of *The Little Review* were treated to a defense of Joyce with an interesting cultural artifact: the preface to the Goncourt brothers' *Germinie*

[8]Judge Woolsey's decision acknowledges the difficulty of the "technique" of *Ulysses* and assiduously attempts to make sense of the narrative strategy, beyond its obvious "dirty" words (xiv-v). Woolsey comments on Joyce's novelistic practices as attempting to be "graphic technique," that is, visual instead of being in language, and this accounts "for much of the obscurity which meets a reader of 'Ulysses'" (xv). He also weighs what today we would call 'community standards' in deciding whether the offensive words on their own would qualify the novel as an obscene text, even turning to two friends for their reactions (xvii). Finally, it is the ambitious technique that demands the book be read "in its entirety" which assures it does not become some sort of "aphrodisiac" (xvii-xviii). A more transparent technique (with less obscurity) would have made such an argument less likely.

Lacerteux (1864), printed as a piece, untranslated, in the July 1918 issue. Pound writes:

> I am tired of rewriting the arguments for the realist novel; besides there is nothing to add. The Brothers de Goncourt said the thing once and for all, but despite the lapse of time their work is still insufficiently known to the American reader. The programme in the preface to 'Germinie Lacerteux' states the case and the whole case for realism; one can not[!] improve the statement. I therefore give it entire, ad majoram[!] Dei gloriam. ("De Goncourt" 56)

The Goncourts' defense of their novelistic practice, of showing the seamier side of Parisian life, gestures strongly toward science. As they wrote in their preface:

> Today [in 1864] the novel expands and reaches out, to begin to be a serious form, passionate, living, a literary study and a social inquiry, that becomes, by analysis and psychological research, contemporary moral History; today, the Novel is imposed upon by the study and responsibility [devoirs] of science. (Goncourt "Preface" 57, my translation)

Here, within the intersecting timelines of publishing history, it is good to remember that even before Zola, the trope of the novelist as social scientist was in force and available. The formal defense of Zola's own novelistic practice

occurs in 1880 with his essay "The Experimental Novel" in which Zola theorized that this form was ideally suited for the working out of societal forces, and of course, like a psychological or medical researcher, the novelist could leave nothing out. When he quotes the Goncourts, Pound defends *Ulysses* on an earlier set of assumptions rooted in an earlier type of science, one influenced by nineteenth-century social science—that is to say, social investigation. As a sort of social scientist, the novelist can claim all material, even what its detractors called "obscene," as matter for novels. One senses also Pound's frustration with the American censors of Joyce, as the same arguments had been apparently resolved several decades earlier in French culture.

Pound's more formal defense of *Ulysses* in its entirety came in May 1922, with an essay printed in *The Dial*. (By then *The Little Review* had temporarily ceased publication after a lost obscenity trial in late 1920, though it would pick up again and continue to be published intermittently until 1929.) Pound celebrated the arbitrariness of allusion in Joyce's novel when he writes, "In *Ulysses* anything may happen at any time" ("Ulysses" 404). As I have suggested, Bloom can think of any number of details, though bounded in readerly time with roughly how long it takes Bloom, say, to cross a Dublin street. Pound celebrates the arbitrariness of Bloom's associations. For him, Joyce in the early chapters in *Ulysses* demonstrates a consummate eye for detail in prose, and a continually

puncturing of middle-class pretensions along the lines of Flaubert. Indeed, Bloom's all-encompassing mind is a little silly; he is a little full of himself at times. There can be no doubt that Pound appreciated Joyce's discovery of *bovaryisme* in Dublin.

Pound's central thesis, articulated later in the same essay, is an argument for artistic expression based on scientific prerogative. He writes:

> *A great literary masterwork is made for minds as serious as those engaged in the science of medicine*. The anthropologist and the sociologist have a right to equally accurate documents, to equally succinct reports and generalizations, which they seldom get, considering the complexity of the matter in hand, and the idiocy of current superstitions." ("Ulysses" 408, author's italics)

Once more, in Pound's view, the novelist is a sociologist. Joyce is, after Zola and Flaubert and nineteenth-century social scientists or medical researchers, entitled to investigate every aspect of human behavior, including sexual matters.

In its final issue of 1929, *The Little Review*, which had moved to Paris and increasingly given attention to the visual arts, asked a diverse group of over fifty famous and lesser-known writers and artists a series of questions, such as, "What do you fear most?" Their responses, many of which are indeed fascinating, invited some intriguing autobiographical speculation from figures including

Gertrude Stein, Dorothy Richardson, Marianne Moore, and William Carlos Williams, all of whose works had appeared in the pages of the magazine throughout its run.[9]

One set of responses from Bertrand Russell reminds us of the growing importance of science in the twentieth century. Asked what figure in history he would like to be, he responded that it was Einstein. "There are about a dozen human beings with whom I would gladly change places; first among them I should put Einstein" (Russell 72). In another response about what he would like to do in the future, Russell replies, "I should like to do physics, to know physics, to be a physicist" (72). Of course, Russell is not an aesthetic writer by any means. In the same questionnaire in fact, he admits, "I have no view of about art to-day" (72). Yet I would like to see this confession as emblematic of a trend in later twentieth century thought: the gradual acceptance of science for embodying more of a culture's ideals, aspirations, even notions of formal beauty.

To sum up, ideas of science have from the very beginning been associated with the reception of *Ulysses*. The novel's serialization was suspended because of the New York obscenity trial after the beginning pages of "Nausicaa" were published in 1920, so we do not have the reactions of initial readers to the

[9]Though asked by the editors, James Joyce declined to answer any of the questions, but the editors printed two pages of *Work in Progress/Finnegans Wake* reprinted from *Transition*, which were heavily covered with Joyce's handwritten emendations suggesting he was hard at work at something else. See "Proof 5," p. 50.

adoption of scientific language in "Ithaca" for novel-writing. However, science has been adduced as a way to defend against charges of obscenity, by Pound and others, and also to justify the novel's apparent all-inclusiveness.

As any student of *Ulysses* of today realizes, the problems for ordinary readers are only beginning in the chapters that were serialized for its first audiences. The later chapters of *Ulysses* show the infinite possibilities of rhetoric and how they limit our access to the real. The shifting styles where language predominates supports a deconstructive reading in the style of Colin MacCabe, as we shall see below. In such a reading, one style is as good as any other, we might suppose, and *Ulysses* might well go on and on. There is, of course, no dismissing any strong deconstructive reading of this or any other novel. While there is no easy solution to overcoming the rhetoricity of texts, certain discourses in the encyclopedic project, such as its scientific allusions in "Ithaca," are more significant than others and may play a greater role in the production of meaning between author and reader.

I will now propose a reading of "Ithaca" that will explore its relation to science to the novel's relationship to encyclopedism and the aesthetic turn, the topic I am attempting to articulate in this study. In the reading proffered here, I hope to concentrate on why the adoption of the language of science in "Ithaca" is significant for a novel as encyclopedic as *Ulysses*, and to consider the status of

science in the scheme of Joyce's whole project, as well as to present some thinking on my proposed category of "aesthetic science," for which "Ithaca" and *Ulysses* will, I hope, serve as a starting point.

Let us begin with Marilyn French's observation that the later chapters in *Ulysses*, with their increasingly ambitious styles, obfuscate and subvert our understanding of "mimetic" character built up in the novel's earlier sections. In these later chapters, "impersonal narrative voices take over completely, and the human subject matter gets lost at precisely the point of greatest tension in the 'action' and in us" (French 207). Despite the text's novelties of style, and there are many, the attentive reader of *Ulysses* can gain entry into the mimetically depicted, naturalistic world of Dublin, one meticulously crafted by Joyce, with the reader assisted, as Ellmann points out, by Joyce's reliance on factual sources—newspapers and frequent letters to Dublin to verify individual details of the city (378, 439).

However much the "naive" reader can get out of the initial chapters of *Ulysses*, the text becomes more difficult in the later changing styles. The difficulty intensifies in the most experimental chapters: "Oxen of the Sun," "Circe," "Eumaeus," "Ithaca" (which will be particularly important for my reading offered below), and the epilogue of "Penelope." It is in these chapters that style

calls explicit attention to itself and the reader's expectation of accessible meaning gives way to something else.

In a purely deconstructive reading, the play of different discourses gives the lie to any possibility of a "meta-language," in Colin MacCabe's terms, of authorial intrusion, of the author telling us what is actually "true" beyond the narration itself. This "absence of a meta-language in Joyce's work" is contrasted by MacCabe to a "classic realist text" in novels by George Eliot (35).

For a reading of *Ulysses*, MacCabe makes use of the "Cyclops" episode (serialized in *The Little Review* in four issues from November 1919 through March 1920). This chapter juxtaposes "two versions of the same events" as Bloom escapes the bigoted Irish Citizen's dog in a Dublin saloon (MacCabe 90). There is a demotic everyday description narrated in a comical Irish voice, which is given to interruption, exaggeration, and innuendo against Bloom's character, versus a more high-flown discourse, which samples rhetoric from many fields. In MacCabe's reading, the types of discourse are extensive, drawing from the "legal", "heroic," "spiritualist," "the scientific," "academic," "parliamentary," "journalistic," "Elisabethan," and the "religious and biblical" (90).

Many of the sections employing the rhetoric of the second type exhibit extensive catalogues of names and things, and are thus typical of a central rhetorical feature of an encyclopedic text like *Ulysses*. Interestingly, MacCabe

notes that between the version published in *The Little Review* and the book version of 1922, "practically every list that appears in *The Little Review* text is expanded for the final book publication" (99). One such list, a catalogue of Irish heroes, goes from just a dozen to over one hundred names. It becomes absurdly non-Irish as well, including non-Hibernians such as Shakespeare and Columbus (99).

MacCabe suggests that the ability of the list to represent the world in *Ulysses* is compromised as the writing itself comes to dominate the usual function of language to represent the world. He writes:

> The Cyclops sequence demonstrates this clearly, for the text works as a montage of discourses, without at any time offering us a final meta-language (an author's impersonal voice) which could control the riot of language which composes the text." (90)

And again:

> To list is to apply a set of identities to the world and it is the power of language to [...] produce a world for the senses. The lists within the text are all, in some sense, ruined; deprived of their ability to disappear and reveal the world. Instead, it is writing which dominates the scene." (99)

In a deconstructive reading, then, the shifting discourses in the novel all point out its discursive nature and dismantle any pretense for a simple, realistic impulse exhibited within the text. However, the play of different discourses does not necessarily cancel out the underlying assumption of the encyclopedic text: that through lists, catalogues, and an impulse toward profusion, it can attempt to represent the world in all its excess. If reader-centered approaches to the novel are correct in exploring the distancing effect of the difficult discourses of the later chapters for readers today, what is different about a contemporary reader of the novel? If we attempt to historicize the typical reader of "Ithaca" in, say, 1922, the effect of defamiliarization must be even greater than it is to us. I think one must acknowledge that the application of scientific approach to novelistic narrative is even more disorienting than the pastiche of English styles in "Oxen of the Sun," the expressionist dramaturgy of "Circe," or the prolix garrulousness of "Eumaeus." Principally, the presumably educated contemporary reader of *Ulysses* might be expected to know the history of English literature parodied in "Oxen," and possibly even the conventions of drama where the inner thoughts and impulses of characters are presented as if they were real (in "Circe").

"Circe" is really the first time in the novel, I would argue, when time and space give way to something else entirely. In the conventions of expressionist

drama, Bloom's subconscious is on display, and the freewheeling associations here could presumably go on and on with endless manifestations of dreams, fears, and imaginings. Yet something "real" happens in Nighttown: Stephen damages the shade of a lamp with his cane, and he is accosted by two British soldiers. Of course, much of the action here places Bloom's interior life on (often embarrassing) display—ultimately revealing a moment of genuine melodrama—specifically, the apparition of Rudy, Bloom's dead son.

More obviously, every reader can know and come to terms with the circumlocutory writing of "Eumaeus." The frustration in this episode engages a different kind of difficulty, that of a circumlocutory surface, one that makes us impatient with cliché and the meanderings of the narrator, as Stephen and Bloom wend their way toward Eccles Street.

On its face, "Ithaca" adapts the most non-literary, obviously scientific materials at the precise point where within the scheme of a well-made nineteenth-century Victorian novel, we want the opposite. The reader wants and expects resolution. In the scheme of the Homeric parallel, Stephen and Bloom are figurative father and son. In this episode, the two discuss all sorts of topics, the convoluted surface of "Ithaca" hints, but we never hear a word of their actual conversation. Does Stephen really wind up giving Italian lessons to Molly? "We are avid to know if Stephen and Bloom will really get together, if their meeting

will change the life of either," as French writes (207). If the reader has expectations in the mold of a Victorian novel's final meetings between characters long-lost to one another, "Ithaca" is a sure disappointment. French's reading points out something that seems true to me: we trust the mimetic world of *Ulysses* if we have made it thus far in the novel, and want in the simplest sense of readerly anticipation to see what happens to these two characters.

Beyond its ornate rhetorical invention, the plot of "Ithaca" is remarkably simple. As with Odysseus after his travels, Bloom heads home after a long journey to Eccles Street, with Stephen Dedalus in tow. Before parting, the two make no specific plans to meet in the future, and the narrative voice is evasive on the implication that figurative father and son have found one another. They travel to the older man's home and talk, parting rather indecisively as no more than acquaintances (from different generations, no less). However, the style of "Ithaca" renders this uncomplicated surface in a truly defamiliarized rhetorical terrain that, I would suggest, is the most removed from mimetic narrative technique.

It is a plausible reading to see the early catalogues of the novel as partaking of a dynamic of a naturalist's sense of investigation—Joyce as a social scientist. However, other forces come into play when we consider the category of science in "Ithaca." When it comes to this episode, we are indeed faced with a

narrative intelligence that delights in rehearsing numbers, facts, and figures, and borrows terms from mathematics with the devilishness and aplomb of an autodidact. The omniscient narrative intelligence of "Ithaca" spins out ever more detail. It never seems to acknowledge that we are, in fact, interested in these two characters more than, say, we are in the water systems of Dublin. In Mendelson's argument, every encyclopedic text must include science in its attempt to represent the world. "Ithaca" is the place in *Ulysses* where this formal feature of the genre is most clearly fulfilled. "Ithaca" is first and foremost a descriptive compendium of detail, which models and certainly parodies a traditional Enlightenment encyclopedia in that it inscribes the detail of the world and gets it all down for the reader. The episode creates the impression of completeness, of reproducing the world itself in such rhetoric, but it exposes a paradox in that, while providing ever more detail, it conveys less meaning.

In 1922, there would be nothing like "Ithaca" in any reader's experience. Appropriating the language of science, which is usually out-of-bounds for an aesthetic experience, especially when there is a strong readerly expectation of a mimetically rendered meeting between Bloom and Stephen, is a highly unexpected choice for a writer. If we accept in Mendelson's idea that every encyclopedic text must represent "the science of its day" (164), naturally the inclusion of scientific detail is justifiable. Of course, we must then wonder why

the intelligence also catalogues trivia about Dublin and private information about Bloom and his possessions, such as photographs and personal memorabilia and rather embarrassing medical aids, in his bedroom. As we shall see later in this study, Pynchon also adopts scientific language for aesthetic means, for the most ambitious tropes and metaphors in his novels. I will also argue that Don DeLillo in *Ratner's Star* even appropriates the question-and-answer format of "Ithaca" for a long and significant chapter in this early novel, which also demonstrates the limits of a scientific approach to the world as typified by the different approaches to describing the reality of a group of scientists working on a secret government project to investigate an astronomical mystery.

Besides the raw shock of the presentation of the scientific, "Ithaca" also freezes narrative time to a standstill. Some of the questions in this episode describe processes, such as Bloom boiling water in his kitchen, but many others, such as comparing the ages of Stephen and Bloom with a puzzling numerical obsession, are entirely descriptive; they show no 'delta-T,' a term from physics borrowed by Pynchon to describe moving objects through space and time. When this 'change in time' approaches zero, narrative time stops, so to speak, and this happens within several sets of queries and responses. French is probably quite

right to observe, "If Ithaca were the first chapter in the book few [readers] would read further—yet it is probably the greatest chapter in the novel" (221).

The other episodes are governed by narrative time; the excursions into allusion and circumlocution are kept in bounds by real events as the characters interact with the actual historical world of Dublin. Of course, I realize that Joyce stretches and compresses experiences of lived time—Bergson's *durée*—but there is no extensive flashback in the entire novel, outside of the long dramatic re-imaginings of the earlier episodes in "Circe," to throw off the reader from the relentless pursuit of present experience. As I have suggested above, Stephen and Bloom's memories are hemmed in by the *nacheinander* of encountering new stimuli in Dublin. The memories and speculations of Bloom's lively mind are hemmed in by the sensorium of detail engendered by his walking down the street. The Homeric parallel is thus a built-in defense against the reader's getting lost. There is a narrative momentum at work that hems in the stream of allusions while keeping Bloom and Stephen's paths criss-crossing in the city until their final meeting at Bloom's home in Eccles Street in "Ithaca."

In its question-and-answer format, the narrative in "Ithaca" risks stopping time altogether. Each question posits a distinct moment in narrative time and a response, in which the nearly obsessive intelligence presents much, much more than most readers could be interested to know about scientific or technical

matters. It is up to the reader to connect the rhetorical dots, so to speak, and continue the narrative of Stephen and Bloom at Eccles Street.

The reader's reaction to this narrative approach has been explored by Wolfgang Iser, in an early example of reader-response theory. About the question-and-answer format of "Ithaca," Iser writes, "One's immediate reaction to the mass of scientific detail offered in answer to often quite banal questions is bewilderment" (221). Iser tests his theory of readerly expectations against the final chapters of *Ulysses*, where the shifting styles repeatedly challenge our sense of meaning. For Iser, the morass of details in "Ithaca" only furthers a sense of confusion. "The tendency underlying this question-and-answer process is one that aims at showing the degree of indeterminability of all phenonema" (221). In one sense, Iser is right: the closer one looks at a scientifc process, for instance, the underpinnings of Bloom boiling water for cocoa for Stephen in his kitchen, the more there is to say about the science of heating water. Human agency is marginalized whenever the inner workings of the scientific phenomena come to the fore.

Most "reader's guides" to *Ulysses* assume that meaning is still within reach. However, Marilyn French writes of the pairs of questions and answers in "Ithaca," that these "sets are presented in such abstract, technical, or pedantic language that we get no sense of the humanity of the characters" (221). "Another

paradox [...]," she continues, "is that this 'inhuman' chapter includes the smallest details of human experience" (like Bloom's toenails) (221). In this dynamic, the ordinary reader gets caught up in Joyce's stylistic excursions in familiar reader-response terms. Just when we want to find out about what happens to these two characters, Stephen and Bloom, two intelligences to which the novel has earlier accorded so much attention, the increasing stylistic invention interferes.

Specifically for my proposed reading here, what exactly are we to make of the science presented in "Ithaca"? Critical responses range from the dismissive to the enthusiastically grandiose. In his revised reader's guide to *Ulysses*, Hugh Kenner discovers a "demotic" source of the question-and-answer format in the *Tit-bits* weekly newspaper, which, he reminds us, is Bloom's favorite journal (145). Instead of real scientific experts, according to its editors, the source of the paragraph-long answers to short questions was "'the office help who had the answers ready'" (qtd. in Kenner 145). Such a reading puts "Ithaca" on the same page as its predecessor as the discursive and meandering "Eumaeus" which can be read as written by Bloom for the very same *Tit-bits* publication. This reading accounts for the obvious fact that a good deal of the science in "Ithaca" is mock learning. The narrative voice here seems to be trying a bit too hard to impress us with an extreme level of surface detail and an excess of information to apparently simple questions.

In this view, "Ithaca" punctures middle-class pretensions about civic improvements such as Dublin waterways, inventions, and one advertising solicitor's daydream version of a summer house. This is a mind built for 'trainspotting,' the practice of collecting all different trains on a timetable with an obsessive precision. A gentle irony here is that it required the same sort of energy for Joyce to compose this chapter. Joyce's genius includes a gift for making and building lists of all kinds. The narrative voice in "Ithaca," a disembodied intelligence, shares with Bloom a distinct enjoyment of relating the achievements of Dublin's civic infrastructure, its waterways, and the like. One thinks of Bloom's pipedream in "Ithaca," to build a country cottage (possibly named "Flowerville") financed by numerous schemes and inventions, which are extensively and exuberantly described in this chapter (*Ulysses* 585-90).

A much more ambitious reading of the science in *Ulysses* and "Ithaca" is Donald Theall's study, which argues that Joyce designed *Ulysses* (and especially *Finnegans Wake*) as artistic machines. Theall's argument is most directly concerned with *Finnegans Wake*, but he does deal with *Ulysses* at distinct points, mostly to launch into ideas that apply more suggestively to the later book, which he reads as strongly concerned with most every kind of science imaginable:

> telegraphy, telephony, photography, the typewriter, the rotary press, electromagnetic power, sound recording, electric light,

> skyscraper construction, moving pictures, radioactivity, wireless, air flight, the theory of relativity, quantum mechanics, complementarity theory, and mass mechanization. (31)

Theall regards Joyce, first and foremost, as a sort of "poetic engineer" who composed all his books from knowledge of machines and the contemporary technology of his time (31). Theall seems to me to be right, that *Ulysses* occasionally represents "communication technology" such as the printing presses of "Aeolus," but I do not see that "machines, and machine-like processes of old and new forms of everyday culture *pervade* the action" of the day represented in *Ulysses* (46, my emphasis). "Ithaca," however, provides a good example of this impulse for appreciating technological processes, with Bloom's interest in new inventions. Despite evidence like this, it is harder to discern such a strong technological impulse in the initial chapters of the novel.

Eventually, in his very McLuhanesque reading, Theall sees in Joyce a precursor to cyberspace (195). Theall's exuberance perhaps asks too much of any author, though one surmises that Joyce himself might have approved such a reading, which places his work on the forefront of late twentieth-century obsessions with technology.

Denotatively, however, even in Theall's radical argument for a more suggestive reading of science in Joyce, there is nothing specifically in *Ulysses* that

refers to the so-called New Physics, and it is problematic to suggest that the numbers, facts, and figures referred to here really imply a deep understanding of mathematics in the intelligence behind "Ithaca." Although Theall's reading is indeed ambitious and has taken Joyce's scientific allusion much farther than "the science of [his] day," even anticipating hypertext and digital life in the pages of *Finnegans Wake*, I am arguing that the dominant, central tendency in Joyce, as typified in *Ulysses*, is still a classical, Newtonian world.

"Ithaca" and Classical Science

In *A Portrait of the Artist*, it will be recalled that a young Stephen Dedalus locates himself in relation to the world in his geography book at the school at Clongowes:

> He opened the geography to study the lesson, but he could not learn the names of places in America. Still they were all different places that had different names. They were all in different countries and the countries were in continents and the continents were in the universe. He turned to the flyleaf of the geography and read what he had written there: himself, his name and where he was: 'Stephen Dedalus / Class of Elements / Conglowes Wood

College / Sallins / Ireland / Europe / The World / The Universe.'

That was his writing. (*Portrait* 22-3)

Right after this, a rhyme undercuts the seriousness of this exercise, the "cod" written by Fleming, "'stephen Dedalus is my name, / Ireland is my nation. / Clongowes is my dwelling place. / And heaven my expectation" (*Portrait* 23).

In this passage, the young Stephen faces the problem of differentiation, of naming, of dividing and classifying his youthful world into logical, hierarchical categories. The problem of locating oneself is accomplished in inscribing oneself in writing, and it is immediately parodied. The dilemma of a lack of differentiation, of Stephen's inability to make sense of the world of distant names in America, for example, is tentatively resolved in the listing of categories in a simple hierarchy on the flyleaf.

Classification is surely concomitant with the encyclopedic impulse, not only to name the natural world, but to place all of the world's things in phylum, order, genus, and species, and the like. However, one problem in "Ithaca" is that this process of classification has gone too far. The narrative intelligence with its incessant lists and catalogues in "Ithaca" seems to me to remain committed to a mimetic description of the world; it is not a problem of rhetoricity that gets in the way of readerly understanding, but arguably the encyclopedic, scientific impulse itself.

However, between the simple categories of a young Stephen and the most Baroque and pedantic responses in "Ithaca" lies a common assumption that objects can be placed in relation to the world, and in relation to one another successfully. It will be recalled from our introduction that one of the tenets of the so-called "New Physics" and quantum theory is precisely the breakdown of knowing exactly where things are. At the smallest levels of matter, the physicist Brian Greene observes, all sorts of paradoxes become possible: a particle can be two places at once, or quite literally neither here nor there.[10] Since quantum physics has been historically available since the turn of the twentieth century, it is quite possible that Joyce could have adopted these very current scientific ideas in "Ithaca" to present a description of two characters' movements in space-time, to adopt the language of a physicist, using ambiguity, simultaneity, and the like, which are core precepts of quantum theory. Perhaps in *Finnegans Wake*, these ideas work better, as the multi-layered, polyglot synchronic language of that novel invites more speculation along these lines, as in Theall's reading above. However, in my view, there is little evidence for such a view of science in "Ithaca." Throughout *Ulysses*, in its allusions to science—for example, Bloom pondering gravity at 32 feet per second per second, "the law of falling bodies" in

[10]One important part of quantum theory is the uncertainty principle. Brian Greene describes that, in theory, under certain conditions, it would be possible—though highly unlikely—for objects to pass through cement walls, contrary to the laws of everyday, classical physics (116).

Hades, an allusion that is reprised in "Circe" as he goes to trial—are also solidly in the realm of classical physics (*U* 59, 397).

Indeed, "Ithaca" would seem to be an episode that obsesses about tracking the precise movements of its two protagonists, Stephen and Bloom, as they approach and enter the house at Eccles Street. The belief that one could place objects with such knowable precision is exactly the stuff of Newton's classical physics. Moreover, the narrative intelligence here thrills at being able to catalogue the relative position of objects with great, exacting precision, starting with its very first question:

> What parallel courses did Bloom and Stephen follow re-turning? Starting united both at normal walking pace from Beresford place they followed in the order named Lower and Middle Gardiner streets and Mountjoy square, west: then, at reduced pace, each bearing left, Gardiner's place by an inadvertance as far as the farther corner of Temple street, north, then at reduced pace with interruptions of halt, bearing right, Temple street, north, as far as Hardwicke place. Approaching, disparate, at relaxed walking place they crossed both the circus before George's church diametrically, the chord in any circle being less than the arc which it subtends. (*U* 544)

We have a very certain mind at work here, able to plot the positions of persons and objects in knowable, Cartesian space and time with absolute confidence. Not only does the narrative enjoy placing objects (Stephen and Bloom) with one another, but it also delights in rehearsing place names. Of course, there is every sense that the verbal mapping that goes on here is entirely accurate against the real streets of Dublin. We might contrast this passage with the mystery of Tyrone Slothrop's "disappearance" in *Gravity's Rainbow*, a gesture toward the so-called New Physics and the probabilistic and, sometimes, contradictory knowledge of the positions of objects in quantum theory.

The "riot" of competing discourses (MacCabe's term) happens later in *Ulysses*, after the realistic world of Dublin is established in the initial style of the novel. As numerous critics have pointed out, the early sections of the novel especially are governed by a clear, mimetic impulse, despite the complication of interior monologue. If Joyce the author stands outside his work, like the Artist of *Portrait*, even in the later, more ambitious chapters, like "Circe" and "Eumaeus," an accurate map of the real Dublin of 1904 is never far away, even if obscured by language. In the shifting complexity of these later episodes, and in the over-precision of "Ithaca," the characters' movements are plotted mimetically against the backdrop of Dublin. Throughout *Ulysses*, Joyce never abandons an allegiance to a representation of Dublin in its "real" geographical and historical coordinates.

The novel's singular achievement is that despite the stylistic experimentation of the later chapters, the reader is still anchored to the encyclopedic project here: representing Dublin at a certain point in actual history.

As we will see in the next chapter, the stylistic excesses in the later sections of *Gravity's Rainbow* also part from a Newtonian notion of space and time. That is, in its later chapters, Pynchon invites speculation on new ways of organizing cities, whether vertically (in three dimensions) or even in the alternative, occult world of spirits, for example. *Ulysses* never really breaks from the underlying understanding of mimetic space of Ireland's capital, even though the style itself certainly obfuscates the reader's access to the actual geographical Dublin of 1904.

To reiterate, in this study so far, I have introduced the encyclopedic project and the relation between scientific allusion in "Ithaca." One of the aims of this study is to explore how some of the most ambitious novels of the twentieth century that aim to explain our world convincingly use the raw stuff of science for novel writing. Joyce incorporated some of the science of Newton in "Ithaca" in *Ulysses*, just as Pynchon has interwoven some of the so-called New Physics, which set the stage, so to speak, for the early reception of *Gravity's Rainbow.* The scope and range of these two novels in particular attain the status of ideal encyclopedic texts. A trajectory in cultural history of the twentieth century is the

gradual acceptance, legitimizing, and, indeed, elevation and celebration of what is scientific in novels of style.

Of course, the kind of science that is preeminent in a culture changes over time. Raymond Williams' well-known categories of the dominant, emergent, and residual can be applied to any moment in cultural history, including the phenomena of science. In all of Joyce and particularly in *Ulysses*, there is predominantly a notion of classical science, meaning Newtonian physics and optics. Moving bodies are mapped with great precision in "Ithaca" and the *techne* of applied science like hydraulics—for the water system of Dublin, for example—exhibits a clear enthusiasm for civic improvements.

These tropes of science are chosen to illustrate or embody what is difficult, perplexing, or unsolvable about our world. In developing the category of "aesthetic science," I want to suggest that recent science offers a way of seeing and a ready source of allusion and tropes that can express the complexity of the modern and contemporary world, one capable of representing the best that has been thought and said. Indeed such tropes can even embody new notions of formal beauty in recent fiction. As I hope I have suggested, "Ithaca" provides a perfect exemplar of such an approach to creating such a new form for fiction by drawing on scientific material. There is an odd beauty in "Ithaca," even though

its prickly, even sterile, rhetoric is so at odds to our preconceptions and expectations of what can be pleasing in a literary text.

Going back to our reading of *Ulysses* by a reader in 1922, I cannot imagine anything but bewilderment in encountering scientific material near the end of such a discursively rich, many-voiced text. As I have suggested, building on a reading from Marilyn French, the defamiliarizing shock and distance—even readerly frustration—that we experience when encountering the scientific 'cross-examination' of "Ithaca" is undoubtedly central to Joyce's project here in one of his most stylistically ambitious chapters.

The inclusion of scientific material challenges the reader with unfamiliar material, a discourse that is entirely removed from the "literary." It is a challenge to the reader to accept a scientific or pseudo-scientific way of perceiving the mimetic world of Dublin at precisely the juncture when literary expectations—that of the meeting between long-lost characters—is perhaps most salient. We are required to confront the fundamental question of why science is competing for our attention in the rich multiplicity of voices that comprise the novel, which as the novel progresses seem to accelerate and intensify in shape-shifting complexity. In the reading offered here, ordering is indeed important. By tackling, representing, and, indeed, enacting a scientific worldview and sensibility within the pages of "Ithaca," Joyce strengthens an implicit claim in

Ulysses—one made on different grounds by critics like Pound using a different theoretical defense—that nothing in the world is out-of-bounds for a novelist.

It will also be recalled that in successful encyclopedic texts, "the science of its day," in Edward Mendelson's phrase, must be represented (164). In my reading of aesthetic science proposed here, appropriating and representing recent science is not only a requirement of the encyclopedic project, but it provides a strategy for Joyce to enact in the reader a dynamic that recalls ideas from Kant, and from the history of the aesthetic, rooted in the reader's affect.

In his Third Critique of 1790, Kant defines the category of the Sublime as that which instills a certain terror in the minds of individual viewers when contemplating natural forces—storms or mountainscapes, for example—that remind human viewers of their relative unimportance. Kant never mentions works of art as instilling this same kind of terror and resultant sublimity. In the Sublime, there is a certain dynamic of loss in the subject's realization that although the capacity of human striving is great, there are more terrible forces. "The feeling of the sublime is a pleasure that only arises indirectly, being brought about by the feeling of a momentary check to the vital forces followed at once by a discharge all the more powerful, " Kant writes (91). In this dynamic, when we contemplate great natural forces, we realize our limits. Yet despite such forces, our sense of striving leads to a notion of the Sublime.

In identifying the dynamic of an agon between reader and the difficult surface of chapters like "Ithaca," Iser and French's readings productively navigate some difficult textual terrain. Kant's Sublime is here relevant. If we consider the effect of the scientific material in this episode, our understanding of the dynamic deepens to consider the status and meaning of science in the encyclopedic project, as well as the immersion of two rather innocent subjects against the field of natural scientific sources. Throughout this chapter, Bloom's (and Stephen's) agency is menaced by an obsessive narrative intelligence based on science. This trajectory mimics a certain realization of the individual's insignificance against impersonal natural forces, and a subsequent relief—and perhaps recovery—as Bloom recovers his individuality at the end of the chapter. This process has resonance, I would like to suggest, with a notion of pleasure developed in Kant's Sublime.

Appropriating the scientific for a dynamic of the Sublime here means that the human subjects under scrutiny—especially Bloom—are held up to a great, impersonal, and, indeed, terrifying Universe. The best evidence for such a dynamic of the Sublime occurs in two questions near the end of the episode where Bloom encounters the night sky above Dublin. It provides another moment of locating a Joyce character as when Stephen places himself in *Portrait* or when we can follow the precise mapping of the movements and activities of

Stephen and Bloom in "Ithaca" beforehand. This time the effect is arguably one of pondering the vast scale of the natural in astrophysical dimensions and human insignificance in the face of it:

> What spectacle confronted them when they, first the host, then the guest, emerged silently, doubly dark, from obscurity by a passage from the rear of the house into the penumbra of the garden?
>
> The heaventree of stars hung with humid nightblue fruit. (*U* 573)

Treating the stars as "humid nightblue fruit" is as ambitious and successful a metaphor as we can hope to find in the novel. The use of kennings here in several coined words hints, I think, as it usually does in Joyce, at an attempt to use language inventively and, indeed, beautifully. The consideration of humankind's place in the Universe follows:

> With what meditations did Bloom accompany his demonstration to his companion of various constellations?
>
> Meditations of evolution increasingly vaster: of the moon invisible in incipient lunation, approaching perigee: of the infinite lattiginous scintillating uncondensed milky way, discernible by daylight by an observer placed at the lower end of a cylindrical shaft 5000 ft deep sunk from the center of the earth.... (*U* 573)

The narrative intelligence then treats us to a disquisition on several astronomical distances for stars in major constellations (like Canis Major and Orion) where distances are measured in lightyears (the vast distance light travels in one year). Here, we learn that ten lightyears is fifty-seven *quadrillion* miles (573). We conclude with Bloom's meditations on the smallness of human agency in the wide astronomical sky:

> Of our system plunging towards the constellation of Hercules: of the parallax or parallactic drift of socalled fixed stars, in reality evermoving from immeasurably remote eons to infinitely remote futures in comparison with *which the years, threescore and ten, of allotted human life formed a parenthesis of infinitesimal brevity*. (*U* 573, my emphasis)

For anyone who has looked up at the night sky and wondered about our place in the stars, the passage above might easily seem trite. However, as presented here, Joyce is able to situate Bloom and Stephen in the wider cosmos with apparent precision. There is never any doubt of their place in the universe, although the overlapping astronomical distances and heavenly bodies makes this effort at location a good deal harder to understand than Stephen's simpler categories in his geography book.

The subsequent catechism answer moves the other way, back toward the infinitesimal: "Were there obverse meditations of involution increasingly less vast?" (*U* 573) This next answer begins with a meditation on "eons of geological periods recorded in the stratifications of the earth" and follows up the matter by a specious hierarchy of "microbes, germs, bacteria, bacilli, spermatazoa" to "trillions and billions of incalculable molecules" to human blood cells:

> themselves universes of void space constellated with other bodies, each, in continuity, its universe of divisible component bodies which each was again divisible in divisions of redivisable component bodies, dividends and divisors ever diminishing without actual division till, if the progress were carried far enough, nought nowhere was never reached. (*U* 573-4)

We might note the comical effect here of a mock wonder at the tiny world of blood cells, which, it seems, could be subdivided forever. The narrative intelligence, which is so keen on precision with astronomical distances, seems vague on the numbers here ("trillions and billions"). There is also the question of what natural taxonomy is in force for breaking down matter (and living things) to "microbes, germs, bacteria, bacilli, spermatazoa[!]" and then beyond that. Interestingly, this system of classification valorizes the human by centering on the blood cell, which can be divided again and again. Of course, there's

something of Kenner's *Tit-bits* reader here, although intriguingly the arrival of molecular biology has indeed found new worlds of complexity in a single human cell.

By interpolating the distancing scientific voice here, Joyce reminds us of our frailty as a species in the face of impersonal universal scientific laws. While the effect in Stephen's notebook is to orient both the young protagonist of *Portrait* and the reader as to a place in the world with a certain comfort, the effect of the location here is just the opposite. The voice of "Ithaca" is by turns whimsical, pedantic, fanciful, but by the end of the episode, it achieves a somber aspect that reveals Bloom and Stephen as very minor entities, both lost in the "cold of interstellar space" (*U* 578).

In my reading here, questions in "Ithaca," which subject these characters to rapid changes in the scale of perception, no different from staring at a tall mountain perhaps and realizing one's minuteness, provide what Kant asserts is a prerequisite for the Sublime: "a representation of limitlessness" in the "beautiful in nature" (90). The narrative intelligence dismantles our sense of Bloom and Stephen as human creatures and leaves us with scientific detail, which is, after all, still part of the natural world. The characters with whom we have spent so much time earlier in the novel are somewhat lost to us in "Ithaca," dismantled by terms, and reduced to a single, silent point at the end of this chapter. Bloom's

meditation on the place of the human in interstellar space and in the biological kingdom are reprised and echoed by the later questions which follow Bloom as he goes to bed, describing his bedroom, his personal items, photographs, mementos, and books (*U* 581-2). However, as two of the question and answers tell us, there are hints that Bloom still manages to find a measure of "satisfaction," comfort, and then sleep at the end of his long day, despite the previous rhetorical onslaught of scientific narrative intelligence in "Ithaca" (*U* 585, 604-7). As Bloom finally dozes off, the relentless rhetoric and classifying intelligence no longer seems to hold sway. To my mind, Bloom has recovered a simple dignity.

To read aesthetic science in "Ithaca" is to attempt to recover the shock of the new, and to experience some of the predicament of early readers who were unaccustomed to seeing scientific matter incorporated into novels of style. As earlier critics have noted, Joyce defers any melodramatic (and mimetically satisfying) encounter between his two creations. The narrative voice of "Ithaca" is evasive as to the prospects of further friendship between figurative father and son. Of course, both men witness the same shooting star as they part ways after relieving themselves in Bloom's garden; in all, hardly a sentimental rendering of their good-bye (*U* 577).

Denied the experience of the human, the real return to home is, of course, in the final affirmations of "Penelope." Molly's soliloquy is a discourse

contrasting with that of the desiccated yet inventive details of "Ithaca." Joyce ends his encyclopedia with a return to body and feeling. Molly's sensuousness while relating the details especially of her youth in Gibraltar are alive and engaged with human feeling in a way that the narrative of "Ithaca" could not hope to convey. (The inability of later novelists and postmodern theorists to account for the body when immersing novels and critical readings in the details of science will be considered later in this study, in Chapter 5, which will deal with the work of Richard Powers.)

The appropriation of science and its engagement with the Sublime within the pages of "Ithaca" offer a working example of what I want to suggest in a working dynamic of "aesthetic science." Remember this is not a hard and fast philosophical category, but a term for understanding recent science as it relates to recent stylistically ambitious novels. Such a reading enriches older readings, which are centered on reader-response reactions to *Ulysses*. To read "Ithaca" with the notion of aesthetic science in mind is to differentiate between the kinds of discourse in the later chapters. The status of scientific discourse, I am arguing, does account for more than a strictly deconstructive reading might suggest.

Novelists themselves have adapted elements from current science so as to engender a new sense of aesthetic beauty, one that is often detached, but which often suggests a muted wonder. The same material can be adapted to express

what is contradictory, troubling, or problematic, as we see in Pynchon, for example. The raw stuff of science, its models and metaphors, can also portray what is dialogic, ambiguous, or even a little terrifying. The scientific turn of mind grows in importance as an impulse in later novels as twentieth-century cultural history progresses. For any twentieth-century writer, it is no longer possible to describe a beautiful night sky without sinking into melodrama or cliché. However, as the writing in "Ithaca" shows, Joyce can render a certain formal beauty by triangulating among reader, writer, and the mimetic impulse by using allusions borrowed from a variety of sciences. While "Ithaca" shocks us with its appropriating of science for the singularly great literary achievement of modernism, later practitioners of the novel of style, and particularly novels with an encyclopedic impulse, have turned regularly to science for some of the raw matter for their novels.

CHAPTER 3

Pynchon's 'Normal Science': Aesthetic Science in *Gravity's Rainbow*

"Entropy" and *The Two Cultures* in *The Kenyon Review* of 1960-61

In 1959, in a talk presented as the Rede Lecture at Cambridge, the scientist-turned-novelist C. P. Snow articulates what he saw as an unfortunate turn in the relationship between those who study literature in the humanities and those who study science. After he and his team interviewed "between thirty and forty thousand" of some 130,000 scientists and working engineers in the U.K., Snow came to a rather surprising conclusion (*The Two Cultures* 11). At the feet of the scientific community, Snow lays the charges that few had read any literature at all: several had read some Dickens and considered that foray into reading as if the novelist were "an extraordinarily esoteric, tangled and dubiously rewarding writer, something like a Rainer Maria Rilke" (12). To working scientists, books were mere "tools" like "primitive digging instrument[s]," Snow writes (13).

On the side of the humanities, the knowledge of scientific matters by his literary acquaintances was no less abysmal. Based on a much more restricted sample of opinion at meetings and dinners at Cambridge and other universities, Snow found that no one trained in literature could explain the Second Law of Thermodynamics. "Yet I was asking something which is about the scientific

equivalent of: 'Have you read a work of Shakespeare's'?" (15). Moreover, Snow speculates that his literary experts would not have been able to explain even more rudimentary physics ideas, like "mass" or "acceleration," "the scientific equivalent of saying, 'Can you read?'" (15).

Snow's thesis, which was published in 1960 as *The Two Cultures*, presents an argument that science and literature would have a hard time getting along at all, especially if neither side could understand the language of the other camp. In the course of this essay, Snow also briefly examines educational practices in the U.S., U.K., and the former Soviet Union and suggests the possibility that the U.K. and the U.S. are falling behind.[1] One symptom of that lag for Snow was that artists were not paying attention to the importance of a true scientific revolution that was all around them. "It is bizarre how very little of twentieth-century science has been assimilated into twentieth-century art," Snow observes (16).

In one of the fortunate accidents of publishing history, the work of C. P.

---

[1]Snow later writes in *The Two Cultures*:

> Our population is small by the side of either the U.S.A. or the U.S.S.R. Roughly, if we compare like with like, and put scientists and engineers together, we are training [...] one Englishman to every one and a half Americans to every two and a half Russians. (36).

Snow's project of cultural diagnosis based on education is reminiscent of Arnold's project nearly a century earlier. *The Two Cultures* is partly an attempt to point out the problem of the U.S. and the U.K. not generating enough scientifically-literate people at the height of the Cold War; the missiles of October 1962 were, of course, only a few years away.

Snow and Thomas Pynchon intersect in the pages of *The Kenyon Review* of 1960 through 1961. The work of both writers, Snow as essayist and Pynchon as fiction writer, appears within the same year. Pynchon's story, "Entropy," can be read as a direct challenge to Snow's assertion that no one in literature could explain the Second Law of Thermodynamics. Not only does Pynchon clearly understand that law, but he makes it the central thematic concern of his early short story, which appropriates ideas from science for literature very directly. Moreover, besides creating an innovative piece of fiction, Pynchon gets his science right. I will explore these issues as a way of understanding the use of science in Pynchon's later work, particularly *Gravity's Rainbow*, and how they relate to the notion of aesthetic science, which is a central concern of this study.

In the Spring 1960 issue, "Entropy" appeared in the pages of *The Kenyon Review*. The actual title of this work appears with a parenthetical explanation as to its status as a work of fiction: "Entropy (A Story)." "Entropy" is usually defined as a measure of the order or disorder in a physical system, and is central to the definition of The Second Law of Thermodynamics, formulated in 1852 by William Thomson, Lord Kelvin, based on an idea from Carnot, a French engineer whose work with steam engines lead him to observe that "all forms of energy tend to degrade themselves into heat, which then tends to spread itself evenly throughout the system" (Cooper 112). If C. P. Snow is correct, the glossing of a

term and title of "Entropy" is an absolute necessity: no reader of *The Kenyon Review* could be expected to know what this title means, and how it relates to the thematic material in Pynchon's short, yet challenging, text. *The Kenyon Review* was arguably a bastion of New Critical sensibility. John Crowe Ransom and Allen Tate were two of its editors, and the magazine published any number of writers whom we associate with the close reading of texts. I want to argue that Pynchon's story is a direct challenge to a New Critical sensibility, which would have the verbal icon remain comprehensible on its own terms. In fact, "Entropy" is crammed with allusion, as Tony Tanner points out, to music, "closed systems" of entropy, and even literary references (to Faulkner and Djuna Barnes) (*Thomas Pynchon* 33-4). Sentence-by-sentence, there is a novelistic sensibility at work here, not the economy of line and idea that we associate with, for example, Joyce's *Dubliners* or a short story of Hemingway's.

A nominal reading of "Entropy" can readily serve as a primer on how to read Pynchon and his ability to make use of scientific theories within fictional worlds. This story sets up two opposing narratives: the chaotic lease-breaking party of Meatball Mulligan juxtaposed against the bizarre and rather poignant world of Callisto, an artist-figure and his lover, Aubade, in their apartment upstairs. The story intersperses scenes of the random chaos of Mulligan's party with the "hothouse world" of Callisto as he nurses a sick bird and meditates on

such topics as entropy (Tanner 34-5). The story culminates in a suicidal gesture by Aubade, who "breaks the window of their hothouse with her bare hands" (35).

To scientifically adept, late twentieth-century or early twenty-first-century readers, the notion of chaos (and chaos theory) is capable of producing states of order, even beauty. Fractal geometry, discovered and popularized by the mathematician Benoit Mandelbrot, gained a certain prominence, even popularity in the 1990s with the publication of books of fractal art.[2] Chaos theory has been interpreted as an argument for our interconnectedness: the idea that a butterfly's wings can cause a drop of water to fall in the rainforest, leading in turn, by the accretion of small effects to ever larger ones, to a rainstorm, for example. (In Chapter 5, I will read chaos theory as it plays out in the work of Richard Powers, who has alluded to the notion that chaos can be a creative force, one that can increase the complexity of life during evolution.) However, an earlier, more brutal, more pessimistic form of chaos and entropy is a part of Pynchon's story here. "Early Pynchon and early thermodynamics are relatively unsophisticated and pessimistic in that they view entropy as an irreversible and irresistible constant force," observes Peter Cooper (112). In

[2]The best example of such a title illustrating fractal imagery is Heinze-Otto Peitgen's *Beauty of Fractals: Images of Complex Dynamical Systems* (New York: Springer-Verlag, 1986). This book combines graphical images and a basic introduction to the mathematical algorithms used to generate the complex images.

"Entropy," no human action on the part of Callisto seems possible. He and Aubade are trapped, it would seem, in the path of the inexorable force of the temperature turning 37 degrees (that of the outside air) as they both presumably give up and expire.

Let us turn back once more to the writing of C. P. Snow, whose essay "Science, Politics, and the Net" appears in *The Kenyon Review* in Winter 1961. In this essay, Snow speculates on what could be next for novel writing, and how the techniques of modernism, particularly stream-of-consciousness writing in the fiction of Dorothy Richardson and Joyce have largely failed to engender new work ("Science" 9). Early in this essay, Snow examines the stream of consciousness in *Ulysses*, which he sees as a "naturalistic" attempt to find words that express an essentially "non-verbal flux" of consciousness, while "discard[ing] the reflective intelligence" (10). Snow contrasts Joyce's technique with that of Proust (whom he clearly appreciates more). "All stream of consciousness writers have to abandon the reflective intelligence [...], while Proust kept it as a major weapon" (11).

Snow's specific concern for the future of novel-writing is that authors take account of current science. He wants novelists to represent how scientists think, and how the process of discovery works, as he writes:

> When I say science, I mean the scientific experience, what it is to be a scientist. This is a kind of experience which is part of the fiber of our age, and, even more, part of the fiber of the future. [...] Any technique based on the stream of consciousness, or even related to it, would make the job forever impossible. ("Science" 13-14)

In representing politics, Snow would like to see the novel return to its roots in representing the social world (16). In this short, discursive essay, it is apparent that Snow finds current novels wanting in fundamental ways, but like Henry James predicting the future of novel-writing in 1871 in "The Art of Fiction," Snow refuses to be prescriptive about what new ambitious novels will look like. At the same time, it is amply clear that the experimental techniques of modernism are not what he expects to succeed.

One is struck by irony of the subtitle to this essay, "The Fish and the Net," as Snow's ideas are already tentatively being put into practice in the work of Pynchon only a few issues previous to the appearance of the essayist's musings on the future of fiction. Snow would likely have taken issue with the hermetic nature of the characters in "Entropy." His ideal for novel-writing seems to be that fiction be able to represent a broad range of characters acting in history, not an artist-figure and his lover essentially extinguishing themselves in a closed room.

However, dramatizing the lives of scientists—and the process of scientific discovery to some extent—is exactly one of the significant impulses in Pynchon's major work, *Gravity's Rainbow*. As I hope to demonstrate in further chapters, science has become readily accessible material for ambitious novelists of style, such as DeLillo and Richard Powers. What Snow perhaps does not foresee is that the lives of scientists and engineers may indeed become dystopic, subject to bureaucracies beyond their individual control. Standard critical readings of Pynchon (and later DeLillo) have argued again and again for readerly paranoia engendered in encounters with their novels. I hope to suggest also that any notion of readerly paranoia is also developed often through not only obvious coincidence—as in, for example, *The Crying of Lot 49*, where Oedipa Maas discovers the ominous horn of Thurn and Taxis in odd places throughout California—but also, in *Gravity's Rainbow*, through scientific tropes that continually challenge the human agency of Pynchon's characters.

It is clear that in the pages of *The Kenyon Review* around 1960, there existed an ongoing dialogue examining the relationship between literature and science. The publication's interest in the intersection between the two fields arguably culminates in a symposium entitled "Communication Between the Arts and Sciences" which was held on October 27-28, 1961. Scheduled attendees included

C. P. Snow, Edward Teller, commonly known as the father of the hydrogen bomb, and literary moderators.[3]

George Steiner, writing in an essay of the same year in *The Kenyon Review*, extends the interest in science and art represented in the pages of that publication during this period in an essay ominously entitled, "The Retreat from the Word." (The essay ends with a sketch of the Tower of Babel, which is more witty than foreboding.) Steiner looks back to the evolution of science and the arrival of mathematics in the seventeenth century, which was a turning point in the ascendance of a new notation for expressing natural reality. "Until the seventeenth century the predominant bias and content of the natural sciences were descriptive," Steiner writes (189). With the arrival of analytical geometry and calculus, though, "mathematics becomes a fantastically rich, complex and dynamic language," he continues (189-90). Next, this essay looks at disciplines like biology, economics, music, and even recent philosophy as aspiring to and mimicking mathematical notation (192, 195, 199). Wittgenstein's famous opening to the *Tractatus*, "What can be said at all can be said clearly,"[4] is seen by Steiner as

---

[3]The announcement read:

> Does the rapid expansion of scientific knowledge and the proliferation of specialized disciplines endanger effective communication between the arts and sciences? Among the sciences themselves? [W]ith the balance of mankind? These and other questions will be discussed. ("Advertisement" 729)

a statement of "drastic retreat from the confident authority of traditional metaphysics" (198). A typical reading of Wittgenstein's opening salvo would be to say that he is eschewing idealist philosophy for a linguistic approach: the world is only what is expressible, in language. However, Steiner reads this more pessimistically, as an attack on a tradition of metaphysics which posited ideas beyond language.

Even mid-twentieth-century painters such as de Kooning, Kline, and Pollock are cited for their Abstract Expressionist canvasses being resistant to description in words (200-1). One thinks of Clement Greenberg's essays, which have no trouble finding linguistic correlates for these images. "Private" languages of poets such as Mallarmé are cited for being too private and "fraught with danger" (207). Steiner also sees music as a threat to reading habits when he writes, "The new middle class in the affluent society reads little, but listens to music with knowing delight. Where the library shelves once stood, there are proud, esoteric rows of record albums and high-fidelity components" (209).

Steiner's essay is clearly a response to Snow's own theorizing on a divide between science and the literary, but Steiner sees the category of the literary under duress from all sides. In particular, he echoes an anxiety about the

---

[4]This passage—in German—is quoted obliquely in Pynchon in *V*. in the radio messages—called "sferics" investigated by the young engineer Kurt Mondaugen when he travels to South Africa in one of the novel's most disturbing historical sections, which descibes Foppl's Siege Party and the cruelties of German officers toward the Herero people (*V*. 278).

degradation of language and meaning when it meets advertising. Always an opponent of fascism, Steiner sees the "language of the mass media and of advertisement" echoing what happened under German fascism, riddled with "clichés, unexamined definitions, and left-over words" (205). In Pynchon's story, "Entropy," Callisto muses on the effects of advertising on language as well:

> [Callisto] saw, for example, the younger generation responding to Madison Avenue with the same spleen his own had once reserved for Wall Street: and in American 'consumerism' discovered a similar tendency from the least to the most probable, from differentiation to sameness, from ordered individuality to a kind of chaos. [...] [He] envisioned a heat-death for his culture in which ideas, like heat-energy, would no longer be transferred [...] and intellectual motion would, accordingly, cease." (283-4)

Steiner's thought is echoed in Pynchon's earlier story directly in regards to the notion of entropy, which could predominate if language grows increasingly the same and is taken over by the forces of advertising.

Steiner also speculates on his own version of the genesis of *The Two Cultures* as he describes a process by which early scientific researchers relied on "descriptive" language, rather than mathematics to advance science (189). Figures as recent as Darwin could express scientific ideas in words, instead of

math (192). Only in fairly recent times as science has matured has mathematics come to predominate, putting at risk a sensibility based on language, which engenders Snows' Two Cultures (192). Steiner's concern for the word may seem prescient, for in the twenty-first century, the word is now under constant assault by a postmodern insistence on image and media of all kinds, though not from necessarily as much from mathematics. Yet we might suggest that Steiner's—and Pynchon's—anxiety about advertising marks them both as writers with modernist sensibilities. Advertising and media are directly opposed to the category of the "literary" in the work of both writers in this period.

The 1960 issue of *The Kenyon Review* reminds us of how closely the reception of Pynchon's work has been associated with a dialogue with science. Making sense of the "scientific" material in Pynchon has always been a central concern for critics. Time and again in critical responses to his work, especially in early criticism, we are asked to consider scientific concepts to understand his complex fiction. To some extent, in fact, Mendelson's essay, "Gravity's Encyclopedia," is an attempt to justify the incorporation of scientific allusion within *Gravity's Rainbow*. Building on Mendelson's notion that if every encyclopedic text must include an account of the "science in its day" in a canon of texts ranging back to Cervantes, Sterne, Melville, Joyce, and Rabelais, *Gravity's Rainbow* is presumably in good company (164). In the attempt to represent a

world as the genre of encyclopedic narrative, science is indeed also fair game. Mendelson calls attention to the fact that other novels have also made use of science, but the matter of whether this is acceptable gathers a new urgency with Pynchon. More recent readings of *Gravity's Rainbow* have attempted to recover the novel's allusions to film, literary influences, and recent theory. However, the clearest source of metaphor in Pynchon's work is science and pseudo-science, and upon the novel's appearance in 1973, this matter needed justification. Not only was this novel, in the opinion of early reviewers "obscene," but its reliance on science—rocket science—as its most central tropic structure challenged literary sensibilities. Could science ever be "literary" enough?

Classical Science Versus The New Physics in *Gravity's Rainbow*

In the reception history of Pynchon, thematic criticism, which attempted to explicate the complexities of *Gravity's Rainbow*, resorted again and again to recent science as a keystone for understanding the novel's later chapters. These episodes frustratingly seem to dissolve the novel's realism in its early chapters, which has an allegiance to a certain mode of historical fiction, presenting Europe during and after W. W. II. An analogy could be made here to early sanctioned readings of *Ulysses*, which resorted to the Homeric parallel to explicate the surface difficulty of that novel. It should be noted, however, that nothing as

convincing as the Linati or Gilbert schemas has emerged in Pynchon criticism, although Steven Weisenburger's use of the Christian liturgical calendar for *Gravity's Rainbow* is one admirable attempt along these lines.[5]

While more recent readings of Pynchon have turned toward what I will term as "nominal" deconstruction to explain the difficulties of actually "knowing" what happens in these later sections, Pynchon critics were, for various reasons, not in the forefront of literary theory in the 1980s, and turned instead toward explicating parallels between recent science and the so-called "new physics," particularly ideas of quantum physics, and, especially, Heisenberg's Uncertainty Principle. The new physics has fostered ways of reading Pynchon that account for the occasional radical discontinuities of the novel, especially in its later chapters. As Joseph Tabbi writes:

---

[5]Describing the process of explicating Pynchon's novel, Weisenburger argues confidently for understanding ambiguous passages and even its plot:

> In fact, when annotating *Gravity's Rainbow*, one of my greatest surprises came with the discovery that the details of story reveal a narrative chronometrics that is concisely plotted [...] [The novel's] chronology unfolds according to a carefully drawn circular design. *Gravity's Rainbow* is not arch-shaped, as is commonly supposed. It is plotted like a mandala, its quadrants carefully marked by Christian feast days that happened to coincide, in 1944-45, with key historical dates and ancient pagan festivals. (9-10)

Few critics have been as confident about resolving the novel's surface difficulties, especially in its later sections. As with *Ulysses*, however, glossing individual allusions can certainly add to readerly understanding.

> There is also the countervailing model of the new physics, a model which, apart from all it implies about how our senses perceive the world, can also reveal something about how we are intended to read Pynchon. Recent critics, aware of the many epistemological concerns shared by writers and scientists, have seen fit to treat the indeterminacy of meaning that we inevitably encounter in Pynchon's text as a structural analogue of Heisenbergian indeterminacy. ("The Wind At Zwölfkinder" 70)

Again and again in early critical responses to Pynchon, we are asked to adopt ideas of quantum mechanics to understand the indeterminacy of *Gravity's Rainbow*.

A short retrospective of the importance of the new physics to critical readings of *Gravity's Rainbow* shows that this was one of the first concepts seized upon for making sense of the novel, which obviously challenged critics with its sprawling rhetorical surface. In an early essay in 1979, provocatively entitled "Readings from the New Book of Nature," Robert Nadeau provided a tour of the history of science leading up to Heisenberg's indeterminacy principle, according to which in the realm of quantum physics, basic atomic structures behave simultaneously as both particles and waves (457). Heisenberg's well-known

questioning of the hard-and-fast distinction between subject and object (observer and what is observed) is also part of the mix here (458).

Scientifically adept, educated as a physicist, Nadeau contrasts the apparent simplicities of Newtonian physics to the indeterminateness of particles at the subatomic level in quantum theory. From here, it is a natural leap to critique traditional notions of cause and effect. Nadeau writes:

> What Pynchon has done here, with a vengeance some may fail to appreciate, is to provide another of his demonstrations that the Newtonian world view, which features along with the western mind itself either-or categorical thinking, simple causality, immutable law, determinism, and discrete immutable substance, is not a viable mode of dealing with experience. (469)

What Newton cannot explain for us in the novel, Heisenberg perhaps can. In Nadeau, we have a critique of not only the Enlightenment project of science, but also "the western mind itself"—which I take to be the Cartesian subject—in an essay that does not need to rely on poststructuralist theories of language and the subject. Surely, *Gravity's Rainbow* often thematizes the struggle of identity of a subject caught in the competing fields of multiple discourses.

This is not to say that critics have always adopted ideas of the new physics without qualification. Joseph Tabbi re-reads the new physics of *Gravity's*

Rainbow and finds a more complicated relationship with the thematics of two kinds of physics. As he writes:

> The difficulty is not simply that references to quantum mechanics in *Gravity's Rainbow* are rare, and, when they do occur, oblique. [While Pynchon is aware of] the epistemological lessons of the new physics, . . . [t]he new physics and the old are better viewed as the complementary halves of Pynchon's vision, simultaneous orders that are neither affirmed nor denied, but [. . .] joined together in a pattern of tensed opposition" ("Wind" 70).

The acknowledgement of the limits of a single model of science (whether new or old physics) becomes a central feature of Molly Hite's reading of Pynchon's novel, one of the first book-length efforts to give a complete account of the science in the novel. For Hite, the trope of gravity's parabola:

> does not succeed in containing the action, for *Gravity's Rainbow* is about the failure of explanatory structures to comprehend the multifarious data of experience. The signal failure [. . .] here is the failure of Newtonian physics, based on a theory of 'forces' that are themselves based on the example of the Universal Law of Gravitation. (73)

Hite reads the novel as raising the possibility of a "providential history" with Newton's clockmaker God behind the notion of gravity—a possibility which the novel ultimately discards (71). For Hite, the novel is all about "the spectacle of an explanatory structure exploding under pressure of the information it tries to contain" (73).

As Thomas Kuhn notes, "normal science," that is, the dynamic of scientific progress, does not record the losers in the progression of scientific research, as newer paradigms of understanding supplant the old. He argues, in fact, that although Newtonian physics still works much of the time for engineers, for example, the physics of Einstein has supplanted the old as a new paradigm (99). With readings that seize on the "oblique" leading edge of physics and especially indeterminacy, it is easy to forget that Pynchon's text inscribes several types of "classical" science as well—and references to the myth—within the same pages. Indeed, the occult in Pynchon's novel figures even more prominently in its later chapters, beyond the séances held at The White Visitation attempting to predict the fall of the rockets, in episodes where characters like Pirate Prentice find themselves in a richly imagined view of the afterlife, figured as "some very extensive museum, a place of many levels, and new wings that generate like living tissue—though it if all does grow toward some end shape, those who are here inside can't see it" (*GR* 537).

A good number of readings of Pynchon have argued for a parallel between the reader's predicament in finding order and meaning in the discursive field of his novels. The reader's quest mimics the actions of characters like Stencil in *V*. or Slothrop in *Gravity's Rainbow* in his tour of the Zone—with all the chaos of war-torn, continental Europe at the end of W. W. II. Brian McHale sums up this idea nicely when he writes that the novel "holds the mirror up not so much to Nature as to Reading. Wherever we open the novel we find images of our own behavior as readers and critics" (87). The most sophisticated argument along these lines is Deborah Madsen's reading of allegory in Pynchon, which argues that his novels encode the "figura" of traditional allegory without the authority to resolve whether these allegorical readings are actually valid or not. "In the space vacated by the traditional transcendental signified, Pynchon's narratives discover provisional systems of power and the pretextual explanations of reality that these systems use to rationalize them," Madsen writes (20). The fallen reader is actually kept in "a preterite condition of ignorance by the oppressive power of signifiers that are manipulated by 'Them'" (20).

There are of course no shortages of questers in Pynchon's writing: Stencil, who searches for V. and the mystery of his father's death; Oedipa Maas, who searches for the sinister Thurn and Taxis horn; Pointsman, who investigates the mysteries of Pavlovian conditioning with his dogs; Kekulé, the discoverer of

benzene rings; and Enzian, whose Hereros search for the enigmatic Rocket 00000 as a kind of sacred object near the close of the novel.

Recovering the place of the reader while approaching the novel's scientific material is something that I am arguing for here. When we attempt to seize on what a sprawling encyclopedic text definitely "means" using thematic criticism based on science or character analysis, we are doomed to fail. This is not only because of the discursive nature of language in the novel, a reading demanded by even the basic tenets of poststructuralism. This problem is especially difficult because of the status of *Gravity's Rainbow* as an encyclopedic text, which mixes together real historical facts about London during the fall of the V-2s with real and imagined ideas from the history of science, but also broad comic excesses, like jokes about toilets, scenes of orgies (as on the Anubis), plenty of silly song lyrics that seem to comment—and often disparage—the actions of the novel, and a stubborn resistance, especially in its final sections, to render time and space mimetically.

In particular, any productive reading of *Gravity's Rainbow* must contend with the fact that Tyrone Slothrop, the ostensible main character in the rest of the novel, literally disappears in the text's later chapters. The successful reader of *Gravity's Rainbow* has to negotiate such ruptures of mimetic sensibility that largely governs the beginning and middle parts of the novel. Early on, at least

excepting the episode relating the drug-induced Kenosha Kid interpolation of Slothrop or his surreal journey down Boston's sewer system (*GR* 60-5), the novel presents a recognizable and realistically rendered sense of time and place. As David Marriott argues, there is plenty of "largely palpable" historical detail interwoven within the fabric of *Gravity's Rainbow*, but also plenty of apocryphal sources, too (69). Pynchon's depiction of 'real,' historical events of life in London under the spell of the V-2s is convincing enough. In fact, critics have consistently gestured toward the portrayal of the wartime romance between Roger Mexico and Jessica Swanlake as a sort of emotional touchstone in the work, evidence of Pynchon's humanity (and, yes, moral sensibility); readings like these co-opt the book's later anarchic, ribald scenes to suggest that Pynchon has an ostensible moral heart, after all. As with *Ulysses*, the early reception of *Gravity's Rainbow* was probably framed by its alleged status as an obscene text. However, in readings such as the one put forth by Judith Chambers, it is customary to argue that Pynchon is ultimately a moral writer.[6]

---

[6]In the preface to her readers' guide to Pynchon, Chambers writes:

> Some argue that [Pynchon's] writing is bleak and even apocalyptic; others find in it an acceptance of human frailty and an affirmation of the possibilities of love. I see both. [...] In each of his novels it is this tension between the absolute bleakness and hollowness and the underlying force of affirmation that prompts me to read Pynchon again and again. (ix)

Chambers reads the portrayal of science in Pynchon's work as contributing to the Cold War, so it is not entirely clear how "affirmative" her reading finally is. Of course, the notion that a writer

Despite Weisenburger's argument for reading mandalas in the organization of the novel, a narrative arc corresponding to the rocket's curve serves the notion of resolving the quest. We start out in London as the V-2 rockets come crashing down on London, a form of terror during wartime. The readerly expectation here is to find out the reason for Slothrop's strange sexual arousal in advance of the falling rockets, which appear at one endpoint of the arc of their launch and descent. This quest extends back toward the other end of the figurative rainbow, that is, at the point of their initial launch. The historical rockets were actually launched from Calais, France, but the novel largely elides this distinction (unless we look carefully). We suspect in the narrative strategy of the text that the rockets are launched from the test site at Peenemünde (actually in the north of Germany, near Denmark).

The disappearance of Slothrop is combined with an increasingly episodic turn in the writing with discursive and sometimes surreal digressions with titles like "The Story of Byron the Bulb" or that of the American businessman Lyle Bland, who discovers "that Earth is a living critter" and learns to put his body aside and travel in the mind or spirit world (590). The novel's final sections intensify the disorientation, with a sort of fast-moving cinematic montage that

---

need be affirmative to be moral does not allow for the notion of satire or irony in a literary work, both of which can be employed for moral effects.

echoes silent movies in David Cowart's terms (58). These final sections intermix allusions to Tarot and relate the final sacrifice of Gottfried by Weissmann, who literally becomes a part of a V-2 in the last sections of the novel. Further, there are anachronistic scenes that parody Richard Nixon and intimate threats of an impending thermonuclear war, which brings the reader imaginatively right under the tip of an incoming missile.

The notion of a text that engenders something like paranoia in the reader is suggestive for my proposed reading of aesthetic science in the novel for the simple impulse that is consistent in almost all of Pynchon's work: scientific tropes and allusions almost always work against the agency and well-being of the human subject. Cataloguing a few other examples of how the human experience of science and technology, or a narrative voice that invokes scientific allusions and ideas, will be necessary here in order to develop a discussion of aesthetic science.

A central use of science to engender paranoia in the reader is Tyrone Slothrop's response to the falling rockets caused, we eventually discover, by a series of psychology experiments conducted on the infant Tyrone at Harvard, conditioning him to the nefarious chemical Imipolex G. The exact nature of the stimulus/response mechanism whereby Slothrop experiences the same reaction to all the rockets falling from the sky is never fully explained. The ritual sacrifice

of Gottfried at the hands of Weissmann obviously involves Imipolex G. Later, we learn that Gottfried's harness is made of the stuff, but it is never made clear if every V-2 rocket contains the chemical in some part of its make-up since presumably not every rocket contains an unfortunate sacrificial victim such as Gottfried. (In *Gravity's Rainbow*, such uncertainties are the norm, evidence of the text's sprawling rhetorical surface.)

Another example of science or technology working against individual agency appears in the episodes describing the wartime experiences of Franz Pökler, who is, literally, a rocket scientist. His devotion to the discipline of engineering makes him one of Foucault's "specific intellectuals," de-politicized in the bureaucracy of making weapons for the State of Germany. As a literary character, Pökler has his analogues in DeLillo's mathematicians and scientists in *Ratner's Star* or the "bombheads" of *Underworld*, their intelligence and research harnessed for the untold destruction of making war, as we will see in Chapter 4.

Pökler's dilemma is rendered with a measure of pathos in *Gravity's Rainbow*, a novel short on such ready access to mimetically rendered sentiment. Separated before the war from his wife, Leni, Pökler commits himself to his science as a part of the team building and testing rockets at Peenemünde and Nordhausen. The couple's daughter Ilse mysteriously reappears at different times during the war years. It is never clear whether the girl, who ages

appropriately between visits, is the same person or if she is a carefully chosen impostor (Tabbi, "Wind" 76). The girl's predicament, it is hinted, is that by deceiving Franz successfully, she will herself be able to survive. The father and erstwhile daughter enact this ritual of pretending several times, the novel tells us, and their odd relationship culminates in their visit to the remains of Zwölfkinder, a sort of Nazi Disneyland, another double of the real article. Pökler's plight is densely realized for the reader, I would argue, though not exactly sentimental. The text draws on the notion of Freud's uncanny and a simulacral invocation of the ultimate American postmodern invention of emerging consumer culture, a doubling of Disneyland no less, which history tells us was built *after* W.W. II, in 1954 through 1955.

Additional moments in the narrative of *Gravity's Rainbow* have been pointed out by critics pursuing the meaning of science in the text. First, the story of Thanatz, the black marketer, in his boat on the North Sea invokes an idea from mathematics, that of the discontinuous function, as he is struck by lightning out on the water, an event that he miraculously survives. The narrator is almost incredulous—yet scientifically quite expert—while relating the mathematics behind this event:

> Most peoples' lives have ups and downs that are relatively gradual, a sinuous curve with first derivatives at every point. They're the

> ones who never get struck by lightning. [...] But the ones who do get hit experience a singular point, a discontinuity in the curve of life—do you know what the time rate of change *is* at a cusp? *Infinity*, that's what! A-and right across the point, it's *minus* infinity! How's *that* for a sudden change right, eh? (*GR* 664, author's italics)

Pynchon gestures to calculus here, which after all was Newton's invention to determine the rate of change in mathematical functions, a discipline that has led to all sorts of practical applications in physics and engineering. Calculus, it will be recalled, figures at other moments in the fabric of *Gravity's Rainbow*. The sign of the double integral of the underground rocket factory at Nordhausen evokes the symbol of Hitler's infamous SS troops, for one notable example.

Finally, the last delta-T (a term at which the rate of change in physics becomes zero), which freezes time, anchors the ending of the novel in the reader's experience by placing the reader imaginatively under the tip of an oncoming nuclear missile. The arc of the rocket's trajectory in *Gravity's Rainbow* extends much farther than a V-2's trip from Calais, France across the channel to London in 1945. The technology behind the rocket developed by Wernher von Braun was essential, the novel finally implies, in engendering the ICBMs of the Cold War.

To reiterate, science in Pynchon is often antagonistic toward the agency of

many of its characters.[7] In the reading posited here, the reader engages in an agon with the scientific material throughout *Gravity's Rainbow*. Scientific allusion in Pynchon is still a discourse of difference. It is a supplement to the literary, we might say. Like all supplements, as Derrida reminds us, what is marginal can come back to the center. In reading the entire novel of *Gravity's Rainbow*, we become educated to accept scientific material in a work of serious fiction. However, at the moment in cultural history in 1973, adopting the language and tropes of science is still arguably disruptive to the reader's sensibility. Later practitioners of the encyclopedic novel—and the novel of style generally—can more easily borrow from the realm of science. This borrowing is almost naturalized into a nominal reader's experience of the novels of Richard Powers, as I will argue in Chapter 5. In Pynchon's work, science is not yet "normal" for fiction. Every allusion and trope borrowed from science can be construed as a distinct challenge to unmediated readerly understanding.

[7]There are notable exceptions to my dystopic reading of several important scientific allusions in *Gravity's Rainbow*. Roger Mexico, the statistician whose Poisson distribution mimics the pattern of falling rockets in London along with the pure patterns of chance, seems very comfortable with his technical knowledge, which does not preclude his acting in the world. His wartime romance with Jessica Swanlake is the novel's one universally recognized gesture of mimetically-rendered human feeling. The quest of Enzian and his Hereros to recover the mysterious Rocket 00000 as a sort of religious object also implies a different relationship with technology and science, one that approaches the sacred, though it is clear these colonized people have chosen to embrace the technology of their oppressors.

Sublime Science: Toward a Reading of Aesthetic Science in *Gravity's Rainbow*

Writing between 1960 and 1973, when *Gravity's Rainbow* was published, Pynchon appropriates science to enact a dynamic of dismantling his characters' agency as free-acting subjects. The dangers of W. W. II in the novel are not as we might expect them to be—bullets or a fear of a knock at the door to be rounded up and arrested—but the products of rocket science falling from the sky, and the paranoia-engendering bureaucracies of scientific investigation, whether Pointsman and his White Visitation, or Weissmann and his rocket scientists at Peenemünde. If we as readers identify with any of the characters in *Gravity's Rainbow*, which has at many points a commitment to realism (even as this mode is dismantled later in the novel), we must perceive an antagonism between science and the human subject.

Pynchon consistently uses the language and matter of science to diminish the agency of his characters in *Gravity's Rainbow*. This subsuming of the human against great, impersonal forces, literally laws of science and nature, is already an important part of "Entropy." Calisto's bird will die when the air temperature reaches 37 degrees, an inexorable process, just as informational entropy in the form of advertising will eventually convey no meaning at all. Pynchon habitually menaces his characters with impersonal forces drawn from science, whether the Second Law of Thermodynamics, Maxwell's Demon (in *The Crying*

of Lot 49), classical conditioning gone awry with Pointsmans' dogs, or Slothrop's bizarre autonomic conditioning to Imipolex G as an infant at Harvard, or the disappearance of Slothrop into the unknowable field of the Zone. Kathryn Hume's study of myth in Pynchon locates his repeated use of certain tropes for certain ideas, but what we need to acknowledge clearly in reading Pynchon is that the raw stuff of science is consistently used to problematize—or even wholly erase—human agency at distinct points in *Gravity's Rainbow*.

In order to develop the dynamic of aesthetic science in *Gravity's Rainbow*, it is necessary to look closely at the notion of readerly paranoia, of interconnectedness in the novel, as well as how a certain postmodern Sublime, posited by Marc Redfield, may be engendered in the reader as well. In his speculative essay, Redfield first turns toward Fredric Jameson's notion of a different—and certainly dystopic—postmodern Sublime, one that can only be sensed in the interconnectedness of global capital and corporations. Originally, Jameson looked at high-tech paranoid conspiracy novels as exemplars of this dynamic; only works that invoke such conspiracy theory can hint at the "impossible totality of the contemporary world system" (38). Redfield turns toward Pynchon's writing to see how Jameson's concept of a postmodern Sublime might play out in works of fiction devoted to building paranoid correspondences.

Akin to Kant's model of the Sublime, encountering natural beauty and larger natural forces triggers an affective response in the viewer: first, the same diminishing of self at such an impressive sight, followed closely by a resumed capacity, a heightened sensation of human striving in the face of such massive forces. Further, this dynamic of loss followed by a renewed sense of human vigor gives a certain pleasure. The Kantian subject has, in theory, access to a full sense of human agency; the point in encountering works of nature is to realize the relative unimportance of humanity in the scheme of the natural world. However, as we might expect from an Enlightenment notion of a free-floating, fully present subject, the result is a renewed sense of self. After encountering the beauty of Mont Blanc, for example, my disorientation, or doubt at my place in the world, is immediately followed by a confirmation of my place in the Universe. This dynamic partakes of the notion of the Sublime, which is never evoked by the simply beautiful or well-made for Kant. A dynamic of pleasure is at work here that is more powerful than what is evoked by looking at a tritely pretty lake or an ordinary painting of the same scene.

In the work of Pynchon, individual agency is questioned in several ways. Redfield looks at the "Under the Rose" episode in *V.*, in which Stencil takes on the voices of eight characters, which are "Stencilized" using impersonations (156). Stencil's de-personalized narrative, Redfield implies, subsumes human agency to

discourse. He also points to the beginning of *Gravity's Rainbow*, which does not easily place the human subject in its well-known opening paragraph. This evidence, Redfield argues, delivers "persuasively and economically the sense of a postmodern sublime" (160). This realization seems, in my reading, to be little more than accounting for the rhetoricity of texts like Patrick MacCabe's notion that *Ulysses* is *just* discourse, with no overarching source of narrative truth that might reveal what "really" happens. So it is in a Pynchon novel. In their deconstructive reading of *Gravity's Rainbow*, McHoul and Wills point out with a measure of real enthusiasm that the competing and overlapping "discourses" of *Gravity's Rainbow* preclude any 'real' solution to the novel. "It's possible to argue that all critical readings are based on assumptions about what constitutes the 'real' (as opposed to, say, the dreamed, the fantasised, the cinematic and so on)" (McHoul 45). Their application of poststructuralism to Pynchon was one of the first to point this out, though we are still left with the problem of understanding what this particularly difficult encyclopedic novel "means," especially in its difficult later sections.[8]

[8]It is worth noting that although couched in a different rhetoric, thematic criticism surrounding the New Physics anticipates some ideas from poststructuralism. Poststructuralist readings arguably re-iterate what thematic readings have already divulged: Pynchon's use of scientific metaphors and ideas borrowed from physics, quantum theory, and mathematics play with ideas of uncertainty, doubleness, and unknowability.

In Redfield's reading, the emblem of the falling rocket is intensely indicative of the subject's endangered position in the historical field of global postmodernism. The rocket falls faster than the speed of sound, and before its victims hear it, they will be gone. "The Rocket is aimed at us, we hear the screaming only when we are already dead. [...] The Rocket becomes the force producing figuration and its error" (160). The figure of the Rocket then has an inescapable doubleness: it inscribes a certain loss of human agency in the laws of physics that come into play with rocket ballistics, which exceed the speed of sound. Redfield's essay concludes by invoking the image of the rocket closing in on the audience—and the reader—at the end of the novel, again a scene of menace for the individual subject, especially when one realizes that the new missiles, the real legacy of the V-2, are the ICBMs of the Cold War. They represent a genuine threat of annihilation on a scale far beyond even the worst-case scenarios of our early twentieth-first century fears of terrorism.

In the usual reading of *Gravity's Rainbow*, the reader perceives the interconnectedness of conspiracy in the Zone and develops a sense of paranoia. The postmodern subject can never perceive all the connections of the paranoid field. This inability to grasp something so vast, such a realm of connections, for

Redfield intimates something of a postmodern Sublime.[9] More theoretically involved than Jameson's initial formulation of the postmodern, Redfield extends this formulation to Pynchon as a kind of Sublime, one that engenders a sort of affective terror in the subject but without the compensating reassurance of Kant's dynamic. Suggestively perhaps, this reading involves an affective response in the reader of Pynchon: as I perceive the growing sinister sense of conspiracy in the forces against Slothrop, there is a diminishing of our sense of the fully present subject in the historical field of the novel.

In a similar fashion, in Kant's dynamic of the Sublime, the human subject experiences a renewed sense of human striving and capability after an initial sense of diminishment in the face of great natural forces. In my own reading of several scientific metaphors that occur in *Gravity's Rainbow*, and in Redfield's reading of the emblem of the falling rocket, there is ample evidence that human agency (the reader and the characters in the novel) is antithetical to much of the science surrounding the fall of the rocket. The relevant question here is whether there is a response of resistance in the novel against a postmodern Sublime, in either Redfield's or Jameson's terms.

---

[9]Mendelson gestures in the same direction as Jameson and Redfield, without the same critical vocabulary, when he writes, "Pynchon's international scope implies the existence of a new international culture, created by the technologies of instant communication and the economy of world markets" (164-5).

One answer is to look closely at its last larger section, "The Counterforce." This section posits an opposing force to the paranoid-engendering They of the novel. I will also turn toward another idea drawn from Jameson which Redfield does not consider. This is the notion of "cognitive mapping," a concept drawn from Jameson's discussion of postmodernism, which as I will suggest, can help recover meaning, however tentatively, throughout the last pages of the novel.

For Jameson, cognitive mapping is a sort of coping mechanism for the inhabitants of the postmodern city. Actually this term is borrowed from architecture, though Jameson's adaptation of the concept extends its usage and hints at a notion of resistance for the human subject encountering the excesses of postmodernism and late capitalism in its global stage. Indeed, two losses in the postmodern turn for Jameson are history and place. Briefly, in the pastiche of styles in late twentieth-century art and literature, we must be content with nostalgia, rather that a thickly realized evocation of the past in late twentieth-century novels and films (Jameson 20). The fiction of E. L. Doctorow is cited by Jameson for a loss of history in favor of a different mode of aesthetic perception, one concerned with surfaces and easily combining historical characters with fictive ones in *Ragtime*, which leads, in Jameson's reading, to a sort of "crisis of historicity" (22). Moreover, the architectures of cities offer buildings that reflect only themselves and actually "repel the city outside" and contribute to a loss of

access for individual city dwellers and a "placeless dislocation" that leads to a postmodern notion of space (42).

No one single individual, this reading goes, can understand the postmodern city with its self-contained architecture, its chain stores, its all-but-identical architecture. While the late twentieth-century city elides landmarks of the past, its inhabitants can still navigate this confusing, somewhat flattened topology with a mental map by moving from point to point. The sinister and complex postmodern city cannot be internalized or memorized. Yet despite a loss of place, the individual can successfully navigate recent urban landscape using "mobile, alternative trajectories" (Jameson 51).

As a mechanism of thought, cognitive mapping is much more than a way to walk to and fro in cities that change quickly and remove the usual markers of place. As such, the concept becomes a tool for navigating ideology, in Althusser's sense—that which cannot be seen in a culture, that which is "natural" and so invisible to individual subjects (51). Jameson intimates that cognitive mapping, if pushed farther as an analytic strategy may, in fact, allow purchase on the "unrepresentable totality which is the ensemble of society's structures as a whole" (51).

So, armed with cognitive mapping, one can still return to Ithaca figuratively (borrowing from Joyce) even without the immaculate certainty of the

narrative intelligence in "Ithaca" (the chapter) which has no doubt as to the precise movements of Bloom and Stephen from Nighttown to Eccles Street. Indeed, as has been noted, the naturalistic depiction of Dublin in 1904 for all the stylistic shape-shifting of *Ulysses* is supremely confident about topology and the precise location of characters, places, and things. Pynchon's text, on the other hand, in its later chapters, is not certain of placing its characters at all, and many of its fictive settings are invented, speculative, or simply unreal.

The disappearance of Slothrop, whose unknown position implicitly has been compared to the unknowability of a quantum wave/particle in Nadeau, occurs near the beginning of the novel's last section, "The Counterforce." I have always found that the hint of atomic physics here that undoes Slothrop in the scheme of the narrative of *Gravity's Rainbow* is problematic, even antagonistic, to those readings that stress New Physics. Much of the science of *Gravity's Rainbow* is classical, after all: ballistics, the science of falling bodies, is the stuff of Newton's *Principia*, not Heisenberg. In my reading, the erasure of Slothrop as a character moves beyond two disciplines, two kinds of older science: Newtonian ballistics and Pavlovian conditioning—though a strange and ribald kind—which give way to other ideas of order. The text enacts a sort of paradigm shift for the reader, from the older science to something else, beyond a simple worldview. The body of Slothrop, which is the site of much parody and comedy in the novel,

we might speculate, has little place in a new bodiless physics, which stresses the unknowability and indeterminacy of precise location, so central to classical physics. It is perhaps fitting that Slothrop's disappears just as he discovers the realities of the fruition of ideas begun in Heisenberg's theories of observer and observed.

The last appearance of the "real" Slothrop in *Gravity's Rainbow* is framed with an allusion to the fulfillment of the New Physics of Heisenberg and Einstein in the bombing of Hiroshima. This event is rendered elliptically, as Slothrop after another one of his comic and carnivalesque misadventures worthy of Menippean satire in the Zone discovers a part of a newspaper headline describing the event. Slothrop sees "the letters MB DRO ROSHI" in a newspaper headline (*GR* 693). It is left to the reader to supply the missing text ("[BO]MB DRO[PPED] [ON HI]ROSHI[MA]"). As the reality of Hiroshima comes into Slothrop's and the careful reader's understanding, we realize that something far more dystopic than previous historical periods is in the works for the twentieth century—the possibility of nuclear war.

As *Gravity's Rainbow* progresses in its final sections, a lived-in, mimetically felt space is continually challenged. Indeed, many of the novel's difficulties in its final sections offer radically discontinuous notions of space. Here it is necessary to keep in mind the admonition of Brian McHale, when he writes, "The

consequence of the drive for critical certitude, in a text like *Gravity's Rainbow*, is very often simple misreading, not seeing what is before one's eye because it does not jibe with one's interpretative hypothesis" (88). I take this charge to be self-evident, but making sense of an ending here, as Frank Kermode reminds us, often confers meaning on the whole.

One is struck in the later chapters of *Gravity's Rainbow* by how frequently Pynchon imagines new cities being built out of the chaos of the Zone, whether the Hund-stadt (the city run by dogs), or the one run by former inmates of the Dora death camp, or several imagined permutations of a Rocket City (the Raketen-Stadt). The novel's digressions are more numerous, more obviously daring and disjunctive, and, of course, broadly comic and sometimes pointless. The lack of definite setting for many of Pynchon's digressions in "The Counterforce" is this final section's single-most alienating strategy. We are forced to ask how a writer who so clearly mapped the lived historical reality of London (in "Beyond the Zero") and the efforts at building and testing rockets at Peenemünde and Nordhausen can become so apparently careless of establishing a sense of place in many of these episodes. Early detractors of Pynchon, who may not have accepted the novel's claim to be a successful encyclopedic text with a complete organizational scheme, might charge that the author has lost control somehow and abandoned himself to rhetorical excess. For any novel in the

encyclopedic tradition, such excess is one requirement for representing the world beyond its pages metonymically while at the same time allowing the text to stand metaphorically as a world on its own. This is surely the achievement of *Ulysses* and other successful encyclopedic narratives.

Mimetic space is sacrificed many times in "The Counterforce." At the very beginning of the "Counterforce" section, we are not anchored in a usual sense of space. We begin with Slothrop "just feeling natural" and wandering pretty much aimlessly about the Zone; he is already about to become the stuff of legend (*GR* 626). The end of the novel chronicles Slothrop's disappearance from lived space into myth and rumor. Several times within the "Counterforce," the narrative also acknowledges the novel's growing incomprehensibility. In one passage, the narrator describes messages from the occult, "where you can sit and listen in to traffic from the Other Side, hearing about the future (no serial time over there: *events don't always 'make sense' back here: they lack historical structure, they sound fanciful, or insane*" (*GR* 624, my emphasis). This is sometimes true of the narrative process itself, at distinct points in this section.

The members of the actual "Counterforce" team, Roger Mexico, Katje, and Pig Bodine, who seek out the missing Slothrop within the Zone, seem to realize the incoherent aspects of their project. After the spectacle of Roger Mexico urinating on the members of Whitehall, the characters discuss the aims of their

group. In one frequently-cited passage, Prentice explains the objective of the Counterforce to its newest member, Mexico:

> 'You're a novice paranoid, Roger [. . .] Of course a well-developed They-system is necessary—but it's only half the story. For every They there ought to be a We. In our case there is. Creative paranoia means developing at least as thorough a We-system as a They-system' (*GR* 638).

The narrator (in the mind of Roger) echoes, perhaps, the reader's own reaction. "It's a little bewildering—if this is a 'We-system,' why isn't it as least as thoughtful enough to interlock in a reasonable way, like They-systems do?" (*GR* 638) The counter-paranoid force is not a "rational arrangement," however, as we are told (*GR* 639).

There are various ways to finesse the success of the Counterforce project with its apparently absurd methods and happenstance gestures of resistance, but the Counterforce, by most measures, is a rather ineffectual bunch. Patti White looks at the rebellious and liberating potential of the "surprise roast" list of disgusting food items invented by Bodine and Mexico at the dinner held at the Gross Suckling Conference (48).

Whether or not readers find Pynchon somewhat sophomoric in passages like these (some surely do), it is clear that the narrative strategy of "The

Counterforce" section is much more arbitrarily inventive than the rest of the novel. Digression is the rule, rather than the exception. To make an analogy with *Ulysses*, for example, the "parade of styles" of the complex surfaces of "Circe," "Oxen of the Sun," "Eumaeus," and "Ithaca" interfere with the reader's understanding of the characters of Bloom and Stephen (French 213). At the moment that we would most like to understand a supposed real, "mimetic" notion of character, *Ulysses* obscures this sense of reality from us. Similarly, at the end of *Gravity's Rainbow*, we are arguably even more frustrated in our expectations for character—especially Slothrop's. Slothrop disappears by the novel's end, forgotten even by the members of the Counterforce, such as Bodine, who relegates Slothrop to memory after giving him a fragment of clothing dipped in the blood of John Dillinger (*GR* 741). Even in the last passage that mentions Slothrop, the narrator still insists in denying us the comfortable security of geography:

> Some believe that fragments of Slothrop have grown into consistent personae of their own. [...] There's supposed to be a last photograph of him on the only record album ever put out by The Fool, an English rock group—seven musicians posed, in the arrogant style of the early Stones, *near an old rocket-bomb site, out in the East End, or South of the River*. (*GR* 742, my emphasis)

Even at the last instance, the narrator refuses to identify the location of the photograph where Slothrop was allegedly last sighted, whether "the East End" or "South of the River."

Of course, the reader of "The Counterforce" must contend with other forces that refuse to give what we ask, precisely when we would most like to have our questions answered. Just as *Ulysses* is a quest for Penelope and Ithaca, *Gravity's Rainbow* is a quest for the Schwarzgerät and the mysterious Rocket 00000. Even if the text refuses to answer precisely why the maps of Slothrop and Mexico coincide, it still must provide something of the solution of the mystery of Rocket 00000. The novel plays with this readerly expectation in the episode of Thanatz "rescued by a Polish undertaker in a rowboat, out in the storm tonight to see if he can get struck by lightning" and subsequently meeting gay "prison-camp inmates" who have founded a town based on nostalgia for the Dora death camp (*GR* 663-5).

It is by concentrating on the lived-in, geographical detail of the Lüneberg Heath (in Germany) that Thanatz is able to remember what happened with Blicero and the rocket (*GR* 670). "Little by little his memory of that last rocket-firing on the Heath grows clearer" (*GR* 670). Enzian and his Hereros learn everything the reader would like to know. "By the time he's done, they will all know what the Schwarzgerät was, how it was used, where the 00000 was fired

from, and which way it was pointed" (*GR* 673). It is striking, of course, that this answer to the mystery of Rocket 00000 is in the text as intimated here with Thanatz, but couched in the noise (entropy) of surrounding digressions, it loses its immediate effect on the reader. The reader must wait to learn the mysteries of Rocket 00000 until the very last sections of the novel.

The final sections of *Gravity's Rainbow* consistently force us to imagine new kinds of cities, new kinds of architectural space. Besides cities based on dogs (the Hund-stadt), the city of village idiots (who revel in a carnivalesque fashion as they celebrate their town's initial organization), and the ex-Dora inmates (who organize themselves in homage to their oppressor Blicero), the "Counterforce" also describes "Happyville" during the set-piece of Eddie Pensiero's giving a haircut to his colonel. Throughout, Pynchon insists on dislocation (concerned with space) as an antidote to simple causality. "Where is the Comb that will move through this and restore the old perfect Cartesian harmony?" the narrator muses just before relating "The Story of Byron the Bulb" (*GR* 655). Byron's story is a set piece, but instead of developing our understanding of lived mimetic space, this omniscient re-telling of a bulb hunted down by the evil forces of "'Phoebus,' the international light-bulb cartel," looks past ordinary geography as Byron survives his pursuers, ending up as a witness to Private Eddie's homicidal act toward his colonel (*GR* 649).

Two descriptions of an imaginary and dystopic Rocket City (Raketen-Stadt) present formal perturbations of our usual sense of architectural space:

> It's a giant factory state here, a City of the Future full of extrapolated 1930's swoop-facaded and balconied skyscrapers, lean chrome caryatids with bobbed hairdos, classy airships of all descriptions drifting in the boom and hush of city abysses, golden lovelies sunning in roof-gardens and turning to wave as you pass by. It is the Raketen-Stadt. (*GR* 674)

Besides being set in nostalgia mode, circa 1930s, the means of movement through this imagined city is distinctly different. As the novel suggests, "Travel here gets complicated—a system of buildings that move, by right angles, along the grooves of the Raketen-Stadt's street grid" (*GR* 675).

In this episode, we are given what I would read as a dramatized psychomachia of the Oedipal conflict of Tyrone and father Broderick, as the Tyrone's radio serial/comic book superheroes, "The Floundering Four," do battle against the "Paternal Peril" (*GR* 675). The murderousness of the Father here—along with the Raketen-stadt's Nazified citizenry—is more than enough to suggest a dystopic vision based on Rocket aesthetics. Later on, the Raketen-Stadt is embellished with an even more revolutionary sense of three-dimensional

organization. "By now the City has grown so tall that elevators are long-haul affairs, with lounges inside, padded seats and benches. " (*GR* 735)

A slightly less negative depiction of another rocket city comes later, a city combining Rocket technology and Herero sensibilities:

> It resembles a Daguerreotype take of the early Raketen-Stadt by a forgotten photographer in 1856: [. . .] it shows, from a height that is topographically impossible in Germany, the ceremonial City, fourfold as expected, an eerie precision to all lines and shadings architectural and human, built in mandalic form like a Herero village. (*GR* 725)

The particular city presented here is an endlessly self-transforming design. "Engineering changes to the Rocket create new routes of supply, new living arrangements, reflected in traffic densities as viewed from this unusual height" (*GR* 726).

Besides gesturing towards a new kind of space, new possibilities (though frankly dystopic ones) for social and spatial organization, the two most important final sections at the end of *Gravity's Rainbow* are the most disjunctive of all, in terms of both anti-mimetic space and basic narrative continuity. In the first such section, buried within broad and somewhat unsuccessful comedy are short episodes with titles like "On the Phrase 'Ass Backwards,'" "My Doper's

Cadenza," "A Moment of Fun with Takeshi and Ichizo, the Komical Kamikazes," and "Listening to the Toilet" (*GR* 683-94). Within these comic sketches are buried the serious moments of "Streets," where we and Slothrop learn that the atomic bomb has been dropped on Hiroshima, and in "Some Characteristics of Imipolex G," where we discover more scientific data about the Imipolex G compound (*GR* 692-700).

Each subheading moves us into short episodes, with no discernible thread or connection, and no consistent geographical setting. Readers of Pynchon's novel have no clue how these episodes all hang together, unlike perhaps the readers of "Aeolus" in *Ulysses*, which presents newspaper headings that comment ironically on the actions depicted as Bloom visits the Dublin newspaper office, or even "Wandering Rocks," where the synchronic depictions of arbitrary moments around the city of Dublin still adhere to a strong mimetic presentation of space and real, lived time. Noting the typographic parallel with "Aeolus," David Seed has suggested the best way to read the final sections is to think of them as rapid jump-cuts, or "cross-cutting" from film (217). For Pynchon, certainly, we can turn to the tradition of encyclopedism—and its mandate that more is more, and comedy is part of the genre—in order to make sense of these disparate elements, for these episodes are often satiric and broadly comic. They present a mixture of high and low genres. The news of the first atomic bomb, with its "pale Virgin"

witnessing the devastation of Hiroshima (surely a religious image), and a "scientific" treatise on Imipolex G are interwoven with toilet jokes and obvious stereotyping of the Japanese Kamikazes (*GR* 694).

The second section of "The Counterforce " that relies on such headings and short vignettes is, of course, the very last chapter of the novel. Here, we get several sections that gesture toward Weissmann's occult use of Tarot—"Weissmann's Tarot," "The Last Green and Magenta," and "The Horse" —and biblical allusion—to Abraham's near-sacrifice of his son in "Isaac" (*GR* 746-50). Gottfried will not be as lucky as Isaac, though, as we discover in the first of two notably satirical sections, "Chase Music" in which comic superheroes (including Superman) are too late to save him (*GR* 751-3). Next, the weirdly anachronistic "Orpheus Puts Down the Harp" fractures time and space, and it is these few pages that are most relevant to making sense of the novel's ending. Obviously, this episode has considerable fun at the expense of Nixon. "Richard M. Zhlubb, night manager of the Orpheus Theatre on Melrose, has come out against what he calls 'irresponsible use of the harmonica'" (*GR* 754). The text asks us to undertake a series of metaphorical mappings here: "night manager" as President, and "Orpheus Theatre" as the whole of America, presumably. The tone shifts rather powerfully into what must be taken as an apocalyptic gesture. "But the sound is greater than the police. It wraps the concrete and the smog, it fills the

basin and mountains further than any mortal could ever move." (*GR* 757) Clearly, this is some type of alarm beyond even presidential control; a siren that signals the end—a nuclear apocalypse, presumably—which is intimated in the very final section, where the rocket is frozen in time "above the roof of this old theatre, the last delta-t" (*GR* 760). The end of the novel reminds us that the American moonshot was not the only legacy of Weissmann's (or the real Wernher von Braun's) V-2 technology; so were the missiles of the Cold War.

Having worked through all the spatial dislocations of "The Counterforce," the reader has arguably obtained a more sophisticated sense of space and causality. The successful reader of Pynchon is not at all like Pointsman, who "is left only with Cause and Effect" (*GR* 752). One larger effect of *Gravity's Rainbow* is that the text refuses to rely on easy mimesis or lived-in geographical space. If, as I have suggested, the book's rhetorical excesses fracture traditional Cartesian or Newtonian space, especially in its final sections, then the reader can never really hope to comprehend the totality of *Gravity's Rainbow*. Yet, armed with something like Jameson's cognitive mapping, though we can never internalize the whole of the text, we can still navigate its difficult rhetorical surfaces. In such a reading, there is no relying on the realistic episodes to resolve all the complexities of the novel. Jameson warns us that we must avoid "some older

and more transparent national space, or some more traditional and reassuring perspectival or mimetic enclave" (54).

In the reading proferred here, cognitive mapping is a strategy that lets the reader negotiate the complexities of the novel and its dislocations of natural, geographical space. As a concept to recover tentative human agency, cognitive mapping remains provocative, perhaps, as it does for Jameson, who speculates what a "politically minded" postmodernism would entail as it navigates "spatial as well as our social confusion" (54). As he suggests further:

> Cognitive mapping in the broader sense comes to require the coordination of existential data (the empirical position of the subject) with unlived, abstract conceptions of the geographic totality. [...] The political form of postmodernism, if there ever is any, will have as its vocation the invention and projection of a global cognitive mapping, on a social as well as a spatial scale. (52, 54)

Adopting the notion of cognitive mapping, the reader can move through the sometimes incomprehensible whole of *Gravity's Rainbow*; we can situate ourselves within the totality of the novel. So it is with Slothrop facing the shifting indeterminacies of the Zone and the reader's own navigational strategy within the overlapping discursive fields of Pynchon's vast and complex novel

and the totality of the space it represents. Whether the novel is historical and mimetic, fantastic, or absurd, the reader is perhaps better served with this strategy, rather than an attempt to explain away all the novel's discontinuities and dislocations within the critical paradigms of the New Physics, film, or post-structuralism.

There is no quick recovery of the place of human agency in the historical field. This notion echoes Jameson's formulation of the postmodern subject's place in an ever more globalized world, governed in his reading by an ever more interconnected global capitalism. However, if cognitive mapping salvages a notion of human agency, then my proposed dynamic of aesthetic science can help us understand *Gravity's Rainbow*. Encountering the forces of science amassed against character and the individual subject, we are certainly diminished, but by successfully navigating the novel, we have some measure of agency, as actors in the historical field. This is my argument for an aesthetic science, though in Pynchon, it is admittedly more tentative and harder to recover than in "Ithaca" and *Ulysses*. I do not believe, as does Redfield, that the final image of the rocket's approach erases any chance of human activity. At the very least, there is an esprit de corps, an argument, as I suspect is always true in actual times of war, that we are all in this together.

On another level, the inclusion of scientific tropes and material contributes to the "strangeness," to borrow Brian McHale's term of admiration for *Gravity's Rainbow* (111). In 1973, the scientific was still antithetical to the category of the literary. In fact, Pynchon's career as a fiction writer exploits a cultural tension exemplified in Snow's *The Two Cultures*. It is shocking, in a way, to be told that human history is a product of unseen forces of the Second Law of Thermodynamics, or that rockets fall because of the conspiracies of chemists or rocket cartels, or any of the other examples where science menaces the agency of characters in Pynchon. Earlier in this study, I have argued that Joyce in "Ithaca" uses science to create a different sort of beauty in the strangest chapter of *Ulysses*. Pynchon stages his own dynamic of aesthetic science, too; the linguistic field of his novel menaces both its characters—and by analogy the reader, who must navigate its rhetorical twists, turns, and complexities with something like a notion of formal pattern. If this patterning is not simply beautiful (it is at times disturbing and difficult too), it shows an intricate, new ordered universe for fiction. Pynchon's universe is one whose valence and sensibility would be impossible without invoking scientific ideas, which, until his arrival to the literary scene, would be as unthinkable as it was to Snow or any other educated reader in the mid-twentieth century.

I am arguing, finally, for an education of readerly sensibilities in the trajectory of writers like Joyce and Pynchon. *Gravity's Rainbow* fulfills the project of navigating the Two Cultures for successful fiction and putting scientific matter into play for fiction writing, as never before in cultural history. C. P. Snow was perhaps wise not to predict the shape of what ambitious fiction would look like when it turned to the world of science. He could not have foreseen the fundamental strangeness, and formal, disturbing beauty, of *Gravity's Rainbow*, nor could any reader seeing the beginnings of Pynchon's project in a modest short story from 1960.

The project of appropriating science in fiction does not end with Pynchon. Arguably, his work puts sciences into play for novels of style like never before. In the work of Don DeLillo, science takes on an important role in an early novel which also placed that novelist onto the literary scene. *Ratner's Star* was arguably that author's first ambitious novel, a literary attempt to embody the history of mathematics. This text offers another glimpse of the intersection of the scientific and the literary with a challenging and intriguing result. *Ratner's Star* achieves a status as a certain kind of encyclopedic text, even while *Underworld* becomes, as we shall see, a sort of failed encyclopedia. Explicating the changing role of science and the encyclopedic impulse in the work of DeLillo will become the object of the next chapter.

CHAPTER 4

The Pure Delight of Theory: Reading Aesthetic Science in DeLillo's *Ratner's Star*

Before Don DeLillo turned toward conspiracy, American consumerism, waste, and terrorism as central thematic concerns, he responded to the same cultural pressures as did Thomas Pynchon. One simple and I think truly counterintuitive biographical detail that often goes unnoticed in criticism of both authors is that DeLillo was born six months *before* Pynchon in 1936.[1] It is customary to read DeLillo as a writer of a different, perhaps younger, generation, but the simple fact of biography proves the opposite. Yet their publishing careers—and the reception of their work—follow quite different paths, at least from the years between 1960 through 1971. It can be argued that after the appearance of his first novel *V*. in 1963, Pynchon became almost immediately a "serious" if not canonical novelist.[2] DeLillo's early work largely

---

[1]The *Dictionary of Literary Biography* lists Pynchon's date of birth as May 8, 1937, and DeLillo's as November 20, 1936, which is approximately six months earlier. These dates are readily verifiable in sections of critical 'reader's guides' to both authors. For a biographical chronology of Pynchon, see Judith Chambers, pp. xiii-xiv. For the same in DeLillo, see Keyes pp. xi-xiii. I am indebted to David Cowart in noticing the closeness of the two author's ages "born within six months of each other" (7), though Cowart doesn't point out that DeLillo is actually a bit older.

[2]While Don DeLillo's first novel, *Americana*, does not arrive until 1971 along with the "Author's Note" in the pages of *Epoch*, Thomas Pynchon's first novel, *V*., was reviewed in glowing terms by Walter Slatoff in the Winter 1964 issue some seven years earlier. "About the only thing one feels sure upon finishing *V*. is that one has read a book of major importance and

consisted of a handful of short stories published in *Epoch* magazine, edited by Baxter Hathaway from 1958 to 1968. This early fiction shows a writer who is not all "a child of Godard and Coca-Cola" (in Mark Osteen's formulation) but really an Italian-American regionalist, one who represents the speech patterns of the author's native neighborhood in the Bronx, as I will demonstrate.

Writing in 1964, Baxter Hathaway reflected on fifty issues of his magazine, *Epoch*, which had already published two of DeLillo's earliest short stories. It would go on to publish two more, all but two of the earliest short stories from a young writer who would not publish a first novel until 1971 with *Americana*, an event also acknowledged in the very same magazine with DeLillo's "author's note." As Hathaway writes:

> Men and women all over America and the English-speaking parts of the world have been sitting in front of typewriters in all conceivable situations—in sparsely furnished cold winter flats in the Village, in beach houses, *in suburban bedrooms, in makeshift cellar studies*—in the attempt to give the airy nothings of their minds a local habitation and a name. ("Fifty Issues of Epoch" 79, my emphasis)

Notice the hierarchy here, a sense that real literary work is arguably done in

---

that its author, Thomas Pynchon, has a vitality, intelligence and magic to become one of the major writers of our time" (255).

New York and moves more progressively away from that putative center to the suburbs and beyond, finally, to "makeshift" basements. As an editor for a magazine started right after W.W. II, which is filled with names of writers who would go on to substantial literary careers, Hathaway has a perspective on evolving postwar American literary taste. "A lot has happened in American culture between 1947 and 1964," he observes off-handedly, which seeks to place the role of little magazines amidst an emerging popular culture. "The paperback industry, in its infancy in 1947, bloomed. Television became a dominant form in the mass media of communication" (80). Yet Hathaway's relationship to a more dominant mass media is not wholly antagonistic. He argues that the middle-class reader "may lend his attention to Perry Mason or professional football or manned flight into space even though he acknowledges no fealty to them" (80). Hathaway then borrows what I think is a Paterian notion, that the length of "attention" to mass media does not equal "allegiance" in, perhaps, intensity. "The history of what is real in our individual moments may be written in terms of *attention* and not of *allegiance*," he observes (80, my emphasis). In other editorials from this period, Hathaway speculates on the relationship between mainstream fiction magazines such as *The New Yorker* and *Esquire*, which commanded significantly more "attention" from audiences, while

little magazines like his own did not.[3]

A speculative reading of the fiction in *Epoch* during the years of 1960 through 1970 might serve as an index of literary taste. While such a sampling cannot be representative in a sociological or scientific sense, it can point to what DeLillo was up against in forming what would become a quintessential voice of postmodern writing. Throughout the pages of *Epoch* during these years, one sees many pieces that create a distinct sense of place, in Hathaway's phrase, "a local habitation." Poems such as "Brooklyn My Betrothed," "The North Fork Spinster," or fiction set in upstate New York written by Joyce Carol Oates, whose burgeoning fiction career was also helped along by *Epoch*, provide examples of this kind of writing rooted in a distinct sense of place.[4]

Indeed, DeLillo's evolution into a novelist of conspiracy and placelessness, and a keen documenter of emerging postmodern life, does not emerge until several years later. The DeLillo of the early short fiction takes on a regional voice, not of the American South, upstate New York, or New England,

---

[3]Hathaway writes, "This is not to attack the *New Yorker* or *Esquire* for having succeeded. […] If we [at *Epoch*] are envious, our envy takes the form of thinking that success in those places is a result of an *impure* alliance between excellence [...] and something else" ("Fifty Issues" 82, author's italics). Some of these extra-literary impurities seem to be "perfume advertisements, the calendar of available entertainment around the city, the projection of sophistication" and the like, missing from small magazines like *Epoch* (82).

[4]For its fiftieth issue, *Epoch* included an index to all the writing which appeared in its pages between 1947 and 1964. There are many well-known names of emerging young writers in DeLillo's generation besides Oates, and there are many poems and short stories that bear evidence of a local setting (outside New York City). See "Fifty Issues of Epoch," pp. 121-130.

or a knowing, citified milieu—the setting employed by other writers in *Epoch* during this period—but instead one of the rough-and-tumble of life in the Bronx. Examining DeLillo's short fiction is valuable because it allows us to read the Bronx scenes in the later work of his "middle period" (notably *Ratner's Star)*, which will be my focus for a reading of aesthetic science, below. As I hope to demonstrate, as his fiction turns towards postmodern concerns, DeLillo's early depictions of real bodies in the social fabric of cities give way to a certain disembodiedness or discomfort with bodies. DeLillo's invention of style, which critics have taken as an exemplary voice of postmodern writing, comes after an apprenticeship of trying to represent the fabric of his real city, a problem solved earlier, and very convincingly, by Joyce in the novelistic procedure of *Ulysses.*

The first short story by one "Donald R. DeLillo" in *Epoch* magazine in Winter 1960 demonstrates a writer already in search of larger themes, no less the place of religious belief in a culture under siege by advertising. "The River Jordan" describes the plight of seventy-year-old Emil Burke, an evangelist for the "Psychic Church of the Crucified Christ," as he wakes up on a hot summer day to go out and preach on the steps of the New York Public Library (106). At several points in the story, his religious message is confronted and parodied by the language of advertising in the mouths of hecklers. For example, after Burke gives a disquisition laced with three-item abstractions

such as "Being, Existence, Life; Aesthetics, Ethics, Religion; Passion, Death, Resurrection" and no less than "the triune God: Father, Son, Holy Spirit," a boy responds with a joke. "'Hey man. [...] How 'bout Purity, Body, and Flavor? Mel Allen say[!] it on TV all the time" (116). Another heckler counters with a baseball joke about Yogi Berra and the Yankees (115).

Throughout this story, Burke suffers keenly from a messiah complex. In fact the story ends with him "try[ing] to visualize a crown of thorns upon his head" (120). Mr. McAndrew, a former businessman and a financial backer of Burke's church, cynically comments on the impossibility of its mission. The title of the story comes from his ironic use of the River Jordan, which to McAndrew is "where salvation awaits in the form of a parking space and air-conditioned moviehouse" (112). "'What a waste,'" McAndrew says about the printing and distribution of their pamphlets (113).

This story culminates in the small drama played out in a bar as one stereotypically collegiate couple discuss the merits of sex. Burke is menaced by a bartender brandishing a pool cue after confronting the young couple, and he expresses a wish for death for defending his faith. "'Strike the blow! Do what you were born to do. Kill,'" Burke admonishes, only to be dismissed by the bartender as an "old bum," whose talk of religion amounts to nothing (120).

Burke's own situation is rendered pathetically, and there is every sense

that the author has a commanding sense of place of the city. Besides demonstrating a command of Catholic doctrine here, which might have fit one of the Jesuits at Clongowes Wood in Joyce's *Portrait*, DeLillo at points flirts with an Eliotic vocabulary. "In the beginning of man's becoming and being, within the concept of a concept, is a spark of awareness, a rasp of rock upon rock, soul upon soul" reads one passage describing Burke's internal musings (112). This story stages the predicament of holding religious belief in the post-war city, one whose inhabitants only want a parking place and an air-conditioned movie theater on a hot summer day. Like Pynchon's early short story "Entropy, " DeLillo's narrative is thoroughly novelistic, that is, filled with detail suitable for a longer, more substantial fiction, though not as brimming with musical or scientific allusion as Pynchon's early effort. Both stories stage two sets of conflicting values: for DeLillo, this is advertising and religion; for Pynchon, chaos and order within the process of entropy. Even early in their careers, both authors are able to seek much larger themes, which in the American short story typified by other writing in *Epoch* (and arguably fiction of this period generally) tends toward a smaller canvas.

In DeLillo's effort, there is just a hint of an engagement with a scientific vocabulary. At one point, Burke muses on "particles of infinity" (111). His congregation "must make known the message of eternity, of the living-after-

death when each man, a *fragment of gravity, transcends matter* and becomes an eternal spirit, one with the universe" (111, my emphasis). Yet a vocabulary like this only hints at the author's future adoption of science for some of his most ambitious tropes in his later, mature fiction.

In "Take the 'A' Train," which appeared in *Epoch* in Spring 1962, we can see the most disturbing portrait in all his fiction of life in DeLillo's native Bronx. This piece depicts the downfall of Cavallo, divorced and unemployed, who ends up living on a train, literally underground. Later, DeLillo uses the subway to suggest a kind of primal wonder at his native New York City, whether in scenes of a young Lee Harvey Oswald in *Libra,* Billy Twillig in *Ratner's Star*, or the graffiti artist Isaac Munoz in *Underworld*. It is impossible not to read the basic dramatic situation of life on the subway as a response to the depiction of such "yo-yo-ing" in Pynchon's *V*. Benny Profane, of course, sleeps on the subways when he first arrives in New York City after life in the Navy in Norfolk, Virginia. Profane's life in the subways is almost comic, evidence of his passive "schlemielhood," and there is really no sense of deprivation or even danger as he rides the rails. However, Cavallo's situation is filled with unrelenting hardship, including hunger and a knife attack by a street gang of "garbage can alleycats" that deprives him of his very last dollar ("A Train" 20).

The overbearing crudity and cruelty of the protagonist's Italian-

American father is the most remarkable note sounded within this story. The father is unremitting in his insults to his son, which are rendered in a rough, Italian-inflected dialect of English. The elder Cavallo refuses to accept his son's British wife, Helen, a rejection which the story implies leads to the son's divorce and downward spiral. The father also berates his son for the younger man's financial failure. "'Lots jobs,'" he says, "'Even carpenter like me make so much money in one week that in old country I dropa dead joost to look at it. But you, my son, can find no good job'" (15). The elder Cavallo says that he has "'a bum for a son'" (15).

Yet the father and son's relationship is cast as a sort of fall. As a young boy, Cavallo suffers from a life-threatening fever. After a kind of ritual conducted by his father, he survives. "'My blood is yours, my little son Angelo. My strength is your strength. I send forth life into your body'" (17). In the most powerfully rendered scene, the father exposes the realities of sex by touching his thirteen-year-old son in an inappropriate manner, one might say, and admonishing him, in a harshly naturalistic moment, to go forth and multiply. "'No book I need tell you this. Take down your pants. [...] That is all you must know. You do it because it must be done'" (18). DeLillo's unrelenting harsh tone in "Take the 'A' Train" counters the effusive jazz standard of the same name. The story's allusive title is certainly a knowing gesture toward the fact

that the author has risen above his circumstances of his otherwise grim portrayal of life underground. This story's tone is astonishingly at odds with "Don DeLillo's" later mature voice of suburban anomie.

A later slice-of-life story set in the Bronx entitled "Spaghetti and Meatballs," which was published in *Epoch* in Spring 1965, offers a more kindly portrait of life in the Bronx and centers on two of the "fresh air inspectors" later depicted in *Underworld.* A middle-aged Santullo and the elderly D'Annunzio converse on a stoop and reminisce about life in the Bronx. Their conversational banter seems convincing as they complain about modern life. "'Everyone is crazy,'" D'Annunzio observes ("Spaghetti and Meatballs" 245). The narrative voice seems truly comfortable with the details and rhythms of street life. It is a style that cannot but remind the reader of the later Bronx sections of *Underworld,* as Bronzini strolls through his neighborhood. The two men are subject to gentle comedy, but this portrait lets them retain their fundamental dignity. Santullo is literally kicked out of his home and abandoned by his wife "'with nothing and with nobody and with nothing, '" as he puts it, but he is treated to at least one last satisfying meal (249). The two men converse about their ideal food. "'Then all I ask is some bread, some cheese, and a glass of wine. It is simple and yet it is everything. That is all I would need,'" says the elder D'Annunzio (248). There are none of the grotesques of "Take the 'A'

Train" or any of the malevolence of street life suggested in the Bronx sections of *Ratner's Star*.

In some ways, the two men partake of a certain aetheticist impulse to enjoy one last simple, pleasurable meal together before returning to the harsh circumstances of their lives. "'But this kind of beauty never lasts,'" says Santullo. "'Think of the present,'" counters D'Annunzio (249). (The resemblance of the name to that of Gabriele D'Annunzio, associated with a certain Italian aestheticism, surely cannot be lost on DeLillo.) The story concludes with the details of a more contemporary life encroaching on the two men in the form of a radio broadcast. There is a sense that the two men are of a different era and sensibility. "The music stopped and an announcer came on to give the latest stock market report. Utilities were holding their own. [...] Santullo smoked his cigar" (250). DeLillo's confident voice here, in a modest short story, suggests he could have become a writer who relied on depicting the Italian-American life. From this point on in his fiction, DeLillo's re-invention of his narrative style is nothing short of astonishing. Until the Bronx sections of *Ratner's Star* and *Underworld*, DeLillo does not return to the Bronx for any of his fiction.

The next story to appear in *Epoch* really does mark the arrival of DeLillo's "mature" style, though his first novel, *Americana*, is still three years

away.[5] With the publication of "Baghdad Towers West" in *Epoch* in 1968, the voice of Don DeLillo achieves its characteristic tone. In this story, an unnamed first-person narrator speaks, as do many of the other characters in the novelist's later work. A middle-aged businessmen, who seems to have abandoned his job, leaves his Gramercy Park apartment for the "damned nightmare" of a new complex named "Baghdad Towers West" (197), and rents a room in an apartment occupied by three young women, who in their way, represent youth culture in 1968. Robin, who is British, wants to be in fashion. Melinda Bird wants to break through in acting. Caroline is a "junk sculptress" who makes art out of found objects and waste (199). Her process anticipates the approach to art by Klara Sax in *Underworld*, though on a smaller scale. Caroline's manifesto

---

[5]DeLillo's "Coming Sun. Mon. Tues." appeared in the *Kenyon Review* in 1966. This three-page story actually articulates a high point of stylistic experimentation in almost all of DeLillo's prose, excepting short sections of experimental writing in *Ratner's Star*. The story revisits a set of circumstances of a pair of young lovers and their unwanted pregnancy, a situation famously depicted by Hemingway in "Hills Like White Elephants" (published in 1927). DeLillo's piece conjures up the exuberance of youth culture in the early 1960s, and ingeniously plays with this setting as the actions of the young couple are universalized with geographical details that multiply on the page. "It is Fifth Avenue or Grosvenor Square" (391). "The boy and the girl go to a store in San Franscisco or Toronto or Liverpool. They steal some groceries" (392). In a witty choice, DeLillo suggests that 'youth culture' is universal as the couple dresses the same across all countries in "heavy sweaters and blue jeans and desert boots" (394). Their cultural heroes are the Beatles and Jean-Paul Belmondo, hero of Godard's *Breathless*, which is clearly an influence here (393).

Patti White in *Gatsby's List* has made much of DeLillo's three-item lists in novel like *White Noise.* In this early piece, DeLillo experiments with two-part lists, using two places instead of one for many of the geographical points of reference within this story. The couple's decision not to come back to the abortionist's office to have their child also breaks with the outcome later depicted in *Underworld* as Nick Shay and Amy Brookhiser travel to Mexico for an abortion that seems to puncture the one truly passionate affair in Nick's lifetime (see *Underworld*, pp. 587-8).

clearly subjects her to gentle ridicule, so the reader is left wondering what DeLillo might think about such an approach to making art.[6]

The narrator expresses a weird fascination with the rituals of postmodern life, particularly the architecture of the new apartment, which he describes as "promis[ing] a new mystery, electronic and ultra-modern, in which the angel of death pushes a vacuum cleaner and all the werewolves are schnauzers" (198-9). And again, he observes "the kitchen hummed with power and a kind of stainless steel lust" (201). In particular, the main character is fascinated by the ritual of "being put on security" by the doormen who work behind a console that reminds him of "the blockhouse near the launchsite during countdown" (206, 199). Being placed on security means that "if anyone enters your apartment while you're out, a buzzer sounds and the felon is swiftly apprehended" (206). However, after an ill-considered sexual advance

---

[6]The manifesto of Caroline the "the junk sculptress" is the following:

> In a sense I anticipate Calder. Marble is dead. Bronze is dead. The Greeks are dead. If junk dies, I may as well go with it. I am committed to junk. Give me sparkplugs, Maytag washers, jet engines, the teeth of combs. Today all beauty is apocalyptic and it demands new forms for its expression. I would like to work in cobalt and zirconium. I would like to make fantastic signboards for the superhighways. This is the age of the orbital bomb and the brand-name, the neon pizza joint. Doom. Doom. Doom is my medium. ("Baghdad Towers West" 200)

Although there is over-the-top comedy here, the energy of combining the detritus of postmodern life, "sparkplugs, Maytag washers, jet engines, the teeth of combs" seems in my reading to be something that would hold a certain fascination for DeLillo, who devotes a good deal of *Underworld* to waste and its containment.

on the three women, an attempted "triple simultaneous seduction" on the last night of their time in the city (before they move on to other lives), the narrator takes to being locked down in the now vacant apartment while he is *inside* (212).

Moreover, the narrator begins to sleep in the beds of each in the manner of a fairy tale. Yet even his episodes of rest, "adventures in the twilight zone," as he describes them, turn sinister (217). "The tremors have started. They come at night, without warning, a spasmic metaphysical current that rises from the belly until I have to open my eyes for fear of dying" (216-217). The narrator is left riding the elevators in his building while ranting about such topics as "the universe and its origins" and "the persistence of memory" to a young boy named Ulysses (217).

The reader is struck by the unexpected originality of "Baghdad Towers West." The accretion of detail in the metonymic selection of DeLillo's earlier stories set in the Bronx—as in Joyce's Dublin—gives way to something else. Instead of more and more details, the characteristic DeLillo voice works by subtraction, rendering the surfaces of new, made-up architectural spaces and the new rituals of consumerism in emerging postwar American suburban life. DeLillo delves into this material perhaps more directly than any of the other writers in pages of *Epoch*.

In 1972, after DeLillo's first novel *Americana* was finally published, *Epoch* ran the author's own commentary on the novel in "Notes Toward a Definitive Meditation (By Someone Else) on the Novel *Americana*." Even the title suggests a reluctance on the part of this not-so-young first novelist (already near thirty-five) to be certain of his work. In an introductory paragraph, the editors argue that DeLillo was supported by the magazine as an "authoritative" voice of his generation ("Notes" 327).

We might ask what DeLillo's writing during these years could have been expected to be "authoritative" about. The answer has to be the voice of local color—a Bronx regionalist—as suggested above. Within this short and, at times, self-deprecating piece, DeLillo observes that his protagonist David Bell is a "child of Goddard[!] and Coca Cola" (327). Instead of Jean-Luc Godard, DeLillo inadvertently invokes Robert Goddard, the ostensible father of modern American rocketry.[7] One doesn't want to take the misspelling too seriously, although it was precisely this sort of thing that a poststructuralist might seize upon to develop an entire reading. However, it suggests that the world of the French New Wave cinema is perhaps not familiar turf to the copy editors of *Epoch.* DeLillo's allusion originally comes

[7]The *American National Biography* describes Robert H. Goddard (1882-1945) as a researcher whose "predilection for secrecy makes it difficult to assess his impact." By refusing to collaborate with rivals, his actual impact in rocketry was left to his wide-ranging patents on such areas as control systems and liquid propellants.

from a black-and-white caption late in Godard's "Masculin féminin" (1966) which labels his cinematic characters as "Children of Marx and Coca-Cola," for him a contradictory mix of working for the Left in Paris while being swept up in American pop culture. (DeLillo's other direct allusion to Godard in "The Uniforms" was inspired apparently by viewing *Weekend*; in my reading, this story wildly misses the mark in its tone.[8])

In any case, I want to suggest that DeLillo's typographical slip is fortuitous and may point out his own preparation for his first major work, *Ratner's Star*, which, as Tom LeClair's interview with the author suggests, required substantial immersion in mathematics and science.[9] This novel by

---

[8]In "The Uniforms," published in 1970, DeLillo's lead character, Jean-Claude, apparently a devotee of Godard, says, "Terrorism, unlike ballet, cannot be performed with economy" (457). DeLillo's first attempt to depict terrorists at work has little economy either. Its matter-of-fact depictions of killings, burnings, and rapes do not really let the reader contemplate what terrorism might mean. Here is a typical disturbing passage:

> They watched Duong rape a retired colonel's wife in a secluded area at the edge of a country club. The colonel was now a well-known industrialist whose firm made sandwich-wrap which he sold to South Africa. Hassan killed him slowly, as he had killed French paratroopers in the Casbah, and then Harlow poured lighter fluid on his wife to ease entry for Jean-Claude. When he was finished they set her on fire. (456)

In an author's afterword, added when this story was placed in a collection, DeLillo states that his intention was to respond imaginatively to the Godard film *Weekend*. "Thousands[!] of short stories and novels have been made into movies. I simply tried to reverse the process" (533).

[9]In Tom LeClair's early interview with Don DeLillo, the author commented on the research that went into *Ratner's Star*. "'I started reading mathematics because I wanted a fresh view of the world. I wanted to immerse myself in something as remote as possible from my own interests and work'" (DeLillo qtd. in LeClair, "Interview" 85-6).

DeLillo surely does owe more to rocketry and the push toward the exploration of space in American public life in the early 1970s than to one of the inventors of the French New Wave cinema.

How does a writer who has an allegiance to a particular place and time escape, as it were, and reach for a more ambitious and original way to write fiction? DeLillo chose football for his attention in *End Zone* (his second novel) and rock-and-roll in *Great Jones Street* (his third). His fourth novel, *Ratner's Star*, adopts the language of mathematics and science for fiction and takes on the encyclopedic project directly. Without suggesting an immediate influence, it is intriguing to see *Epoch*'s editor, Hathaway, speculate in 1961 on the emerging importance of science in American life and its possibility for a different sort of aesthetic. In a short but suggestive editorial written in the magazine, Hathaway notes (as does C. P. Snow in the *The Two Cultures* as we have seen in Chapter 3) that educational practices have placed a new emphasis on science:

> One curious offshoot of the recent national efforts on behalf of the natural sciences as a result of the pressure of cold war rivalries has been a series of moves, widely scattered, to assert that the natural sciences are, after all, humanistic studies. ("One Curious Offshoot" 123)

Hathaway then speculates on the "monuments" of cultural history and, with

tolerance, admits that such cultural "monuments can be made by Galen, Max Planck, and Darwin as well as Aeschylus, Donatello, or Brahms" (123-4). Here Hathaway notes that canonical works can be from music and science, as well as literature.

Hathaway then speculates on a notion of beauty that resonates with DeLillo's own novelistic practice in *Ratner's Star* (as well as in a short play, *The Engineer of Moonlight*, and a short story, "Human Moments in World War III") that all make ample use of science for notions of aesthetic beauty and order during this phase of DeLillo's career. I will examine these texts below to develop further my analysis of aesthetic science and how this dynamic plays out in DeLillo's first batch of mature fiction, which offers a distinct movement away from mimetically realized places. For now, by way of introduction, Hathaway's speculations actually prove right in some way—again without suggesting direct influence—in DeLillo's mid-career writing from 1978 through 1983. Hathaway writes:

> Since there has been some popular resistance to expanding our concept of our native heath to include outer space, publicists have gone on television urging us to think of scientific research not primarily as a pursuit of knowledge but as the unfolding of a way of life which is *awesome, beautiful, and comforting*. What is new

> about this set of ideas is the scientist's assurance that he can provide a better aesthetics as well as a better knowledge of the nature of the physical world as the poet can. (123, my emphasis)

If one could substitute "terror" for "comforting" in Hathaway's proposed reading of science, one would have a working triad of terms for understanding DeLillo's work and his adoption of science and technology for fiction, as well as a way into this difficult text in terms of aesthetic science. Making sense of terror in the work of *Ratner's Star* turns out to be a focal point for what to make of DeLillo as a novelist, whether he is a neo-romantic, a neo-modernist, or a postmodernist.

First, it is necessary to establish the status of *Ratner's Star* as an encyclopedic narrative. This novel arguably fits this category much more closely than its larger successor *Underworld*, which I will consider below as a "failed encyclopedia," yet one that partakes of the encyclopedic impulse at particular points. Given the difficulty and general unapproachability of *Ratner's Star*, the question of its genre has generated several responses from critics. Mark Osteen points out that the novel is a Menippean satire, a classical genre that mixes high and low and all kinds of discourse (61). (Usually when a text is categorized as a Menippean satire, it is likely to engender critical difficulties with genre.) Besides containing a history of mathematics and a

compendium of different kinds of science espoused by the various practitioners in Field Experiment Number One (FENO), *Ratner's Star* offer many kinds of rhetoric. In addition to interior monologue centered on the inner musings of its protagonist, fourteen-year-old mathematician Billy Twillig (and several of the other characters), there are lists created by a madwoman in Billy's Bronx apartment building, philosophical propositions on language by a linguist, Edna Lown, at the end of the novel (in its Logicon One section), and numerous dialogues between competing scientists, who rehearse their theories with technically precise and often stupefying detail. There is even a made-up language by Troxl, the novel's villain and cartel owner, who eventually takes over the FENO complex. Troxl speaks a made-up language borrowing words from French, German, Spanish, Russian, and Latin. Even a casual reader will quickly realize that DeLillo's range of voices in this novel is much greater and overtly experimental than anything else he has written. Except for the backwards chronology of the narration in *Underworld*, that later novel's stylistic choices seem to me to be much more narrow.

Billy Twillig is only one of the many scientists summoned to the FENO project to work on a scientific problem of decoding a message transmitted, it is first believed, from outer space. In its outward shape, the novel borrows "a device of science fiction" (LeClair, *In the Loop* 117). For Charles Molesworth, the

novel partakes of a special category of "theological science fiction" (155). By inventing characters who are scientists from many different fields, DeLillo has ambitiously attempted to represent the "science of [his] day" in ample detail. In *Ratner's Star*, these ideas are no less than a fairly thorough history of mathematics, one well explicated by LeClair.[10] Additionally, the novel questions the status of science versus myth and a more mystical primitive worldview by including an aboriginal time traveler, for example, who may or may not be a fraud (*Ratner's Star* 107-9). In its selection of sciences to represent, the novel draws features from recent physics like black holes, cosmology, and dark matter. These ideas play out in an alternative vocabulary of invented science in such terms and concepts as Billy's Nobel-prize-winning 'zorgs' (a truly inexplicable mathematical invention); boomerang-like 'twilligons,' a shape that recurs throughout the novel such as on an ancient shard of pottery recovered in Maurice Wu's bat cave; and 'moholes,' which provide the novel's imaginative analogue to black holes. (Eventually a mohole is the culprit in the unexpected solar eclipse at the end of the novel.)

Where there are certainly several motifs drawn from science fiction, in particular, a message from outer space which needs decoding and an assembly

[10]LeClair's chart for the chapters in *Ratner's Star* suggests that each is devoted to a mathematician (from the Egyptians and Pythagoras to Cantor) along with the type of math invented by each figure (*In the Loop* 125). This grid suggests that DeLillo compiled some thorough research into the history of mathematics into the novel.

of the best minds to solve what it means, the book depicts material well beyond the scope of science fiction in sections devoted to the Bronx childhood of Billy Twillig. It is this weaving back and forth of the rarified world of science and mathematics in the mind of Billy and his companions, juxtaposed against the adolescent Billy's discomfort with bodies (his own and those of others) and the details of his past in the Bronx that provide a good deal of the narrative energy in *Ratner's Star*. One could posit something of the same dynamic in the career of the author; that is, DeLillo escaping the more narrow confines of a particular place and time to ponder more ambitious scientific ideas.

Ratner's Star can be read as a direct response in cultural history to two other "strong" writers (in Harold Bloom's sense): Joyce and Pynchon. With its narrative technique, *Ratner's Star* offers an imaginative response to Joyce and the "Ithaca" in *Ulysses*, particularly, in both its technique and even for some of its stylistic choices, notably in the "Rearrangement" section of the novel, where Billy is forced to defend himself by answering three mathematical questions posed by Timor Nūt, who may or may not comprise a legitimate rival. "'Two great savants,'" Timor challenges, "'You in your rarified specialty. I in mine'" (*RS* 125). Nūt's questions and answers would not be out of place in Joyce's "Ithaca," with their mock-erudition and high-flown mathematical diction.

Besides representing the science of its day in almost bewildering detail,

DeLillo consistently uses scientific language and tropes to embody notions of order and beauty. Throughout the text, the narrative voice articulates a sort of pristine mental arena, the pure delight in theory, so to speak, which is never undercut by irony. Here is one typical passage, as Billy faces the boredom of a long plane flight enroute to the FENO complex, somewhere in an Asian desert:

> He tried to think in a context of Sumerian *gesh*-time, hoping to convince himself this would make the journey seem one-fourth as long as it really was. That wedge system they used. Powers of sixty. Sixty a vertical wedge. Sixty shekels to a mina. Sixty minas to a talent. Gods numbered one to sixty. He'd recently read [...] that the sixty-system was about four thousand years old, obviously far from extinct. More clever than most, those Mesopotamians. Natural algebraic capacity. Beady-eyed men in ziggurats predicting eclipse. (*RS* 5)

In this passage, DeLillo provides some of the conventions of third-person narrative ("he tried," "he read") but soon turns toward interior monologue, which places the reader directly into the consciousness of Billy as he muses on numbers or their arithmetical properties and combinations. DeLillo lets the reader experience, we might suggest, what it must be like to do mathematics at a high level. I disagree with Joseph Tabbi's claim that "DeLillo is not writing

about what happens when a scientist thinks; he is writing about the collective ability of two thousand scientists" (*Postmodern Sublime* 171). Although there is scientific bureaucracy at work in the organization of FENO (one actually much larger than The White Visitation in *Gravity's Rainbow*), the process of doing scientific research is always opposed to the individual thinking of Billy. Whatever madness surrounds Billy in the FENO complex, sections like these argue for value beyond difficult material hardship. As the narrator states:

> It was as though he had two existences, right and left terms in an equation, and obliged to face the danger that one of them, the mathematical, might overwhelm the other, leaving him behind, name and shape. (*RS* 129)

Many of the scientific characters in *Ratner's Star* are made sport of, especially with comic bodily details, inappropriate dress, imperfect bodies, or even strange sexual behavior. David Cowart reads the satirical treatment of different "figurative hobby horses" of these researchers as echoing the ridicule of science during the Age of Reason by Voltaire, Swift, and Samuel Johnson (*Don DeLillo* 153). Billy's mental processes, on the other hand, are regarded almost as sacrosanct. His flights in the thinking about numbers carry with them the charge of the quasi-theological. As Osteen has pointed out, the allusive structure of the book has the governing sensibility of Pythagoras, whose

theories of number achieved a sort of theological resonance (66-7). Billy's ruminations on integers are surely based on a belief in the inherent properties of numbers along the lines of Pythagorean belief. These passages, which often frame the beginning or end of chapters, argue for Billy's genius, but also for something more significant. In its own way, *Ratner's Star* posits beauty in numbers, mathematics, and, by association, science in these passages of interior monologue.

Molesworth points to one scene of lyrical writing in *Ratner's Star*, in which the scientists have taken to flying kites in the night sky, as evidence of DeLillo's "sheer skill which goes beyond control and mimicry to a lyrical excess." DeLillo deftly describes the "human folly of bestarring the night by sending up highly flammable kites" (151). The narrative voice of *Ratner's Star* delights just as well in describing the details of the artificial environment of the FENO complex, which are rendered in terms and tropes borrowed from math and science. Here is one example that befits a reading of aesthetic science and points to how skillfully DeLillo is able to conjure scientific tropes within Billy's consciousness: "He couldn't see the shadow [cast by the revolving sculpture] from his chair in the solarium but he knew the figure it made on the earth below could be one shape and only one, that of a *pristine ellipse*" (*RS* 59, my emphasis).

The great literary antecedent for a gifted, overly cerebral young man is, of course, Stephen Dedalus in episodes like "Proteus," where musings on Aquinan theology combine with the *nebeneinander* and *nacheinander* of Lessing (Thorton 42), mixed in with thoughts of discomfort at the physical world and its bodies—for instance, the dead dog on the beach encountered during Stephen's walk—and his own bodily imperfections. The allusive structure of Stephen's cognitions is limned with an erudition that juxtaposes such philosophy with the rocks on the beach at Sandymount, and the young artist's highly original observations as he looks out on to a ship at sea, along with fragments of Yeats, and memories of his lost mother.

The structure of Billy's mind is, necessarily, much more narrow, but DeLillo slips deftly into his character's thoughts, mixing aversion to bodily sensations and attempts at depicting the process of doing mathematics at a rarified level, which, the novel imagines, is worthy of a Nobel Prize. The reader of *Ratner's Star* overhears Billy's mind at work at many distinct points in the novel, just as we see his disquiet with bodies at many points in the text, well beyond, I think, what LeClair describes as a typical "adolescent's anxieties about sex, death, and his place in the adult world" (118). For example, Billy contemplates the birth of a baby to the wife of one of the researchers at FENO, Cyril Kyriakos. He "tried to imagine the birth of Cyril's wife's baby. It would

happen in grim lights violently. A dripping thing trying to clutch to its hole. *Dredged up and beaten*. Blood and drool and womb mud" (*RS* 36, my emphasis). Although Billy seems an altogether normal adolescent, apart from his precocious gift for mathematics, the narrative voice's insistence on extreme depictions of bodies in passages like these does not seem at all typical of an awkward, gifted teen.

Interestingly, Billy's mathematics is especially "pure" in the sense of having nothing to do with the physical world or even with practical, applied science. In this way, the novel can be read as a response to *Gravity's Rainbow*. The governing trope for Pynchon is Newton's ballistics using equations or and the great physicist's calculus to determine the speed of falling bodies (incoming V-2 rockets) at each delta-T. In Pynchon's fictive universe, this sort of mathematics is eminently applicable to the real world. Billy's zorgs are completely useless, as argued early in the novel. However, as often happens in science, something theoretical in one generation begets a practical application later in scientific history. In this fashion, the "useless beauty and elegance" of Billy's zorgs ends up explaining Mainwaring's eclipse-engendering mohole by the end of the novel (Cowart 153).

Billy's aversion to bodies then extends to his research. The narrative scheme of *Ratner's Star* posits value outside bodies. Like the author, Billy

would seem to have had a lot to escape from in his Bronx upbringing, the scene of DeLillo's first fiction. DeLillo's two most ambitious novels act out a tension between mind and body. More abstract speculations about math (*Ratner's Star*) and history and waste (*Underworld*) are juxtaposed against a more mimetically represented and realized space, that of the Bronx. While I am thoroughly convinced that DeLillo is scrupulously not an autobiographical writer, the selection, ordering, and presentation of details from an urban environment strike the reader as an altogether different mode in these Bronx sections, where the narration is not nearly so speculative or hypothetical as the rest of the novel, which is set in the rarified and wholly invented world at FENO.

To reiterate, Billy Twillig is very uncomfortable with his own underdeveloped adolescent body (and bodies in general, though he is curious about female bodies throughout the novel). *Ratner's Star* is filled with his fear and disgust at bodies, bodily functions, imperfections, sex, taboos of touching, and the like. Following Kristeva, Ruth Helyer has explored abjection and waste in *Underworld,* the notion that "personal debris become the subject of ritual acts to ward off defilement" (1003). There's something of the same dynamic at work in *Ratner's Star.* Perhaps much of DeLillo's fiction carries this same thread, from the horrors of the body represented in "Take the 'A' Train" on through the grieving performance artist, Lauren Hartke, and her rituals of grooming and

self-effacement rendered in *The Body Artist* (2001).

Terry Eagleton has remarked that postmodernism—that is, recent literary theory—often has difficulty accounting for the body, the site of pain, disease, and ultimately mortality. I hope to explore this idea in depth in the following chapter on the fiction of Richard Powers. Yet we do not need postmodernism to see the mind-body problem at work; one could just as easily turn toward Descartes or Catholic theology to arrive at the same dynamic within DeLillo's writing. In the "Opposites" section of *Ratner's Star*, Billy Twillig meets the aged and frail Shazar Ratner for whom the star has been named. Kept alive by a medical team in an airtight and germ-free bubble, Ratner recounts his career in astronomy and physics to Billy, who has been selected to speak with the reknowned researcher. Billy then translates—and sometimes simplifies—the old man's frail pronouncements to an audience of fellow Nobel laureates, thirty-two in all, who comprise a makeshift assembly in the Great Hole deep inside Field Experiment Number One.

In this scene, it is revealed that Ratner, besides being a student of science, has studied the Talmud and also has developed several truly bizarre theories about the body, including demons being released from the body during sex. As this dialogue progresses while Billy relates what Ratner says, the old man invites the boy to come inside his bubble to hear some sort of secret:

> 'Hold your breath and lift out the shield. Take time. It's a worthwhile whisper or I wouldn't ask.' 'I'm scared in plain English.' 'We're all scared,' Ratner said. 'Who isn't scared. You, me, the laureates. Terror is everywhere.' (*RS* 227)

With Ratner so close to death, it seems, the reader might expect the transmission of a meaningful secret. The deathbed scene is, after all, a staple of the nineteenth-century novel; one thinks of the wonderfully rendered moments between Magwitch and Pip in *Great Expectations*. Perhaps a more sentimental writer would have allowed this interaction to take place. If anything, we might note, Billy is missing a father figure. His own father Babe cannot understand his child. In one scene, Billy overhears his parents talking about getting rid of the family's puppy, mistakenly thinking they mean him (*RS* 28). Robert Softly, Billy's mathematical mentor, is no better a model. Softly seems to have misled his charge and even exploited Billy's talents for personal gain, especially in the Logicon One section where Billy is made to work on an entirely different problem than the one he was first asked to solve.

Yet a figurative meeting of elder and son is not to be, as Billy's fears of the body preclude his entering Ratner's bubble and hearing any sort of secret. After Billy hesitates, Ratner experiences some sort of biological meltdown: "The old gentleman's face appeared to be collapsing. Clear matter was being

discharged from his pores as the face itself began to settle" (*RS* 227).

The movement in *Ratner's Star* is toward a deeper section of Field Experiment Number One in the last sections of the novel. The characters are pared down to just three researchers (including Billy) in the Logicon experiment, guided by the gnome-like Robert Softly. The three researchers attempt to synthesize a "pure" mathematical language without context, suitable for communicating with a supposed extraterrestrial intelligence. Billy's fear and loathing surrounding the body only worsens in the Logicon sections of *Ratner's Star.* He develops a fever, which causes an even greater alienation to his ailing body, and he soon takes to living under a table in an improvised tent. "He had never before been so aware of himself as a biological individual. He smelled, he sweated, he ached" (*RS* 361).

The ending of *Ratner's Star* takes place in the breakdown of borders in liminal spaces, violating boundaries on multiple levels. This blurring argues in a strange way for a kind of transcendence where previously articulated and defended categories are transgressed. It is here that DeLillo's ending engenders something like wonder.

First, Maurice Wu's descent into the bat cave near the very end of *Ratner's Star* partakes of the Sublime, but also shows a direct confrontation with waste. He is literally knee-deep in bat guano before being trapped in a

very narrow hole in total darkness. After becoming wedged in—and surrounded by potentially flesh-eating bats—he reminds himself to remain calm, but clearly does not succeed:

> Analyze the fear and you will contain it. He began to wail then. [...] What came out of him was a series of prolonged near-rhythmic sounds, intense and pitiful, marked by the fact that he was able to sustain each high-pitched cry far longer than might have been considered possible under the circumstances, any circumstances. (*RS* 391)

After literally screaming into the void, Wu regains his bearings to continue his archeological exploration. More than recovering his forward motion, Wu experiences what can be read as a moment of the Kantian Sublime as he observes the bats organize to exit the cave in what seems like an astonishing—and unexpectedly beautiful—rhythm and pattern. "And because he liked to be dazzled, Wu in his corner of the cave, pondering [the bats'] means of navigation, sat *laughing into the night*" (*RS* 395, my emphasis).

Reader-response criticism shows us how the reactions—and even confusions—of a 'typical' reading can have value. Considering briefly such an approach, the thoughts of several of the characters meld together in these final sections. Within the passages that render the associations of Jean Venable, the

reporter (and artist figure) who is surreptitiously turning her article on the Logicon project into a work of fiction, we hear her thoughts mixed in with those of Maurice Wu after he has his moment of terror in the bat cave. Without telling us, the narrative voice moves to and from Jean *twice* within a single page (*RS* 394). While Maurice explores the cave and discovers remnants of an early human civilization, Jean ponders the meaning of primitive cave drawings placed on "inaccessible walls" (*RS* 394).

The terror at the "reproductive dust of existence" (438) at the very end of *Ratner's Star* follows the graphic scenes depicting the non-Western world's abject poverty, an almost brutal depiction of bodies. As the eclipse passes over Africa and India, the text gives an "omnidirectional viewpoint" of the reactions of people in its path:

> children immobilized by gastroenteritis, scavenging to live, to know what passes above, this nearly sunset occurrence, shadow moving toward the eastmost Ganges, choleroid feces, choleroid dehydration, choleroid vomit, girls with finger-cymbals laughing in a mango grove, the cowrie, the owl of good fortune. (*RS* 430)

This extended passage juxtaposes the Western tourist's eye for stereotypical local color and detail with brutal conditions of poverty. Later, the narrator seems to accuse the "you" of the mathematical researcher, who has

contemplated the trajectory of the eclipse without realizing the human reality underneath a formula. "Having dismantled the handiwork of your own perceptions in order to solve reality, you know it now as a micron flash of light-scattering matter in a structure otherwise composed of purely mathematical coordinates" (*RS* 431). Yet such a theoretical model seems to fail when confronted with the brutal facts of human lives. "At the contact line of nature and mathematical thought is where things make sense, things accede to our view of them," the narration continues (*RS* 431). Such sense is perhaps only a fiction, the ending seems to argue, as even the eclipse itself that highlights all this human suffering outside of convenient theoretical models is unpredicted by any of the scientists at the FENO project. Field Experiment Number One is, after all, built in an Asian desert, though there is precious little to locate us throughout the novel—except, of course, the sections set in the Bronx. As the eclipse passes over the lands of India and Asia, the encroaching shadow blurs East and West, rich and poor. There is a direct confrontation with the brutality of poverty. In a novel that largely elides social and political realities (outside of the Bronx episodes), the final sections pit the circumstances of the real world in all its ferocious terror against FENO's researchers trapped in the isolation of their pet paradigms.

The book's final sections show the developing "noncognate celestial

event," (*RS* 420) unpredicted by Western science, or more threateningly, an event suggested by the influence of Billy Twillig's "useless" mathematical zorgs meeting Mainwaring's research into moholes, which are figured in *Ratner's Star* as an especially strange analogue to a black hole, spaces where the traditional laws of physics seem to be violated. By alluding to an eclipse and a black hole, DeLillo is shrewdly adapting the history of physics for fiction. As the physicist Brian Greene relates, it was a solar eclipse off the coast of West Africa in 1919 that validated Einstein's notion of gravity warping space, as the bending of light from Venus near the Sun's occluded disk was thus correctly predicted by Einstein's earlier theory (77). The event horizon near black holes is the site where recent physicists like Stephen Hawking theorize the contradictions of intuitive theories of physics to develop new notions of matter and time.

The final image of Billy on his tricycle trying to out-pedal the oncoming darkness of the eclipse is rendered pathetically. In one way, Billy is reduced to a small child. Yet it is not entirely clear that this "reproductive dust" is not something more. Molesworth suggests such a dust is like pollen: "At the center of the closure of the novel stands the paradox of a dust that is seminal" (149).

To reiterate, the book has worked through a dynamic that oscillates in a way between body and mind. The inadequate or abject bodies of Billy Twillig and the other researchers at FENO versus a realm of pure theory are captured

well in Billy's mental associations and processes while doing mathematics, which are never finally undercut, while the competing theories of many the other characters in FENO certainly are.

The ending of *Ratner's Star* demonstrates that the human subject can be menaced by inexplicable large natural forces. In this dynamic, as with Slothrop in *Gravity's Rainbow*, we can once again develop a reading of aesthetic science. The "non-cognate celestial anomaly" is the central example of this terror and fear, but there are others. Maurice Wu's descent into the cave of flesh-eating bats, then getting trapped in a hole, engenders terror—literally, a primal scream into the void, followed by laughter. LeClair reads this scene psychoanalytically as a "constricted birth trauma" (141). There is also something like wonder here, in the levelling effects of the eclipse as it covers rich and poor across many nations. Actually, a bit of terror may be, the novel suggests, at the heart of Billy's otherwise "pristine" cognitions:

> There came a time in every prolonged effort when he had a moment of near panic, or '*terror in a lonely place*,' the original semantic content of that word. The lonely place was his own mind. As a mathematician he was free from subjection to reality, free to impose his ideas and his designs on his own test environment. The only valid standard for his work [...] was *the*

> *beauty it possessed*, the deft strength of his mathematical reasoning (*RS* 116-7, my emphasis).

Any new reading of science in the work of DeLillo must arguably contend with Tom LeClair's proposed "systems novel." LeClair seizes on all the terror in *Ratner's Star*, as in the passage above, to suggest the novel is really "an encyclopedia of fear" (*In the Loop* 139). The ending of the novel, in this reading, provides a "loop of fear" (140). Such a looping back offers a correction to the attempts by Billy and the other researchers to codify nature at a safe distance:

> The history of mathematics provides DeLillo with a cultural metaphor for the looping proto-theme of much of his fiction: the process of abstraction and withdrawal leading to insights that dissolve in *unfathomable mystery or truths that terrorize* his characters, thus requiring a circular correction of idea and behavior. (LeClair 116, my emphasis)

We are beholden to LeClair for turning toward a different, more sophisticated notion of science in his "systems theory," which argues against a simplistic notion of cause and effect. Paul Civello has built on LeClair's formulations to see the connections with recent physics in an updated notion of naturalism, one predicated on the physics of fields (noted by Katherine Hayles in her reading of writers like Pynchon) instead of a simpler nineteenth-century

notion of cause and effect, an "undermining of linear causality" (123). As we have seen, the Second Law of Thermodynamics is one such nineteenth-century paradigm, important to early Pynchon, which even though it seems to speak of measuring chaos, is finally a reductive measure, certainly when compared with today's chaos theory, which often finds beauty and complexity in apparently random processes.[11] However, I think LeClair overreads the aspect of fear at the end of *Ratner's Star*, an interpretation which appears to me to be reductive. "It is in this most gamelike of DeLillo's novels that he explicitly traces the secret roots of mortal terror," LeClair observes (141). On one hand, that is certainly correct: there is ample terror in the novel. However, such a reading does not account for the novel's strange beauty—and visionary wonder—at other points, nor does it account at all for the verbal and comic energy on display within the text. Aesthetic science can account for the adoption of terror in *Ratner's Star* and recover wonder and awe in an updated Kantian Sublime, as well as see the inclusion of mathematical and scientific material for ambitious tropes that allow DeLillo to create a new formal beauty on his own terms.

In subsequent novels, DeLillo makes use of visionary moments (usually within endings) whether the weirdly beautiful toxic cloud near the middle of

[11]The older sense of chaos has more to do with LeClair's model science of systems theory. Chapter 5 on Richard Powers will consider the implications of chaos theory for systems theory, as well as the notion of beauty and even order engendered through apparently chaotic processes.

White Noise or Jack Gladney's son miraculously pedaling across the highway at its close. Tap Axton's lyrical depiction of Owen Brademas' snake-handling in the final section of *The Names* comes to mind as another sort of visionary realization, one based on glossolalia. The ending of *Underworld* gestures toward cyberspace to blur characters' identities and suggests a utopian idea of nothing less than world peace. Explicating these moments of vision or insight, in fact, becomes a sort of contested ground in determining the novelist's place in cultural history. Is DeLillo really a thorough postmodernist, or does he have roots in a kind of neo-Romantic or neo-modernist impulse that posits meaning beyond language?

Ironically enough, critics have turned to DeLillo, the ostensible prophet of Jameson's conspiracy networks in the lattice of global capitalism, to find a strategy of resistance. For example, David Cowart argues that DeLillo is a writer who balks at the postmodern "gospel" (as if there were such an easy thing to speak of) and also argues that the novelist's use of language offers a measure of resistance and even courage versus the historical field (*Don DeLillo* 5). By turns, DeLillo's early reluctance to present himself as a public figure has been taken to embody the death of the author, even though it is by now hard to see DeLillo as a truly obscure novelist.[12]

---

[12]The bibliography to the Viking Critical Edition of *White Noise* lists over a dozen

For Paul Maltby, DeLillo partakes of a manifest Romantic sensibility. When Maltby turns to the Romantic Sublime as a way of explicating the "visionary moments" in *White Noise*, he defends DeLillo's work against recent theories of poststructuralism, which would argue that easy transcendence is no longer available under such a model of language (499). Further, he notes the tendency of postmodernist writing to place such visionary moments in quotes, so to speak, in a meta-fictional frame that also denies their "availability" (498). Maltby then invokes Burke's theory of the Sublime, and its explanation of terror and affect in aesthetic responses (509). In Maltby's reading, DeLillo values childhood and pre-linguistic babbling in several of his novels, reminiscent of Rousseau's or Wordworth's theories of oral language untainted by writing (504). This idea seems to contradict one of the early projects of Derrida, who worked to recover writing's position versus spoken speech. Summing up his view, Maltby writes that DeLillo's "Romantic appeals to a primal language of vision, to the child's psyche as a medium of insight, to the sublime contravene

---

author interviews and profiles of DeLillo (526-7). Since the popular success of *Libra*, DeLillo has been forthcoming on his work, and there seems to be no legitimate argument to make that he is now as obscure as Thomas Pynchon. Astonishingly, even sophisticated readings of DeLillo (like Joseph Tabbi's reading of the sublime in his work) routinely quote DeLillo's authorial commentary, often without any qualification. This is arguably a real contradiction in any reading that proposes that DeLillo partakes of the dynamic of the "death of the author" as authorial intention (and such extra-literary commentary) should not govern the meaning of a text.

the anti-metaphysical norms of postmodern theory" (512).

The dynamic of the Sublime has generated several readings of DeLillo's work. Joseph Tabbi has adapted the analytic of the Sublime to postmodernism and recent technology in a reading of DeLillo "at mid-career" (around the time of *Ratner's Star* and *Libra*) in ways that will inform a reading of aesthetic science. Tabbi, like Maltby, first gestures back to Romantic readings of the Sublime:

> The egotistical sublime, the negative or Kantian sublime, the mathematical sublime, the metaphorical, the metonymic, and the dynamical sublime—all may be seen to function, to varying degrees and at different moments, in the work of Mailer, Pynchon, McElroy and DeLillo. (*Postmodern Sublime* 16)

Yet when Tabbi argues for a postmodern Sublime in his chosen authors, it is toward Jameson's model of being able to represent the unpresentable, that is, toward a reading akin to what we have seen in Marc Redfield's interpretation of Pynchon in similar terms:

> Kant's sublime object, a figure for an infinite greatness [...] in nature that cannot be represented seems to be have been replaced in postmodern literature by a technological process. Now, when literature fails to present an object for an idea of absolute power, the failure is associated with technological structures and global

> corporate systems beyond the comprehension of any one mind or imagination. (ix)

When approaching DeLillo, especially in *Libra*, Tabbi makes use of an important distinction by Kant: that is, to be truly Sublime, the observer must look inward, not into Nature. A "ground external to ourselves" is merely beautiful, not sublime (175). In a nuanced reading of *Libra*, Tabbi notes that DeLillo has no place to stand outside the convoluted textual record of the JFK assassination, much like the predicament of Nicolas Branch as unofficial archivist for the whole investigative effort surrounding the various players involved in the event. Tabbi also points out that DeLillo's earlier *Ratner's Star*, in the style of "ambitious" or "overeaching" texts like those by Thomas Pynchon and Joseph McElroy, was a doomed project from the start. "The American experimental novel of the seventies could never hope to keep pace with technological innovations and consequent changes in the culture at large," he writes (171-2). In other words, by even attempting to make use of technological discourses, novelists like DeLillo in *Ratner's Star* partake in a Sisyphean process as new scientific inventions outpace the writer's grasp.

Moreover, "an aesthetic that too readily devotes itself to technical innovation always risks sudden obsolescence" (Tabbi 171). Of course, obsolete or historical science soon disappears in the progression of 'normal science' in

Thomas Kuhn's reading of paradigm shifts, but inscribing different models of science in fiction does not at all invalidate them. Readers can still enjoy the passages devoted to the occult in The White Visitation in *Gravity Rainbow* or the allusions to the history of mathematics in *Ratner's Star*. There is no requirement, as in scientific research, to remain absolutely current for ideas of scientific order in fiction.

Without an Archimedean point from which to contemplate historical reality, the postmodern artist cannot perhaps engender the dynamic of a true Romantic Sublime. In lieu of this, Tabbi develops an analytic of the postmodern Sublime, reminiscent of Jameson and Redfield, which suggests heretofore unimaginably large connected networks of conspiracy and global capitalism. It is with approval that Tabbi sees DeLillo giving up the intense engagement with science in *Ratner's Star* for something else, that is, attempting to represent the late twentieth-century novelist's struggle with contemporary history.

Tabbi's insistence on a pure Archimedean point of observation asks for an analytic that cannot exist for any critical intervention in history. Such an ability to stand outside language is at root tainted by any author partaking of language, which requires context, historical and cultural, for it to function. Asking this of any author is arguably the equivalent of the Logicon Project, the attempt in

Ratner's Star to devise a language with only its own rules to transmit to another civilization. In his reading of Pynchon, Tabbi is clearly aware of recent physics, as in his allusion to Heisenberg's problematized dichotomy of observer and observed and Katherine Hayles' explication of field theory (104-5). Yet Tabbi's reading takes recent novelists like DeLillo to task for their inability to stand outside history for their fictional observations. In particular, the encyclopedic project, which I believe DeLillo has successfully engaged in *Ratner's Star*, cannot avoid the messy details of lived existence, and particularly, the fabric of the city, for the pure delight of theory instead. Even the intense meditation on waste that comprises much of *Underworld*'s fabric is an acknowledgement that the world exists in all its bewildering excess.

In 1979, just a few years after the appearance of *Ratner's Star,* DeLillo's first play *The Engineer of Moonlight* appeared in the *Cornell Review* with a glowing afterword by Gordon Lish (somewhat of a force in the publishing world of the 1970s owing to his post as fiction editor of *Esquire).* The publication of *Engineer* also cements the allegiance of Baxter Hathaway as a constant proselytizer of DeLillo's work. As the magazine's chief editor, Hathaway writes an editorial in the same issue describing the political and cultural landscape in American life in 1979 just as his earlier writing in the pages of *Epoch* had described life around 1960 ("Introduction" 5).

Engineer continues to display DeLillo's interest in science and mathematics as a source for his imaginative work. This short two-act play's dramatic situation is that of a brilliant but ailing mathematician named Eric Lighter and his entourage, consisting of his wife, Maya, his disciple, James Case, and Eric's visiting, business-savvy ex-wife Diana Vail. In time, Diana ambiguously decides to devote herself to Eric's cause by staying on an extra few days, though it is not entirely clear that she will ever be able to leave (*Engineer of Moonlight* 36). *Engineer* also reminds us that the interests and obsessions of ambitious writers like DeLillo are usually consistent across time. In fact, eighteen years before the appearance of *Underworld*, Sister Edgar, "wiry and quick," gets a mention here as Diana and James reminisce about their schooldays (23). When Eric comes onstage, his pronouncements on life and mathematics are mordant and sad, like those of Henrik Endor, the researcher who in *Ratner's Star* takes to living inside a hole in the desert. In Act II, as the four characters play a board game with evocative identities such as the Skater, Java Man, the Wood Cutter, and the namesake Engineer of the play, Eric holds forth, describing his recent time in an asylum after a breakdown, as well as observations on science. "'When we observe something, we change its behavior,'" he pronounces, echoing Heisenberg (38). "'shape doesn't mean shape,'" Eric says, "'It's like charm in physics'" (39). Allusions like these show

DeLillo's continued acquaintance with ideas from recent physics, as well as his ability to choose such details for their aesthetic effect. They argue for a certain formal beauty in the play and provide another example of aesthetic science in DeLillo's writings.

Eric's small group both protects him from the outside world and is responsible for editing his notebooks and taking down his dictated messages for posterity. In its basic outline then, *Engineer* anticipates Bill Gray's entourage in *Mao II* (1991). Both Eric and Bill are reclusive and talented figures surrounded and protected by a circle of devotees. *Mao II* explores in its suggestive way the novelist's relationship to his or her audience. This earlier piece, though, reminds us before DeLillo became an authoritative commentator on men in small rooms (Oswald and the conspirators of *Libra),* terrorism (in *Mao II* and his 2001 nonfiction essay on terrorism), or waste (in *Underworld),* he first turned toward science and mathematics (the underpinning of my proposed reading of aesthetic science) for his protagonists and for ideas of beauty and order.

Beyond *Ratner's Star*, a high point in DeLillo's appropriating science for fiction comes in a short story published in 1983 in *Esquire*, "Human Moments in World War III." Once again, as with *Ratner's Star*, DeLillo takes a premise reminiscent of science fiction and re-invents it. Twenty-three-year-old Vollmer

and the older unnamed narrator orbit Earth as it suffers a world war (one conducted with some sort of laser beams from on high). "The banning of nuclear weapons has made the world safe for world war," the narrator remarks ironically ("Human Moments" 572). The two men must act together to fire their laser-based weapons, and DeLillo captures the jargon and protocol of a militarized existence in space with aplomb. At times, the narrator of this story shares a fascination with mortality of war like Gary Harkness in *End Zone*. "This is what comes into my head. 'I am standing at the corner of Fourth and Main, where thousands are dead of unknown causes, their scorched bodies piled in the street'" (580). Of course, unlike Harkness, the narrator of "Human Moments" is directly responsible for the actual casualties of war, so this graphic association does not so seem out of place.

In "Moments," DeLillo revisits the motif of broadcasts from Earth returning later in time. Instead of just a mysterious, at first indecipherable, transmission of *Ratner's Star*, the two travelers receive voices from old radio broadcasts, first transmitted in the time of W.W. II. "What old happenstance, what flourish or grace of the laws of physics, enables us to pick up these signals?" the narrator muses (582). These "traveled voices, chambered and dense" (582), evoke nostalgia for life on Earth, and with their old-fashioned advertisements, remind the narrator of the magic of brand names just as in

White Noise. Interspersed within these musings on voices are the two astronauts' memories of home life, especially Vollmer's idyllic recollections of Sundays in Minnesota, which are figured as "human moments" outside their highly technologized existence in orbit around the Earth.

In my reading, the achievement of this story is its invocation of the Kantian Sublime as the two astronauts contemplate Earth from on high. DeLillo is able to effect astonishing changes in scale within vivid descriptions that borrow metaphors from science and technology, as the two observers experience their insignificance and then an odd sense of empowerment and beauty as they observe Earth:

> The view is endlessly fulfilling. It is like the answer to a lifetime of questions and vague cravings. It satisfies every childlike curiosity, every muted desire, whatever there is in him of the scientist, the poet, the primitive seer, the watcher of fire and shooting stars, whatever obsessions eat at the night side of his mind. (586)

This passage goes on and on in a single lyrical sentence, which anyone sensitive to the music of language must appreciate. As in the much longer *Ratner's Star*, this short piece adopts scientific tropes and allusions on their own terms, as well as invoking a dynamic of the Sublime in the face of natural terrors, literally

the view of the Earth in jeopardy from both war and natural disaster. In arguing for a dynamic of aesthetic science in DeLillo's writing during this period, we can point out that something has shifted in the cultural history between 1970 and 1980: scientific metaphor is a legitimate source for tropes without the need for encyclopedism here. Both *Engineer of Moonlight* and "Human Moments" assume that readers will understand their scientific allusions.

Once again, we can look back to Baxter Hathaway's ruminations on the use of science for fiction. "If we use science, would we have a cold-hearted Sparta or a nervous Athens?" he muses back in 1961 ("One Curious Offshoot" 124). The answer seems to both in the "mid-career" of DeLillo's fiction. *The Names* (1982) depicts lives of expatriate Americans in Athens, who are indeed nervous as they experience an incipient anti-Americanism in the Mideast. DeLillo's work is prescient of historical events. Written soon after the Iranian hostage crisis of the late 1970s, this book engages the Middle East in a direct fashion unimaginable to the writers of "local habitation" in *Epoch*, many of whom went on to successful publishing careers. Finally, Hathaway himself makes use of the trope of space flight in his discussion of the difference between writers and scientists. "The Humanist [...] admits the solidity of the untenable and his monuments are artificial. Ab initio, the scientist wants

something more than this. His human hero is not entirely unlike Job; he is the *astronaut suffering flight*" (124, my emphasis). This last line invokes the essence of what I hope to suggest in a reading of aesthetic science, that is, an allusion to science that is used for an almost poetic effect, creating a brief moment of lyricism or formal beauty.

Underworld and the Impossible Encyclopedia

In *Underworld*, after Nick Shay kills George Manza with ambiguous intention, he is remanded to a school in Minnesota run by Jesuits after serving his sentence in a juvenile prison in upstate New York. It will be recalled that Father Paulus quizzes Nick on the parts of the shoe. With an encyclopedic (and indeed Jesuitical) precision almost worthy of "Ithaca," the priest enumerates the parts of a shoe for some three pages, from the obvious choices (which Nick can identify), like "laces," "sole and heel" to the progressively obscure (which he cannot), including "cuff," "welt," and "vamp" (*UW* 540-1). This disquisition culminates in the "last," that is, the "block shaped like a foot" at the shoemaker's (542). This section seems to me to inscribe the novel's desire to become a genuine encyclopedia of postwar America, while demonstrating its impossibility. If so much detail is required to describe only Nick's shoes, how much more impossible is it to describe all of American post-W.W. II life during

the Cold War?

As a long and very ambitious novel, albeit of a very different kind than *Ratner's Star*, *Underworld* is surely DeLillo's most arduously constructed work. Its set pieces—in particular, Bobby Thomson's home run in 1951, Truman Capote's black-tie ball at the Plaza attended by J. Edgar Hoover, and its imagined comic dialogues by Lenny Bruce during the Cuban missile crisis of October 1962—offer tour-de-force descriptive writing. There are few critical readings of *Underworld* that do less than celebrate its achievement, but I would suggest that despite its length and breadth, this text does not achieve a status as encyclopedic novel. Despite its much wider historical scope, *Underworld* is not a defensible example of the genre, though it inscribes a nostalgia for the encyclopedia project, the impulse of the book representing an entire world and all its comic and vibrant excess. For its bulk, *Underworld* offers relatively few different voices. Its "initial style," if I might borrow the term from Joyce criticism, is in the voice of Nick Shay. His narrative restraint is almost constant though it has its moments of excess, worthy of an encyclopedic text, as in his description of the recycling practices of his family, or in describing the bewildering diversity of a condom store.

DeLillo's most ambitious novel can be read as juxtaposing the cool—and I would say muted—voice of suburban placelessness with a more "thickly

realized" rendering (indeed traditionally mimetic) depiction of life the Bronx of the 1950s. As we have seen, *Ratner's Star* anchors its high-flown scientific theories with episodes set in the Bronx as well. The set pieces of *Underworld* whether in the Pafko at the Wall episode, Capote's famous black-tie ball, or Lenny Bruce's darkly comic monologues, provide the real energy of the novel. Like the historical sections of Pynchon's *V*., which critics almost universally have more highly valued than the chapters set in the novel's present, the energy, detail, and confident virtuosity of the writing in *Underworld* within these historical and Bronx episodes provide reasons enough to read the coolly rendered sections of Nick's life in Phoenix. *Underworld* may be an exercise in exposing the difficulties of writing a novel with an unsympathetic, apathetic protagonist (Nick): for much of the novel he is truly a paragon of withholding information. Nick's reticence is described best by his brother, Matt Shay, a weapons researcher:

> When Nick dies a team of metaphysicians will *examine the black box*, the personal flight recorder that's been designed to tell them how his mind worked and why he did what he did and what he thought about it all, but there's no guarantee they'll find anything at all. (*UW* 447, my emphasis)

Nick's withholding is hardly boring, but it does flag when compared to the

verbal energies harnessed in the set pieces, especially the extended sections taking place in the Bronx. Nick himself points out the difference in energy late in the novel when he says, "I long for the days of disorder. I want them back, the days when I was alive on earth, rippling in the quick of my skin, heedless and real. I was dumb-muscled and angry and real" (*UW* 810).

The narrative logic of *Underworld* tunnels back into the world of the Bronx for some of its most accomplished chapters. Far from blossoming into the stylistic experimentation of other works in this study, the parade of styles in *Ulysses* or the extensive narrative digression and intensive jump-cutting of the end of *Gravity's Rainbow*, DeLillo's novel actually turns into a largely realistic work within these later sections. In my reading, Arthur Bronzini echoes Leopold Bloom as he walks down the street. Even if the novelistic technique remains free of constant experimentation in Joyce, the parallels between Bronzini and Bloom as flaneurs seem to be clear. In one passage, Bronzini speculates on a scheme to place part of his neighborhood into a museum:

> He imagined a fragment of chalked pavement cut clean and lifted out and elaborately packed—shipped to some museum in California where it would share the hushed sunlight with marble carvings from antiquity. Street drawing, hopscotch, chalk on pavement asphalt, Bronx, 1951. But they don't call it hopscotch, do

> they? It's patsy or potsy here. It's buck-buck, not johnny-on-the-pony. It's hango seek—you count to one hundred by fives and set out into alleyways, shinnying up laundry poles and over back fences, sticking your head into coal bins and finding the hiding players. (*UW* 662)

Like Bloom, Bronzini is possessed of an inventive mind, here scheming to place part of his neighborhood in a museum. Both characters seem to exhibit a fundamental decency and civic mindedness. Bronzini relishes his interactions with other citizens in a downtrodden section of the city. Other details are surely a nod to an inescapable literary precursor. Bloom is 38, the same age as Bronzini. Bronzini is also a cuckold, we might note, although it would be hard to see Nick Shay as his Blazes Boylan, or Klara Sax as Molly, a figurative Penelope.

In these Bronx sections, the narration is not nearly so speculative or hypothetical or, in the specific case of *Underworld*, guarded. We leave the realm of the what-if for a return to lived experience in these passages (even if it is perhaps tinged with personal nostalgia). These sections remind the reader of the idea that history does not only encompass public figures such as J. Edgar Hoover or Lenny Bruce, but also in the thoughts of a betrayed, early middle-aged man strolling through a downtrodden neighborhood of his city and

savoring the sights, sounds, and human inhabitants—a description that could just as well apply to Leopold Bloom's Dublin in 1904 as Arthur Bronzini in the Bronx, New York, in 1953.

The ending of *Underworld* partakes of the same dynamic of blurring identities as does *Ratner's Star*, as well as a confrontation with the fact that the world exists in all its messy detail. After witnessing the ostensible miracle of the appearance of a murdered child, Esmeralda Lopez, on an orange juice-billboard near the close of *Underworld*, Sister Edgar gives up a lifetime of scrupulousness and obsession about germs, removes her gloves, and embraces the "awestruck" crowd in front of the billboard (*UW* 823):

> She feels something break upon her. An angelus of clearest joy. She embraces Sister Grace. She yanks off her gloves and hands, pumps hands with the great-bodied women who roll their eyes to heaven [...] She finds Ismael and embraces him. She looks into his face and breathes the air he breathes and enfolds him in her laundered cloth. (*UW* 822-3)

This short scene presents another moment of transcendence in DeLillo's writing, literally, a vision. The placement and tone of this passage argue for its weight in the narrative frame of the novel. I do not believe that the final gesture of *Underworld* can overcome the book's relentless meditation on American

waste, and the incessant withholding of Nick. However, I believe that DeLillo would like us to take this passage as a gesture toward mystical beauty.

The coda to *Underworld* takes place in cyberspace; Sister Edgar and Edgar Hoover become one in a sort of digital afterlife "in cyberspace, not heaven" as the novel meditates on the end of the Cold War (827). Surely it cannot be lost on DeLillo that the Internet was originally the product of Department of Defense research.[13] All the data from the world's history of nuclear tests is on the Internet, the novel implies, yet this fact does not seem to diminish the sense of wonder here.

Embedded in this passage of some notable lyricism, DeLillo stages a return to the scene of writing:

> You look at things in the room, offscreen, unwebbed, the tissued grain of the deskwood alive in light, *the thick lived tenor of things* [...] the chipped rim of the mug that holds your yellow pencils, skewed all crazy, and the plied lives of the simplest surface. (*UW* 827, my emphasis)

This passage offers a tacit acknowledgment of things in the world as they are. The end of *Underworld* counters the utopian energies of cyberspace with an

[13]It is a well-known fact about the Internet that one of the requirements specified by the Department of Defense was that messages could be transmitted reliably from sender to receiver even if any number of nodes or way stations went missing, a perfect solution for keeping communications going after a nuclear exchange.

admission that we are still bound by bodies. Joseph Tabbi notes that:

> DeLillo's novels have always resisted the impulse to transcend their own materiality, not only in words but in the human body, in manufactured objects, even in the printed circuits of metal and silicon that make possible seemingly weightless communications of modern electronics. (*Postmodern Sublime* 206)

Even in a scene where bodies seem to be cast off, DeLillo bravely returns once more to the real circumstances of lived space, the "offscreen, unwebbed, living grain" of the novelist's writing desk.

Although aesthetic science has not been central to DeLillo's writing since the middle of his career, he has, I believe, consistently engaged the problematic of bodies, as the above passage suggests. Of course, *The Body Artist* (2001) makes this interest especially apparent. The tension between lived experience, as in DeLillo's own past in the Bronx, and a realm of pure theory, as in *Ratner's Star*, or in a muted, placeless sensibility, that of Nick Shay in Phoenix, is a consistent dynamic within this novelist's work. Although DeLillo stopped pursuing the "science of [his] day" for his more recent fiction—clearly by now he is more associated with a name-brand paranoia and has become a sort of authority on terrorism—reading aesthetic science serves to remind us that this ambitious stylist pursued a path similar to Pynchon (almost his exact

contemporary) after turning away from Bronx regionalism (as represented in his early fiction) to become a major American novelist. Ideas from aesthetic science can help us understand major work by each novelist; each took on directly some of the most challenging ideas from science and mathematics and made them suitable for fiction.

Aesthetic science does not finish with the technologically astute novels of the 1970s. In the work of Richard Powers, we see a novelist who takes on the next generation of science, including molecular biology, digital computer simulation, and chaos theory. Although it would seem difficult or impossible to make such material sing for successful fiction, the work of Powers also can be productively read using the terms of aesthetic science outlined thus far. Like DeLillo, the fiction of Powers also has a complex dynamic of representing bodies, as I will explore in the next chapter.

CHAPTER 5

Mind-Body Problems: Common Readers and Aesthetic Science in Richard Powers' Major Fiction

In a triad of novels published in the last decade before the millennium, Richard Powers has thoroughly explored the science and technology of the late twentieth century. Many of the major characters in *The Gold Bug Variations* (1992), *Galatea 2.2* (1995), and *Plowing the Dark* (2000) are scientists of one kind or another. Moreover, Powers' ability as an author to demonstrate a commanding knowledge of different models of science in each of these texts has garnered for him a public authorial persona as both a "genius" and a "polymath," as well as an ambitious stylist, one whose ability to make recent science suitable for the novel of style helps make his work an exemplary test for a reading of aesthetic science.[1] Whether it is molecular biology, artificial intelligence, or virtual reality, the central types of science represented in these three novels, Powers is very comfortable navigating the divide between science and literature. "For Powers, the split between the humanities and science has ceased to exist," observes José van Dijck (77).

---

[1]Reviews of Powers' novels often mention his MacArthur or 'genius' award. For example, John Updike writes, "Powers is a MacArthur fellow, for what it's worth" (111). Sharon Snyder describes Powers as a "technologically adept and solitary polymath" in her reading of science and scientific amateurs in his novels (88).

Powers' work is also an ideal test case for a reading of the appropriation of science within recent cultural history, because in *The Gold Bug Variations*, this novelist updates the genre of the encyclopedic narrative for his most ambitious novel, one that clearly established his reputation as a contemporary novelist of significance. Subsequent works move away from the encyclopedic impulse as a scaffolding for including scientific material. It will be one of my purposes here to describe the changing status of science in the novel of style in the late twentieth-century and to suggest once again that science has become acceptable fare for ambitious novels of style. (Later, I will suggest several contemporary American and British authors who have adopted terms and ideas from recent science for original work.) Additionally, Powers' approach to novel-writing exhibits an updated concern for the role of the 'common reader.' To develop this aspect in his work and its reception, I will turn to the resources of the internet, where the opinions of 'ordinary' readers are now perhaps accessible as never before.

Central to my reading here is the status of science and the encyclopedic project in *The Gold Bug Variations*, which despite critical engagement with many of his subsequent works, remains Powers' singular achievement. This novel treats the quest for understanding molecular biology and genetics in the same way that *Gravity's Rainbow* appropriates inorganic chemistry, rocket science, statistics, or Newtonian ballistics. Impressively, this text attempts to synthesize

molecular biology and Bach, set among three characters who are just a bit arcane: Jan O'Deigh, a thirtyish research librarian at a branch of the NYPL, Franklin Todd, a stalled graduate student, and Stuart Ressler, an older enigmatic biological researcher turned computer programmer and, as we discover, a composer. These three characters are a bit obsessed with one another—romantically, as with Jan and Franklin, or, intellectually, arguably, all three.

The status of *The Gold Bug Variations* as both an encyclopedic text and as a novel that ambitiously represents the science of its day—molecular biology and genetics—is amply clear. Although he has been as much an early defender of Powers' work as Stuart Gilbert was of Joyce, Joseph Dewey has quibbled with the "static passages of specialized information" in the novel, which are "bewildering" to some readers (210). But such passages of extensive information are more explicable when the novel is considered as an example of encyclopedic narrative. Critics like Herman and Lernout place it firmly within Mendelson's canon of encyclopedic narratives, "a foremost instance of […] an encyclopedic endeavor" (152). In *Galatea 2.2*, the character of Richard Powers comments on the creation of *The Gold Bug Variations* when he writes that he "was trying to write an encyclopedia of the Information Age" (215). Readings like Herman and Lernout's acknowledge Mendelson's category of encyclopedic narrative directly,

and other critics have explained the relationship of this text to the "science of its day."

Science and *The Gold Bug Variations*

The best explication of the molecular biology in *The Gold Bug Variations* is arguably Jay Labinger's attentive reading, which is informed by an understanding of the actual science behind the book, combined with a speculative eye for the ways in which Powers manipulates his raw matter into new schemes of order. The central question that Labinger asks is: In what way is the DNA sequence a "code" and how does this concept operate in the novel? The simplest answer is that code operates as a direct substitution "where a cipher has the sole function of converting a set of instructions, which are readable only after a reconversion to clear text" (80). The underlying source of this idea comes in a literary allusion to Poe's "The Gold Bug," in which the reclusive naturalist William LeGrand must decode an encrypted message to find a treasure chest. This task also reflects the central scientific mystery of Ressler's appropriately named Cyfer team, assembled at a large Midwestern university to determine the way in which a raw sequence of DNA encodes the twenty known peptides.[2]

[2]In his review of James Watson's memoir, Sydney Brenner, a molecular biologist who faced the exact same scientific problems as Stuart Ressler in the 1950s, explains why the sixty-four possible combinations of four bases (CAGT) should generate only twenty peptides, also

As Herman and Lernout observe, however, it is not just a particular message that needs decoding, but Ressler's team must discover the rules by which this transcription occurs (160). Herman and Lernout note that this literary allusion in *The Gold Bug Variations* constructs the "literary" in the opposite sense that readers have come to expect, that is, a "rationalistic" view of the world, rather than a construction of the literary as "poetic vagueness" (160-1). Ressler's most important discovery—how three-letter codes of DNA generate the twenty amino acids necessary to build the universe of proteins in the cell—is just such a substitution. "In the substitutional sense, the coded message [...] yields upon decoding just another list, and that of amino acids that make up a protein" (Labinger 80-81). The real-world discovery of the rules from this process was made by Marshall Nirnberg, who won a Nobel Prize for solving this problem using an "in-vitro cell-free enzyme synthesis experiment" (92). The achievement of this historical figure is obviously the model for Ressler, though, of course, Nirnberg completed and published his discovery for the world while Ressler drops out of science just as he makes his breakthrough.

---

explained by Powers in *The Gold Bug Variations* (see pp. 138-9). Even in this short piece, Brenner manages to convey the excitement of scientific discovery in the U.K. during a high time in molecular biology. By contrast, Powers' descriptions of the Cyfer team's research arguably shows a scientific enterprise falling apart; by the end of the novel, four of its members have left (one has committed suicide, two have abandoned science) before the solution to this particular coding problem is published.

Within the fictive world of *The Gold Bug Variations*, however, Ressler's discovery seems to be reductive. He abandons a life of science just as he invents his technique. Only later in the novel do we get a sense as to why, in episodes where a much older Ressler comments on the 'real' meaning of genetics as a "generative" process, one that creates "infinite variability" (*GBV* 81). It is here that the musical allusions in the novel gain explicative and imaginative resonance. Bach's *Goldberg Variations* "illustrate how such a generating code can imply, if not actually produce, infinity" (*GBV* 81).

In a reading of the novel's allusive structure, Herman and Lernout highlight the connection between music and genetics; this "score is a DNA sequence" (155). As they write:

> In a section of chapter XXVII specifically titled "The Goldberg Variations," finally, Powers provides a detailed and almost technical analysis of Bach's composition, using metaphors from genetic biology to describe how the thirty-two variations are generated from a simple thirty-two note [theme] (155).

A singular accomplishment of Powers' novel, then, is to educate the reader enough in both sets of allusions—genetics and music—so that by the end of the novel, ideas from molecular biology can be used to embellish the reader's understanding of Bach's music.

At the same time, by the novel's close, Powers succeeds in thoroughly interrogating the predominant metaphors of molecular biology itself—that of a simple code that might be solved and "read" as Poe's naturalist/treasure hunter does. In José van Dijck's reading of the novel, he first observes that "the double helix is probably the most famous analogue model in science to have achieved the status of icon" (66). That said, the predominant metaphors in molecular biology "remain remarkably unchanged," that is, borrowing ideas from "linguistics and communications of the 1960s" (67-8). "The most popular contemporary metaphors for genome research are still derived from linguistics or its assumed computerized equivalent," he writes (68). However, Powers in *The Gold Bug Variations* manages to show the limitations of a one-way or "linear" relationship between DNA code and a resulting living organism.

As van Dijck suggests, "Powers' critique is more profound" (69). Instead of a simplistic, one-way coding, "the genetic code, in Powers' novel, is not *like* language, it *is* language, language in all its facets, including polysemy—its intricate potential to generate infinite meanings in different compositions," he argues (73). Of course, the achievement of the novel is that this correspondence between DNA and a Bach score (and our growing understanding of no less than the variability of life) is not "mechanically" projected (Herman and Lernout 157). Rather, the attentive reader of the novel undergoes an informal—yet surprisingly

complete—education in biology (and, to a lesser extent music) in the combined narratives of Jan O'Deigh—who herself undertakes an autodidactic research project to understand exactly what Ressler accomplished while conducting his research in 1950s biology.[3]

This reading of the science in *The Gold Bug Variations* surely accounts for the novel's attempt—and arguable success—at representing a new kind of life science. A separate but significant thread lies in the margins of *The Gold Bug Variations*, and this is the novel's indebtedness to the recent emerging trends of chaos theory. The arrival of chaos theory to the scientific scene during the 1980s marks a significant paradigm shift, one that reprises and even extends the purchase of Newton on everyday things. In his discussion of chaos theory and complexity in *The Gold Bug Variations*, Scott Hermanson notes that Newton's *Principia Mathematica* and Defoe's *Robinson Crusoe* "were published within thirty years of each other," (39) marking an initial affinity between a classical science predicated on linear equations and the forms and concerns of the genre of the novel. As Hermanson writes:

---

[3]Tom LeClair correctly notes that the twinned narratives of Jan O'Deigh and Franklin Todd are not exactly "spliced" together, but rather a collaboration of "cross-fertilization," which means that the "novel's chapters and subsections simultaneously obey two formal codes—genetic and musical—that neither 'author' could have managed to follow or impose alone" ("Prodigious Fictions" 19).

> The intellectual culture that fostered a new way of calculating the universe also created the idea of the novel. Stories were about movement. They were concerned with plot, events, and how characters reacted to being struck by blows, both physical and emotional. The Newtonian way of seeing the universe was concrete, straightforward, and, as we call his equations, linear. (39)

In particular, the project of the science of chaos—the practices and theories of a new, post-1970 science—seeks to extend the mathematics beyond simple linear equations and the classical worldview of Newton.

James Gleick's bestselling account of the emergence of chaos theory, *Chaos: Making a New Science* (1987), depicts a bright, but marginal, group of mathematicians and physicists willing to look across disciplines and find recurring numerical patterns in number and nature. The discovery of 'chaotics' (another term for this sort of science) is a perfect example of a Derridean supplement, that which is leftover, but when considered in full, gains an explicative force that re-interprets the center, in this case, 'normal' science. In the margins of classical systems is the "noise" left over by classical Newtonian linear equations. The tendency to rely on idealized examples in Newtonian science may be, as Katherine Hayles suggests, a tradition "that privileges ideal abstraction over empirical variation" ("Complex Dynamics" 17). Actually, "there

are far more systems that require nonlinear equations than there are those that follow linear equations," Hayles notes (17).

Chaos theorists have explained problems that are poorly (or not at all) explained by Newton—for example, a double pendulum, consisting of two connected pendulums moving back and forth at the same time. "The double pendulum demonstrates that chaotic systems need not be esoteric or rare," writes Hayles (9). Furthermore, even the movement of a swing on a playground—a simple pendulum in the ideal—has forces that cannot be easily described in the real world, outside laboratory conditions (Gleick 42). Turbulence in hydraulics and fluid analysis is central testing ground for the new science, an area that could never be adequately explained by classical science. An important moment in Gleick's account is when a truly rigorous 'traditional' French physicist named Albert Libchaber measures flow and turbulence in liquid helium with a meticulous precision, thereby legitimizing the approach to seeing non-linear deterministic behavior in a real physics problem that had not yielded explication through previous 'normal' science (205-6).

It turns out that what was in the margins in Thomas Kuhn's 'normal' science may in turn become a central way of seeing the world for scientists of all kinds. As Hermanson notes, "Linear equations can only describe a small portion of the events in the universe. Most phenomenon in nature are nonlinear in that

they cannot be reduced to easily solved equations" (40). Gleick quotes one of his scientists as saying that the three major scientific revolutions of the twentieth century (in Kuhn's sense) will be remembered as "relativity, quantum theory, and chaos theory" (6). Of course, it is perhaps too soon to tell, but for working scientists across a wide range of disciplines and problems, chaos theory and its non-linear equations often explain what was previously inexplicable under Newton using the smooth curves of linear equations.

In terms of a specific reading of *The Gold Bug Variations*, Hermanson takes note of several key passages that show Powers' own awareness of the emergence of this science of chaos. Hermanson also argues for the novel's "recursive symmetry," that of motif and theme occurring on different organizational levels. However, it is hard to call the novel a textual analogue of Benoit Mandelbrot's well-known fractal patterns, which are visually recursive on an infinitely magnified scale, "beautiful and intricate fractals and graphs that show the same patterns reappearing again and again for unapparent reasons" (40). Trey Strecker's reading of the text as a "narrative ecology" is what I have in mind here as a response that exaggerates Powers' reliance on chaos theory in a novel that is centrally concerned with molecular biology and evolution.[4]

[4]Trey Strecker's reading of Powers begins with a proposed genre of the "narrative ecology," as a "complex, hybrid network of information systems linked by narrative," which he

What is compelling about chaos theory in a reading of the work of Richard Powers is that unlike most other advances in scientific understanding under Kuhn's normal science, there is a distinct recognition of and, indeed, invitation for the "amateur" scientist to partake of the process of understanding chaos theory. This has to do with the interdisciplinary nature of the new chaos science, notably, that mathematicians and practicing scientists could not understand each other's narrow specializations. "Chaos breaks across the lines that separate scientific disciplines. Because it is a science of the global nature of systems, it has brought together thinkers from fields that had been widely separated" thus contravening a trend toward ever greater scientific "specialization" (Gleick 5). The career of the inventor of fractals, Benoit Mandelbrot, provides an example of a scientific 'amateur' in the best sense of the term.[5] His career is all about solving

---

juxtaposes against the "failed" encyclopedic projects of Mendelson (230). Strecker extends his metaphor to imply a sort of living system of narrative in Powers' work:

> Across the various epistemic systems of encyclopedic information, diachronic narrative processes self-organize reactions and catalyze reciprocal feedback relations across the textual network. The structure of the system evolves as the product of co-evolution between system and environment, involving a multi-directional collection of linear and nonlinear processes (230).

It is difficult to see, however, how such a system of meaning is different in Powers' writing versus other major works of fiction. Such a description of reading fails to account for the experience of time for both writers and readers, specifically, a print novel is 'fixed' and does not evolve like a living ecological system (or a computer simulation of the same), an idea which Strecker arguably has in mind here.

[5]Gleick describes the career of Mandelbrot starting with his relative obscurity as a researcher at IBM studying fluctuations in cotton prices, then transmission errors over phone lines and then discovering patterns in the apparent disorder of these phenomena (83, 91).

problems in widely disparate fields, and even though not technically specialized, his language of fractals worked to solve and describe vastly different phenomena.

Sharon Snyder credits Richard Powers with a similar trait, his "artistic ability as deriving from an ability to function as a roving operator between informational matrices—as a skilled cross-referencer of the arcane vocabularies and models of disciplines" (88). In Snyder's reading, the portrayal of Jan O'Deigh as a scientific amateur partakes of an older, eighteenth- and nineteenth-century "pre-institutional" process of doing science which was not so specialized or professionalized (96). O'Deigh "provides a model for the expert negotiation of incompatible vocabularies and insular research" that are a danger of traditional science (94). However, part of this "amateurism" is a recognition of the role and possibility of "common readers" partaking of such an enterprise. "*The Gold Bug Variations* conveys an optimism that the secrets of science are open to cross-referencing 'common' readers," she writes (89). The scientific understanding achieved by the character of Jan O' Deigh, who quits her job to read and study what Stuart Ressler was up to as a biological researcher in the 1950s, is arguably enacted in the reader as well. Powers prepares the reader, explaining early

---

Mandelbrot's own re-telling of his career places his discoveries in the history of mathematics (going back to Aristotle's geometry) and re-claims his place at the center of mathematics, but it is a career begun very much in the margins.

genetics from Mendel's flies, to Darwin, to the discovery of DNA, up through the work of Stuart Ressler (itself based on real Nobel-Prize winning work). Any attentive reader will gain a basic knowledge of recent genetics, besides learning the structure of Bach's *The Goldberg Variations*.

The invitation to understand chaos theory comes not only through bestselling accounts of this science from Gleick, which arguably act as 'avatars,' putting science into play for a class of common readers, but also through published accounts of research by chaos theorists themselves, who invite readers to become amateur scientists by viewing and understanding the graphics involved in fractal imagery. Mandelbrot calls his exposition of fractal geometry a "casebook" filled with pictures and descriptions, rather than solely a mathematical treatise (2). (He relegates the mathematics to certain sections and appendices, which can be skipped for 'common readers.') Even trained scientists who practice Kuhn's normal science are invited to become common readers of a new map of nature (to paraphrase, perhaps, Robert Nadeau's examination of the intersection of the New Physics and the natural world) and to see how chaotics can impact and explain their own specialized fields. Mandelbrot's text is filled with accessible pictures, many invocations between nature, art, and science, in between more 'rigorous' mathematical definitions. For the first time in cultural and scientific history, 'ordinary' readers—without significant mathematical

training—can intuit and understand these new theories provided they can look at graphics. *The Gold Bug Variations* can itself be read as such a "casebook," articulating and demonstrating recent biological theories from Mendel to Crick and Watson, to the implications of the Human Genome Project and beyond, to genetic engineering. In *The Gold Bug Variations*, Jan O'Deigh's chapters are filled with such examples.

While the common reader in the late twentieth century still cannot hope to understand the math behind chaos theory, the basics of its rules can be simulated on any intelligent high school student's computer in truly accessible, graphical images. At the same time, one does not want to make great claims for "fractal art," which seems ideally suited for display on one's personal computer, perhaps, rather than the gallery or museum, although two of its proselytizers have mounted exhibitions of intricate fractal patterns in the early days of chaos theory.[6] The arrival of chaos theory coincides with the development of computer technology and all the optimism that it engendered, a cultural fascination that has undoubtedly garnered a certain popularity for avatar texts of science like Gleick's.

---

[6]In the preface to their collection of fractal images, H.-O. Peitgen and P. H. Richter describe how they mounted several art exhibitions of fractal art in Germany starting in 1984 in venues like the Max Planck Institute and the Goethe Institute (vii).

For any reader who has completed high school physics then, Newton's ideas about motion and the like are practical enough, applicable to comprehending everyday life. Quantum physics, on the other hand, has lead to a scientific investigation of ever finer distinctions, far removed from everyday life which even trained physicists could not understand. In one interview, Richard Powers describes concerns of an ever more specific science, especially in physics, as a factor in his decision to pursue fiction, instead of science. Physics, Powers says, "depends upon dividing and conquering […] into ever smaller domains" (qtd. in Williams 96). Richard Powers' work in the context of chaos theory makes use of ideas drawn from a new popular science. The notion that deeper patterns appear between largely disparate subjects (DNA and Bach) is, in fact, authorized—even demanded—by recent science.

To reiterate, chaos theory undoes the tendency toward an ever more narrow disciplinarity, a movement toward over-specialization. The patterns of chaos theory explain problems across disciplines. In fact, the catalog of problems solved reads like something out an encyclopedia. Gleick's list of scientific endeavors explained by chaos theory includes physiology ("the human heart"), ecology ("the rise and fall of gypsy moth populations"), economics ("stock price data"), meteorology, anatomy, and astrophysics—"the shapes of clouds, the paths of lightning, the microscopic intertwining of blood vessels [and] the galactic

clustering of stars" (4). Mandelbrot's ideas dismantle Newtonian orthodoxy on all levels, as well as the isolating disciplinarity of experts from different fields, who have adopted the same techniques to solve widely different scientific problems.

While chaos theory invites the participation of common readers as never before, we should remind ourselves that ambitious fiction taking on science has indeed always asked questions of Newton. In Chapter 2, we saw that the hyper-intelligent (and very classical) narrative intelligence of "Ithaca" in Joyce problematizes the notion of a hyper-rationalistic view of the world. If Stephen Dedalus and Leopold Bloom become particles whose every moment is known and plotted in this chapter as they head home to Eccles Street, at the same time, the reader's understanding of the mimetic human reality becomes obscured. Joyce's extreme (and at the same time playful) precision obscures just what we want to know about these characters. Knowing the world with a Jesuitical intelligence steeped in numbers and arcane facts (even if exaggerated and parodied) obscures human agency just as a completely knowable Newtonian worldview—the equations to define the movements of everything and everyone—might well problematize free will. The narrative strategy of "Ithaca" certainly makes us aware of this predicament.

As I have suggested in the work of Pynchon in Chapter 3, Newton's concerns—ballistics, pendulums, optical experiments—gave way to the minutiae of quantum mechanics, which looks at the unknowability of particles on a very small scale. Pynchon uses ideas of indeterminacy from quantum theory in *Gravity's Rainbow*. Unlike a scientist, literary appropriations of scientific ideas are not subject to Kuhn's normal science. Outdated, historical (or just plain wrong) scientific ideas can still hold sway and even co-exist within the same author's work. The concept of entropy is important to Pynchon's early short story of the same name and sections (regarding Maxwell's Demon) in *The Crying of Lot 49*. Newtonian ballistics remain the governing trope of falling rockets in *Gravity's Rainbow*. However, competing explanatory structures in The White Visitation—whether Roger Mexico's statistics, Pointsman's Pavlovian conditioning, Milton Gloaming's experiments with the occult, or Slothrop's inexplicable arousal as the rockets fall—all compete for readerly attention.

One could arrange models of science in *Gravity's Rainbow* that are deterministic (statistic, Pavlov, Newton) with that of the indeterminate (Slothrop as quantum particle dissolving into an unknowable Zone) and, important for our discussion here, a look at Thanatz's lightning strike, a distinctly nonlinear event, of which Pynchon is fully aware—as we have already seen in Chapter 3:

> Most people's lives have ups and downs that are relatively *gradual, a sinuous curve with first derivatives at every point*. They're the ones who never get struck by lightning. No real idea of cataclysm at all. But the ones who do get hit experience a *singular point, a discontinuity in the curve of life*—do you know what the time rate of change is at a cusp? Infinity, that's what! A-and right across the point, it's minus infinity. (*GR* 664, my emphasis)

When Thanatz the smuggler is struck by lightning, the usual, predictable curves of linear equations (the stuff of Newton's falling bodies) give way to an unpredicted rate of change (a discontinuous, exceptional event) unavailable and inexplicable to classical science. As we have suggested, though, one does not need to be struck by lightning to experience phenomena that can be explained by discontinuous equations. Chaos theory actually explains many more everyday phenomena than does quantum mechanics. As a metaphor, its purchase reaches more convincingly into everyday experience.

In the narrative scheme of *Ratner's Star*, the various models of science practiced by the researchers at Field Experiment Number One are extreme examples of the lack of 'cross-referencing' between disciplines in recent science. Each scientist at FENO is concerned with his own specialized version of science (or pseudoscience) and narrow obsessions (such as moholes, the behavior of ants,

computers, or bat guano) and, as I have noted, are subjected to parody and ridicule, except arguably for Billy Twillig's own pristine mathematical theories. But even Billy is seen pedaling away from the oncoming darkness, in terror and wonder, presumably, a testament to the problems of overly narrow scientific specialization and an over-reliance on a single way of seeing the world.

As the history of the development of chaos theory shows, the major discoveries of this new science would have been unavailable to all the other novelists in this study: *Gravity's Rainbow* was published in 1973, just as the first major discoveries in the science of chaos begin to emerge (Gleick 3). The status of science in the popular imagination of Pynchon and DeLillo's *Ratner's Star* and his collection of mathematicians assembled at the FENO experiment is surely esoteric stuff in 1976.

Richard Powers' work arrives in the context of chaos theory that marks a kind of acceptable, popular science. The notion that deeper patterns appear between largely disparate subjects (for example, DNA and Bach) is authorized by the science of its day and avatar texts like Gleick's, which have arguably spawned an entire genre of creative non-fiction, an accessible science writing that is still with us today. The confluence of a technologically optimistic cultural moment in American life, along with these avatar texts, has brought a working knowledge of recent science into play for a good many 'common readers.'

Moreover, chaos theory has a natural affinity to the computer simulation, which helps scientists model and visualize the complex interactions of particles and elements. Simulating human intelligence on a computer becomes the dominant science represented in *Galatea 2.2* while virtual reality (another digital simulation) is staged at several points within *Plowing the Dark*. Significantly, these last two texts are not at all encyclopedic, and yet they attempt to represent with a considerable illusion of mastery of different—though technologically related—sciences.

Like Don DeLillo, Richard Powers arguably began his literary career in the realm of "local habitation," to quote Baxter Hathaway's term, in his first novels, with the important caveat that Powers' novels always juxtapose narratives set in a more normative "present" against one, or sometimes even two more insistently imaginative or historical threads. As James Hurt has pointed out, the plot of Powers' first novel *Three Farmers on Their Way to a Dance* intersperses three narratives and finally invokes the emblem of the "stereopticon" in which artist, text, and reader collaborate in the production of meaning, along the lines of the "parallax" of *Ulysses* (27-8).[7] This collaboration might be apparent to anyone acquainted with any sort of reader-response criticism, but for recent

[7]Building on Powers' own comments in an early author interview, Charles Harris reads *Three Farmers* as an imaginative response to the notion of parallax in *Ulysses* ("The Stereo View" 97).

critics of Powers' work, it is arguably one way this otherwise realistic writer engages postmodernism within his work. Like many contemporary non-fiction science writers, language for Powers is largely assumed to convey the truth of things. There are very few sentences in Powers that cannot be parsed toward comprehensible, referential meanings. (Even DeLillo acknowledges the indeterminacy of human agency in a text like *Libra*.) In this, Powers is a writer whose work does lend itself to readings that would highlight the rhetoricity of language. Indeed, there are no strongly poststructuralist readings of Powers to date. Powers' twinned narratives are never 'merely' discourse, as in the much more formally inventive writings of Joyce and Pynchon. Powers' interweaving of double (or triple) narrative threads, which acknowledge and indeed invite readerly participation, especially at the end of his novels, provide his distinct allegiance to postmodern fiction, even if he is not as obviously experimental as the other writers considered in this study.[8]

Subsequent novels in what we might term Powers' mature fiction also partake of the same narrative strategy. *The Gold Bug Variations* splices together

[8]Power's second novel, *Prisoner's Dilemma*, also partakes of the same narrative strategies. Domestic scenes of the Hobsons, a Midwestern family, with an ailing patriarch, Edward Hobson, are juxtaposed against a much more fanciful invention of a story of Walt Disney creating an ambitious anti-war film utilizing Mickey Mouse and a cast of actors drawn from Japanese-American internment camps. James Hurt provides an excellent reading of the breakdown of episodes here within the narrative organization of Powers' first three novels (up through *Operation Wandering Soul*). See pp. 25-39.

two love stories, one set in the 1950s (Stuart Ressler and Jeanette Koss) versus one set in the "present" of the novel, the 1980s (that of Jan O'Deigh and Franklin Todd). *Galatea 2.2* intersperses recollections of Powers' life with a lover in Holland and his apparently biographical reflection on his burgeoning literary career against the made-up "present" of his time at a Midwestern university conducting his experiment in Artificial Intelligence (AI). Relating the creation of the virtually intelligent being—and making it plausible that such a being could exist—is this novel's singular achievement. *Plowing the Dark* inter-cuts the story of creating a computer simulation in virtual reality at TeraSys with a hostage narrative of Tai Martin in Beirut. *Gain*'s two narratives (and protagonists) are a dying woman and the emergence of a multinational corporation. It is clear that Powers' technique adopts the same strategy as Pynchon's *V*., that is, interweaving two or more narrative threads, one consisting of more highly developed material. The reader adopts the role of detective or quester in order to understand how multiple narratives reflect upon one another.

Powers' novels do not rely on conventional plot, but instead dramatize imaginative connections between different narrative threads with distinct thematic concerns, and, of course, this material is often unapologetically scientific. Although Powers is routinely described as a genius and a polymath in reviews or critical readings (and even for ordinary readers, which I will explore

below), his presentation of science in three of his most ambitious novels strives to be performative, rather than propositional. Jan O'Deigh's mini-lectures on the history of genetics or the later sections (in Franklin's biograpy of Ressler) that detail the musicological underpinnings of Bach's *Goldberg Variations* are one thing. However, when his characters put aside fact and figure to realize connections between Bach and DNA is when this novel makes its strongest claims on the reader's attention.

Common Readers and the Work of Richard Powers

One of the aims of this study has been to articulate how the 'common reader' responds to ambitious novels of style in the works of several major twentieth-century novelists. I have suggested that the analytic of aesthetic science invites the participation of ordinary readers to understand, appreciate, and, indeed, aestheticize scientific ideas. The immersion of Powers' novels in recent science—whether molecular biology (and ideas drawn from chaos theory) on *The Gold Bug Variations*, or artificial intelligence in *Galatea 2.2*, or virtual reality (and computer simulation) in *Plowing the Dark*—is not universally praised. Joseph Dewey finds Powers' presentation of information in *The Gold Bug Variations* as straining against its narrative; "The book is crowded with info-addicts. The two central characters—Jan O'Deigh and Stuart Ressler—pursue

information obsessively" (*Understanding Richard Powers* 57). Tom LeClair's review of Powers' writing stresses the novelist's allegiance to information that "overloads" his novels "reflect[ing] the accessibility and relevance of technical information in the lives of his contemporary characters" ("Prodigious Fictions" 16). Franklin Todd's scrapbook of *New York Times* articles, embellished with his own drawings, turns "information into a private aesthetic object" (19). Sharon Snyder's reading, which points out Powers' ability to navigate different models of science, also notes that his novels show a type of technical professional unable to commit to a particular field. She writes that Powers represents the "bohemian lifestyles of professionals that have emerged out of late twentieth-century technoculture" (95). Powers' fiction, she comments, "functions as a manual for a generation stalled in career counseling" (95).

Snyder notes, as I do, a recent trend in late twentieth-century fiction to appropriate recent science for fiction. However, this appropriation in her view takes on a moralizing or didactic impulse. "A new generation of polymathic scientific literature is attempting to *extract social, moral, and theological lessons* from discoveries forged in the laboratory," she writes (89, my emphasis). In suggesting the place of the common reader in Powers' fiction, we can do more than speculate on whether such science is read as mere "lesson" or something else, and even more significantly whether the presentation of science as the

single strongest reason to read Powers' novels finds resonance or resistance with contemporary readers.

The editorial pages of *The Little Review* provide evidence of the initial bafflement of ordinary readers at encountering *Ulysses* without the usual critical apparatus. Even today in 2005, Justin Beplate has argued that the unreadability of *Ulysses* may be a fact of life for many readers, even after decades of critical engagement with the text. "*Ulysses* remains more talked about than read. Its perceived difficulty has always been one of its defining traits" (4). Certainly, it would be possible to gather responses to literary reviews and essays by ordinary readers scattered in smaller publications to judge the reception of Powers' work with ordinary readers. Yet by turning toward cyberspace, we can obtain a ready source of evidence.

In a reading of some two hundred online responses to Powers' work written between 1997 and 2004, we can see a test case for reader responses to the novelists' work.[9] First and foremost, it might be no surprise that the great

[9]Responses from ordinary readers were collated on March 23, 2005 from Amazon.com, a well-known online bookseller. There were 232 responses for all of his novels, including over forty for *The Gold Bug Variations*, *Galatea 2.2*, and *Gain*. It makes sense to examine postings for all his novels, as writers will often refer to more than one novel in an individual response. While Amazon.com must certainly remove offensive or inappropriate feedback, there is every sense that even negative reviews are still fairly presented. This writer, serving as a contributing editor at Amazon.com, wrote and contributed over five hundred book reviews from 1999 through 2002 as the 'official' voice of Amazon.com on a variety of science and computer science books and was never once asked to revise a review in a more positive light, which speaks well of its editorial policy. Even though it is clearly interested in selling books, the evidence suggests that

majority of responses in this sampling read Powers' novels characterologically, that is, judging their merit on the basis of readerly identification with characters. (Nary a single common reader mentions Powers' low-key plotting as a source of enjoyment.) Here is a typical response along these lines. "[Powers'] knowledge of his material is encyclopedic. He creates characters that are as unique and varied and sometimes eccentric, as any other Author I have read" (Mcinerney, par. 3). This simple observation is probably a gentle reminder that reading for pleasure surely involves character in addition to plot.

A good many readers argue for Powers' adept use of language. They appreciate the "elegantly terraced sentences" in Dewey's early argument for the novelist's work (*American Writers* 210). Writing from "Prairie Village, Kansas," one ordinary reader offers a succinct line of praise. "Powers is one of that group of young American writers who are so imaginative, so stylish, so knowing that *their prose snaps like a flag in a gale*" (Morrison, par. 2, my emphasis). For those readers (and there are a measurable number) who do not respond to the prose of Powers, his language is a hindrance. His characters all sound the same (a charge that might be leveled at DeLillo's writing as well). "Every character speaks with Richard Powers' dense pompous verbiage," complains one reader (Dudek, par.

Amazon.com does not stifle a multiplicity of voices from ordinary readers or customers responding to books within these online reviews.

8). There is ample evidence in responses like these then for Joseph Dewey's complaint that Powers' information gets in the way, that it is sometimes propositional instead of performative. Responses like these remind us that common readers are easily baffled: readers of *Ulysses* in *The Little Review* in 1918 expressed similar frustration at encountering a difficult, challenging text in their day.

Central to my argument about the readerly reception of science in late twentieth-century work, we find readers who are skeptical and others who clearly approve of the way in which Powers adapts science for his novels. There is measurable evidence that Powers' strategies have found resonance with ordinary readers, even those with specialized knowledge of the fields covered in the sequence of novels in Powers' major fiction examined here. Writing on the science of *The Gold Bug Variations*, a common reader with pertinent experience in biology writes:

> I'd known about this book, but as a biologist, I had my doubts about a 'mere' novelist being able to weave genetics, evolution, music, love, and who-knows-what-all into an interesting story. […] I've never been more favorable impressed. […] *Time and again Powers manages to make sense and beauty out of the dry matter of amino acids*. (Bissell, par. 1, my emphasis)

Similarly, for *Galatea 2.2*, another scientifically trained reader approves of the portrayal of the research in artificial intelligence when he writes:

> I've been training artificial neural networks for over a decade and reading literature my entire life. […] Speaking as someone who actually works every day with neural networks, [Powers' technical jargon is] remarkably well informed, and perfectly used. The only flaw in Powers' idea [is] that his concept of what constitutes a training set is exceptionally unrealistic. (McKinstry, par. 1)

The same writer then quibbles as to the size of the training regimen that a future Helen would undergo in "millions if not billions" of steps (par. 2).

Finally, for the computer technology on display in *Plowing the Dark*, another knowledgeable reader praises the presentation of computer graphics and virtual reality:

> I've lived in the world described in the book, doing research in computer graphics for the last 22 years; and in weaving his tapestry [Powers] does not drop many stitches. Every detail of the hardware, and almost everybody I know in the field can be found here. Still, the arcaneness of some of his references (Cornell boxes, please!) go over the line that separates authenticity from pedantry. (Beier, par. 2)

Clearly, these kinds of readers have responded to seeing their particular fields of scientific inquiry successfully and accurately represented in fiction. But even a few ordinary readers celebrate Powers' success at adapting science for his characters and thematic material. Writing on *Galatea 2.2*, a non-specialist expresses his appropriation when he writes, "I enjoyed the cognitive noodling, but *I didn't take it as science as much as metaphor*: Waking up to the millions of ways the mind can look at itself and still not really know much about anything" (Rose, par. 4, my emphasis).

Several readers compare Powers' work unfavorably with Douglas Hofstadter's *Gödel, Escher, Bach: An Eternal Braid*, which is very much an avatar text (like Gleick's), arguing for connections between Bach and mathematics, as well as the recurring patterns of M. C. Escher (which resonates with fractal geometry), in a popular bestselling (and Pulitzer-Prize-winning) text.[10] As one reader states, "The connection between coding and the interplay between molecular genetics and Bach and life was made long before (and far better […]

[10]Douglas Hofstadter's *Gödel, Escher, Bach: An Eternal Braid* (1979) serves as a model for a popular avatar text which successfully navigates between 'the Two Cultures' for common readers. In this bestselling text, Hofstadter broke new ground in finding patterns between the music of Bach (using the composer's *A Musical Offering*), mathematics (using Gödel's notions of undecidability), and the self-similar artwork of M. C. Escher (which gains mention in Mandelbrot as prescient of fractals). While there is no direct evidence of Powers borrowing from Hofstadter, it is almost unthinkable that the self-professed polymath would not have encountered this text of 'popular science.' Hofstadter's work also speculates on the theory of mind and artificial intelligence (AI) and so resonates with both *Galatea 2.2*, as well as the earlier novel, *The Gold Bug Variations*.

by Hofstadter." ("*Gödel Escher Bach*, Anyone?" par. 1) While Hofstadter's book made it possible for a popular book to bridge the gap between the two cultures, Powers' novels take this possibility as a given. Even though a good many readers refuse (or are unable) to negotiate the divide between the two cultures—as Powers himself has surely done many times in his work—his whole practice of fiction-writing assumes that successful readers of his fiction can engage scientific material.

Finally, concluding a brief examination of a set of ordinary readers' engagement with Powers' work, the science in these novels clearly impresses general readers with its argument for his 'genius.' "Powers' polymath mind is a warehouse[!] of art and music, literature and history, religion and philosophy, technology and science—and he likes to incorporate his genius into every sentence," effuses one such reader (Smith, par. 4). Even among readers who are apparently baffled by other aspects of his novels, some will continue to press on reading a difficult text like *The Gold Bug Variations*. In the 1990s, in a culture that clearly values science—especially computer technology—as a source of innovation and commerce, it is intriguing that Powers' ability to sound like a scientist authorizes his work in the minds of some readers. For a good many ordinary readers, mastery of scientific material and adept presentation of different technologies helps validate his work for a contemporary audience.

Aesthetic Science, Terrible Bodies, and the Sublime in Powers

I will now develop a reading of aesthetic science in three major works of Powers, with a particular emphasis on *The Gold Bug Variations*, but also, in passing, *Galatea 2.2* and *Plowing the Dark*. In the trajectory of Powers' writing, we see a consistent representation of wonder and beauty in the explication or enactment of scientific processes (or its digital equivalents in the computer simulation in the third novel) juxtaposed against the limits of the human body, which in Powers is almost never the locus of desire, pleasure, or sensory experience, but rather the site of immobility, pain, and disease.

In the analytic of the Kantian Sublime, the human subject encounters the infinite, represented by a scene from the natural world and, in an affective dynamic, experiences awe and terror at the individual's relative insignificance in the scheme of things. This response is followed by a sort of will to power, that is, a realization of human agency and capability against such large, impersonal forces. As I have suggested in Chapter 1, such a reading based on affect has an affinity with Burke's theory of affective responses.

It is easy to recover moments of beauty and awe in the face of natural phenomena in *The Gold Bug Variations*. The novel is filled with passages, especially in its final chapters, that argue for the beauty and complexity of the

natural world, particularly in those sections devoted to describing Jan O'Deigh's self-study on evolution and the workings of DNA. There are passages that argue propositionally for such wonder, like the following excerpt from Jan's 'diary,' in which she relates the comments of a friend on evolution:

> 'The proper response ought not to be distress at all. *We should feel dumb amazement*. Incredulous, gasping gratitude that we've landed the chance at all, the outside chance to be able to comprehend, to save any fraction of it.' (GBV 333, my emphasis)

It is one thing to argue for wonder and another to attempt to let the reader participate in the realization of the same. I find those passages that work on the reader directly to be much more central to the experience of the novel, like Jan's description of the profound diversity of her 'natural kingdom' in a preceding passage:

> Flowers inscribed with ultraviolet runways, detectable only by particular bees. Wasps that live parasitically in bee bodies. The Bauhaus finesse of trapdoor spiders. Other spider strains that fish. Fish that shoot insects with water streams; fish that fish with electroluminescent bait. […] More bizarrerie than dreamt of in any bestiary. A species for every conceivable emblem. (GBV 252)

Here, Jan presents a catalogue worthy of an encyclopedic text with a list of evolutionary diversity describing the strangeness of flowers, bees, and fish that depend upon one another for survival in seemingly contradictory ways. There is considerable exuberance here in realizing the diversity and invention of nature, but little terror. In fact, Jan intimates such wild invention in nature that is safely contained by its representation in human art or artifice, in the heraldic "emblems" that might contain such novel species.

In my reading of the final sections of *The Gold Bug Variations*, Jan's realization of the insignificance of the human species in the operation of impersonal rules of evolution engenders more than simple wonder and awe. It approaches something like terror, as she contemplates an individual subject's limited role within the process of evolution. One passage which demonstrates this dynamic is the following, in which Jan, separated from Franklin Todd, contemplates no less than the beginnings of life and her place in the Universe:

> Yet the code, the language life writes itself in, is universal for every living thing, taking hold once and spinning, telling in all places at all times an *eerie, inconceivably implausible story* of how in the beginning there was a little water, a little ammonia, and methane, all trapped by trivial rules, and at the end, this woman saying over

> and over to herself, 'I want to tell you, I want to tell.' (GBV 518, my emphasis)

The "eerie, inconceivably implausible story" of evolution begins with the simple molecules that became DNA and lead, eventually, to human life and Jan's own predicament of being separated from Todd and unable to tell him of her deeply felt discoveries. Passages like this one imply the tentativeness of human agency in such an impersonal process.

As several critics point out, the final sections of the novel turn toward the musicological, drawing out parallels between the basic theme and variations of Bach's well-known piece of music, set in motion by 32 notes, and leading to all sorts of possibilities just as the 4 basic molecules of DNA lead to all of human experience:

> Ultimately, the Goldbergs are about the paradox of variation [...] By the time the delinquent parent aria returns to close out the set, the music is about how variation might ultimately free itself from the instruction that underwrites it, sets it in motion, but nowhere anticipates what might come from experience's trial run. (*GBV* 585)

Of course, no one can be terrified of Bach's exquisite music. Conventional readings of Powers' novel, as noted above, point out how a basic knowledge of

molecular biology and Bach's polyphony based on a simple theme reinforce the reader's understanding of both.

However, what has gone largely unremarked in readings of Powers' work are his representations of bodies as fragile and often damaged. This is a consistent motif in his writing, one that argues for a sort of readerly terror at the natural world. Beyond Jan's contemplation of the impersonal laws of evolution, the novel juxtaposes the failure of bodies at the same time it suggests the wonder of DNA and Bach's music. At its simplest, Ressler's death from cancer occurs just as Jan makes her discoveries about the alleged wonders of mutation and evolution. When Jeanette Koss abandons Ressler to go back to her husband, we learn it is because she is infertile. Brutal biological facts trump wonder and desire.

Yet more generally, the portrayal of bodies in Powers is always fraught with peril. Throughout his work, bodies are fragile, and a certain terror at immobility and sickness appears numerous times in scenes that appear again and again. This motif occurs so many times in his work, it becomes difficult to choose an example because there are so many. A visit to a sickbed is, I suppose, a staple of Victorian fiction. In Powers' novels, the reader is again and again struck by the starkness of the narrative voice describing the clinic, the nursing

home, the paralyzed composer facing ALS, the stroke victims' bedside vigil. Here is a description from Jan visiting the ailing Jimmy, felled by a stroke:

> *Aesthetics could not survive the waiting room*. [...] He must have recognized me in some sense, because as I stepped to the bed, he rippled his ruined facial muscles. He ... erupted in a horrible, unformed call like the open modulation of an underwater whale. (...) He made the awful blast again. [...] The sound was edgeless, blurred, terrible. I had to force myself not to run from the room and deny I every knew him. (*GBV* 541, my emphasis)

In scenes portraying characters who are ill or paralyzed, Powers falls back on a reductive naturalism, without as much invention, without the usual facility with metaphor, a voice that yokes disparate allusions with an often dazzling fluency. The silence or incomprehensibility of damaged minds or bodies is clearly an anathema to this novelist, whose sentences are otherwise brilliant at describing photographs, the functioning of DNA, or the deeper organization of J. S. Bach's music.

Powers' narrative sensibility renders desire in ways that are antithetical to the normal readers' expectation. As Joseph Dewey remarks, "The experience of desire […] closes again and again in frustration, sterility [and] abandonment" (56). Powers assiduously avoids describing the physical attributes of his

characters. When his characters feel desire, they bristle with more allusion, more detail. There is little touch in Powers, much more music, and descriptions of painting and photographs. Time and again, a young Ressler in the throes of love returns to his record player to hear Bach's *The Goldberg Variations*. The great love story in *The Gold Bug Variations* is Ressler's love for Dr. Jeanette Koss, a married researcher on his team at his Midwestern university. This failed relationship between a twenty-something Ressler and the slightly older Koss mirrors roughly the ages of Frank and Jan.

In my reading, Koss, the object of Ressler's affection, is seemingly punished for her infertility. In a culminating good-bye letter, Koss describes her affair with Ressler as a test to prove her condition before moving away with her husband, a rather non-descript food salesman. Her own "experiment" with her affair with Ressler was to prove her own infertility. That the raw facts of biology trump desire is perhaps typical in Powers. Koss' infertility weighs heavily on the possibilities here for happiness between her and Ressler. It is a 'trial run' that is wholly determined by a biological fact, which the novel in its awkwardness in the face of dysfunction and illness cannot escape.

The portrayal of damaged bodies (especially Uncle Jimmy and, by implication, Ressler) at the end of the novel serve as a check on simple "dumb amazement" at the natural world. Instead, human agency is continually

menaced by impersonal forces—and the darker side of nature—mutations, sterility, and disease. The final realization of contingent human value in the face of such antagonistic forces is an argument for a updated dynamic of the Sublime. If we do experience readerly wonder at the end of the novel it is when we see Jan and Franklin reunited by Ressler's message, a 'bug' planted in her ATM, as a moment of contingent possibility. Jan and Franklin are arguably not destined for simple happiness, but their spliced narratives which comprise the body of *The Gold Bug Variations* argue for a formal beauty despite the facts of biology—the death of Ressler, Jan's (and Jeanette's) infertility, or Uncle Jimmy's damaged brain.

Within *The Gold Bug Variations*, Powers' vision of wonder and awe is not merely a deft science writer's use of analogy between DNA and Bach, however skilfully these connections are made throughout the novel. Jan's realization of the impersonal rules of biology and evolution, and several scenes of menaced bodies later in the text, remind the reader of how contingent any human experience is in the world. In Kant's model of the Sublime, the initial stimulus for triggering an affective response of contemplating one's relative insignificance in the world would have been a mountain scene of other 'awesome' natural canvas. In *The Gold Bug Variations*, it is a profound acquaintance and realization of the vast, impersonal, and complex rules of evolution on one hand, and several

confrontations with damaged bodies, which occur throughout the work of Powers, as I will examine.

In *Galatea 2.2*, Richard Power's novelist alter-ego of the same name says that after *The Gold Bug Variations*, he was through writing about science; but he clearly was not. *Galatea 2.2* takes on artificial intelligence in a tangle of female characters as well as Powers' alter ego, who is named Richard Powers. First, this novel chronicles the dissolution of Powers' own relationship with a lover, known only by the letter C., in Holland. The novel is filled with a thread of self-pity and an almost bizarre modesty about the novelist's burgeoning literary career, which culminates in the publication and success of the earlier novel.

In *Galatea 2.2*, Powers' returns to his old university town in the Midwest, code-named U., coincidentally the setting of *The Gold Bug Variations* and Ressler and Koss' affair. Powers somewhat reluctantly partakes in a bet with a group of cognitive scientists as to whether they can engineer a truly intelligent computer program that will mimic and pass the equivalent of a literary comprehensive exam for a Master's degree, a process that requires Powers to train successive versions of his pupil in language, real-world knowledge, literature and, eventually, politics. These sections, in which Powers interacts with his sometimes naive, sometimes brilliant, yet always surprising, pupil are where the

novel really argues for wonder. In passages like the following, Powers again works in catalogues, this time from the remarkable facts—and contradictions—of everyday life:

> The gaps in her worldliness gaped so wide one could drive a plow through them, sowing stars. She knew something about the Dreyfus case and the Boer War and the spread of Islam to the Malay Peninsula. Her ignorance, however, extended to such things as corks stuck in bottles, the surface of a liquid reflection, the destruction of the more brittle of two colliding objects, wrappers and price tags, stepladders, up versus down, the effects of hunger... I counted myself lucky if she could infer that a tied shoe was somehow more desirable than an untied one, provided the shoe was on, whatever tying, whatever shoes were. (*G* 230)

In scenes like this one, Powers is able to explore his own clear delight in language and trope, and literally the wonders of everyday knowledge, the value and complexity which has been argued for in John Frow's perceptive reading of the work.[11]

---

[11]John Frow uses *Galatea 2.2* as a starting point for a defense of 'everyday' knowledge as a complex and valuable category of thought, as an "encyclopaedia of human experience" (623). Powers' novel makes clear that the assumptions of everyday thinking are much richer than one might first expect. Of course, it is precisely this difficulty of encoding the everyday knowledge that has plagued the field of Artificial Intelligence (AI) since its inception, a difficulty that Powers is aware of as he iterates through the various versions of his Helen, from Implementation A

Powers' fascination with incomplete or damaged minds is in full evidence in several scenes, too, first with a fellow researcher's son who has Down Syndrome, and next when Powers and the head artificial intelligence researcher, Lentz, visit the latter's stroke-damaged wife in her nursing home in another scene filled with the smells of ammonia and institutional living that is rendered entirely without hope.

Upon meeting Peter, the impaired son of Diana Hartrick, a fellow researcher, Powers writes, that "The child wasn't about to say anything. I saw it in his features. The slightly spatulate face. The fold to the nose and ears. Speech would be long and hard in coming" (*G* 131). And again, in the same scene, Powers writes, "Peter curled like an armadillo. Trisomy may have weakened his muscles, but the weights collapsing his spine were human joy and fear" (*G* 136).

The meeting of Powers and Audrey Lentz, the brain-damaged wife of Philip Lentz, the head researcher at the novelist's AI center, is particularly stark. "Something had happened to her. Something more than age. Her soul had pulled up stakes from behind her features. She bore no more relation to her former face than a crumpled bag of grounded silk bore to a hot air balloon" (*G* 166). Later we discern that Audrey was victim of a "cerebrovascular accident"

---

onward. Each version of this virtual intelligence fails in interesting ways before achieving something like 'real' consciousness.

and could not be rescued by their daughter, an English graduate, who was unable to call in the emergency. "'Not the humanistic encounter that close reading prepares you for,'" Lentz remarks sardonically (*G* 170). In a novel devoted to depicting the accelerating intelligence of Helen's virtual mind, the opposite possibility that minds can be damaged remains an anathema to the narrator here.

The crux of the novel is Powers' gathering obsession with a young woman A.—a current graduate student who is about to leave the academic life, we learn—just as his virtual creation comes to life. At the beginning of the novel, Powers seems to be broken, unable to write, rejected, and consumed with self-pity. By the novel's close, though he loses on all fronts, he has moved on. As Powers loses both the real A. and the virtual Helen, who commits a sort of virtual suicide just as she achieves the ability to think on her own, Powers can go on to write more novels. This loss allows him to give up the burden of past misfortunes. "I could not stay in [the] discarded office for five more minutes without following Helen's lead. I would break under the weight of what she'd condemned me to" (*G* 328). Besides writing the text that is *Galatea 2.2*, of course, Powers moves on to write *Plowing the Dark*, where the dynamic of bodies is explored in an even more convincing fiction.

In *Plowing the Dark*, I believe Powers has achieved something while juxtaposing metaphors drawn from recent science and the language of disfigured minds and bodies. Immobility and bodily dysfunction, instead of a narrative cul-de-sac, an end-point as in scenes from many of his other novels, becomes only a beginning with the portrayal of an Arab-American named Tai Martin from Chicago, who is kidnapped in Beirut and held captive for several years during the course of the novel. *Plowing the Dark* offers another triangle as well for its narrative impetus. Adie, a once-productive painter from New York City, is coaxed into working at TeraSys (a sort of stand-in for Microsoft), to embellish a virtual reality simulator for her old college friend Steven Spiegel. The third in this triangle is a composer, Ted Zimmerman, once married to Adie, who first united them in college. Past or present desires between the characters do not matter much, because by 1989, the year of this novel, the first two characters are stuck behind their computer screens living vicariously as televised events of Tiananmen Square and the fall of the Berlin Wall take place; they are very much obsessed with the bits and bytes of emerging technology. With characteristic aplomb, Powers describes the technological underpinnings of rendering polygons for creating ever more realistic digital simulations. In turn, Adie creates 3-D versions of paintings by Rousseau and Matisse, and then embarks on re-creating the architecture of Byzantium. There is no real passion of any kind

here, except perhaps when Powers describes the world of the simulation, for example, in a passage describing the Jungle Room, a digital recreation of Henri Rousseau's famous tableau:

> Through the Jungle Room, birds wing at liberty. Define a feather when condemned to the wind. Say how the shaft tapers, straining to be weightless. Describe what the vanes do on the air, how they luff and ruffle and flute, how the barbs somersault on the downward curve of their resisting ride. Specify the flight in full, and you have those jungle fliers. Fix the thing's rules, and you slough off the tyrannical thing. Mere birdness alone yields birds on demand. Whole flocks pepper the canopy, from out of description. (*PD* 68)

Passages like this one in *Plowing the Dark* let the reader contemplate the potential beauty of new digital worlds. They invite readerly participation in the project of creating a new virtual reality while exhibiting Powers' continual fascination with new science and technology, which is described in some of his most daring turns of phrase.

However, this euphoria towards technology at the historical juncture of the end of the Cold War is strongly challenged by the juxtaposition of the scenes of bodily disfigurement and mental and physical hardship for the kidnapping

victim Tai, who must contend with living his life inside a small room in Beirut with virtually nothing (except a travel book, then eventually a copy of the Koran). Here is one passage of many scenes of violence:

> A knee jacks into your back, shattering your kidney and sending your spine into your stomach. One of them goes for the head, batting with the butt of a piece of metal that, even as you fall and ball up, you realize must be the electric shears. (*PD* 294)

The strictures of a life so limited provide Powers a chance to invent. The descriptions of Tai's regimen of life—and imaginative journeys with only his own memories and thoughts—provide the most intriguing dynamic in this book. Throughout this 'captivity narrative' is an empathy toward his Arabic captors' lives too.

Parallel to the narrative frames of Seattle and Beirut is a reminiscence between the characters to their college days, and a trip back to visit their dying friend, Ted Zimmerman, immobilized by the ravages of ALS and confined to his head, able only to compose music with a computer. The visit to Ted in Lebanon, Ohio, where he is in a nursing home with only his computer and music, is described in almost brutal terms.

> Ted lay in bed, strapped to the raised headrest. His arms wavered in the air like seedpods on autumn's first breeze. The bewildered

> bulge of his face took them in, mouth sagging, eyes fleeing back into their wells of bone. […] Zimmerman hauled back and sucked air. He seized up, a cracked ignition failing to turn over at thirty below. It flashed through Adie to call for a nurse. But Ted, in agonizing slow motion, was only laughing. (*PD* 308-9)

Like the portrayal of the stroke-damaged Uncle Jimmy in the earlier *The Gold Bug Variations*, Ted's inability to speak is grotesquely rendered here. Again and again in Richard Powers' major novels, the reader is confronted by bodies menaced by illness, debilitation, or in the third novel, even violence. These moments run counter to a consistent portrayal of different kinds of science that engenders wonder.

Recently, in his interrogation of the project of literary theory and postmodernism, Terry Eagleton in *After Theory* argues that postmodernism has a difficult time accounting for the material conditions of the body. "The body, that inconvenient reminder of mortality, is plucked, pierced, etched, pummeled, pumped up, shrunk and remolded. [...] Dead bodies are indecent; they proclaim with embarrassing candour the secret of all matter, that it has no obvious relation to meaning" (164). In all our recent rush and euphoria about cyberspace, virtual reality, and the like, I think also we have failed to account for the limitedness of our material conditions and bodies, which as Eagleton reminds us, are not our

choice to inhabit. In his reading of *Plowing the Dark*, Charles Harris argues that Powers avoids a temptation of technoromanticism, the desire to re-invent reality virtually and escape our bodies entirely ("Technoromanticism" 114). There is no risk of this in Powers' novels, which always turn back to the body as a source of limitation.

To admit the influence of bodies, their possibilities and limitations, is not to re-admit essentialist notions of gender or a sort of biological determinism (which I have suggested is at least hinted at in at least one scene in Powers, in Koss' departure in *The Gold Bug Variations*). Yet it is to re-acquaint ourselves to reality, in Eagleton's terms. Unbounded by the real, we are perhaps free to spin out an endless scaffolding of signifiers. Losing our purchase on the real is a risk for both recent theory and aesthetic writing. I think Powers is an heir to the aestheticist tradition in his ambitious novels of style. This novelist has looked toward recent science for a continual source of some of his most inventive allusions. A pronounced discomfort with bodies in several of Powers' novels reveals some of the recent argument around the pitfalls of a body-less postmodernism in a slightly different key.

CONCLUSION

Aesthetic Science in the Late Twentieth Century

In 1993, a slender novel of style, *Einstein's Dreams*, written by Alan Lightman, a practicing physicist turned novelist, achieved critical praise and a considerable run on the *New York Times* bestseller list. This text meditates on different possibilities for how time might work. It describes worlds in which time stands still, in which people never age, or people age in reverse, or time changes its pace in different ways. These model worlds—fictive what if's as much as Powers' own re-creations of virtual reality in *Plowing the Dark*—are anchored in the local detail of Zurich, a city where Einstein worked as a patent clerk and published three famous physics papers, including his revolutionary General Theory of Relativity in 1905. The conceit of the young soon-to-be famous physicist coming into work early in his office and dozing off on his desk during this *annum mirabilis* in physics serves as the frame for the novel.

The critical and popular success of *Einstein's Dreams* illustrates how common readers today accept and embrace relatively sophisticated ideas drawn from recent science with ease. Playwrights such as Tom Stoppard (in *Arcadia*), and Michael Frayn (in *Copenhagen*) join fiction writers—notably Jeanette Winterson in *Gut Symmetries*, the Irish novelist John Banville (in *Copernicus*, *Kepler*, and *The Newton Letter*), and Rachel Goldstein (in short story collections

like *Strange Attractors*) in writing about the lives of scientists, as well as drawing from recent scientific discoveries for metaphors and thematic concerns in their work. To be clear, these writers have nothing to do with the genre of science fiction, which has always made use of science, often to speculate on the utopian possibilities and dystopic dangers of hypothetical advances in scientific understanding or their application in technology. Rather, writers using aesthetic science appropriate scientific ideas for serious "literary" fiction. Meanwhile, a stream of 'creative non-fiction' authors in leading magazines (notably *The New Yorker* and *Granta*) frequently write about scientific topics—whether viruses, earthquakes, or plagues—using some of the techniques drawn from fiction in essays that appear alongside 'serious' creative fiction.[1]

Aesthetic science argues for a certain formal beauty in the adaptation of tropes and ideas for science. Moreover, it lets us speak of a notion of formal aesthetic order and beauty in a somewhat rigorous way. Tom LeClair's formulation of the systems novels theory adapted for reading the work of DeLillo and the other authors anticipates the reach of chaos theory and other recent science, particularly biology and the life sciences, for engendering new

[1]A very partial list of non-fiction writers who have written on scientific topics with an almost 'literary' sensibility and achieved some measure of popularity with readers in the pages of *The New Yorker* and similar publications might include: John McPhee (earthquakes), Robert Preston (viruses), Malcolm Gladwell (psychology and economics), James Surowiecki (economics), and, of course, Stephen Jay Gould (evolution and biology).

notions of order in fiction. But his readings eschew any notion of beauty. As I have suggested in Chapter 4, LeClair's reading of *Ratner's Star* devolves into a reading of Billy Twillig's terror and fear; this reading avoids any notion of formal beauty or an engagement with the Sublime, a dynamic that I have explained with the analytic lens of aesthetic science. Traditional systems theory sought the same reach as chaos theory but its underpinnings were all about linear equations, and it never achieved any sort of popularity with common readers.[2]

In his examination of canon formation, John Guillory argues that the emergence of English programs in the mid-twentieth century corresponded to the definition of what an emerging middle-class audience needed to know to be literate (a type of knowledge he juxtaposes against mass culture within the emerging project of the New Criticism) (174-5). Aesthetic science argues for a sort of evolution of middle-class taste as well. Over time, readers have been

---

[2]While I want to acknowledge the contribution of LeClair's readings of science using system theory, it is now clear that chaos theory has a achieved the reach and popular accessibility that the earlier science never had. Although LeClair has read ideas in chaos theory in reviews of Powers, Vollmann, and Wallace, and a chapter on McElroy in *The Art of Excess*, systems theory and chaos theory have little to do with one another.

For example, the major titles for chaos theory, including Gleick, Mandelbrot, and Prirogine do not mention systems theory or its nominal founder, von Bertalanffy in any index or discussion that I can discern. Traditional systems theory is strongly associated with linear equations while chaos theory uses non-linear equations. Interestingly, LeClair's original formulation of system theory quotes Prigogine, whose work with chaos theory earned him a Nobel Prize. As Katherine Hayles notes, Prirogine has been associated with a positive notion of chaotics, that systems can increase in order and complexity (18). Chaotics engenders a notion of formal order and beauty in ways that systems theory and LeClair's application of it for fiction does not require.

educated in science. Beyond academic knowledge, the emergence of a type of popular science relies on the accessible avatar text, which places accessible scientific ideas into the minds of today's "educated" common readers. Novelists seeking purchase on middle-class readership's attention and allegiance, in Baxter Hathaway's terms, have adapted ideas from science for contemporary writing. For at least two decades now, a certain thread in cultural production has emerged: the novel or play that makes use of recent science for its characters, scenes, and even structure. Aesthetic science helps us understand these and future works which are at least modestly popular with middle-class audiences.

Further, the adoption of aesthetic science marks a high point of engagement between "the two cultures" for imaginative work, which has not been crossed so well lately in literary theory. If we chart the dialogue between the two cultures of science and literature, relations between the two camps hit a sort of wall in the late 1990s with the so-called "science wars." A certain thread in current literary criticism would see all scientific truth as a historical construct, something Powers does not seem to support with his idea of truth as having to do with the empiricism of "the active narrating conscious brain," an "evolutionary product of several billion years of *bumping up against the world*" (Powers qtd. in Neilson 16, my emphasis). Even if one must articulate a position for or against 'absolute' scientific truth in this historical moment, in imaginative

work, ideas from sciences can be adapted for creative work quite unapologetically. In the dynamic of aesthetic science, the border between the two cultures is more porous than ever. And for most "common readers," ideas drawn from recent literary theory will surely be invisible. Ideas like indeterminacy, doubleness, and the application of formal systems to everyday experience can be brought to bear from scientific texts with relative ease.

Thus, aesthetic science engenders new creative work while literary theory, for all its achievements, does not often lead creative writers to write works that aim to illustrate its key concepts and ideas. It is difficult to create a text that demonstrates ideas for recent literary theory directly, but illustrating ideas drawn from recent science to suggest complexity, unknowability, and the like is demonstrably more easily accomplished. The dynamic of aesthetic science certainly has a continued reach beyond the works considered in this study. The ascendance and accessibility of scientific ideas for new tropes, metaphors, and ideas of order in contemporary letters shows little signs of disappearing. The works of scientifically literate novelists (like Pynchon, DeLillo, Powers, or more recent contemporary authors like Lightman) demonstrate how science continues to be appropriated for literary ends. Moreover, one no longer needs to take on the encyclopedic in order to represent science in new creative work. As Powers' last two novels suggest, we no longer need encyclopedism to justify the inclusion

of scientific allusions or tropes for serious fiction. Ambitious novels of style—and not only those that demonstrate an encyclopedic impulse—can now adapt the discourse of science for their best tropes, a dynamic that marks a change between the "literary" and the "scientific." This crossing between the two cultures also suggests how readerly perceptions and expectations have evolved over time.

Throughout this study, I have articulated how aesthetic science can add to our understanding of several of the most ambitious encyclopedic novels in the twentieth-century cultural history. Yet the idea of reading science with this analytic can easily be extended to a host of new works, which continue to take on recent science and technology quite directly, changing what can be "literary" and what the ordinary reader can be expected to know, to appreciate—and indeed—to enjoy.

BIBLIOGRAPHY

Adorno, Theodor. *Aesthetic Theory*. Trans. Robert Hullot-Kentor. Minneapolis: Univ. of Minnesota Press, 1997.

Advertisement. "Kenyon College Announces a Symposium on Communication Between the Arts and Sciences." *The Kenyon Review* 23 (Autumn 1961): 729.

Allen, Glenn Scott. "The End of Pynchon's Rainbow: Postmodern Terror and Paranoia in DeLillo's *Ratner's Star*." In *Critical Essays on Don DeLillo*. Ed. Hugh Ruppersburg and Tim Engles. New York: G. K. Hall, 2000. 115-134.

Anonymous. "*Gödel Escher Bach*, Anyone?" Online posting. 18 Aug. 2002. Amazon.com Readers Forum on *The Gold Bug Variations*. 23 Mar. 2005. <http://www.amazon.com/gp/product/customer-reviews/0060975008>.

Arnold, Matthew. *Culture and Anarchy and Other Writings*. [1869]. Ed. Stefan Collini. Cambridge: Cambridge Univ. Press, 1993.

Barrett, Laura. "'Here But Also There': Subjectivity and Postmodern Space in *Mao II*." *Modern Fiction Studies* 45 (1999) 788-810.

Baumgarten, Alexander. *Reflections on Poetry*. [1750]. Trans. Karl Aschenbrenner. Berkeley, Univ. of California Press, 1954.

Beier, Thad. "Thought Provoking, Inspiring, But..." Online posting. 29 June

2000. Amazon.com Readers Forum on *Plowing the Dark.* 23 Mar. 2005. <http://www.amazon.com/gp/product/customer-reviews/ 0374234612>.

Beplate, Justin. "No Mistakes: Are Joyce's Failings Merely Failures of Discovery?" *The Times Literary Supplement* 29 April 2005: 4-5.

Bernal, J. D. *A History of Classical Physics: From Antiquity to the Quantum*. [1972]. New York: Barnes and Noble, 1997.

Berressem, Hanjo. *Pynchon's Poetics: Interfacing Theory and Text*. Chicago: Univ. of Illinois Press, 1993.

Bissell, Steven J. "Bach, Darwin, Watson and Crick: An Uncommon Thread." Online posting. 1 Jul. 2000. Amazon.com Readers Forum on *The Gold Bug Variations*. 23 Mar. 2005. <http://www.amazon.com/gp/ product/customer-reviews/0060975008>.

Brenner, Sydney. "Think Small, Talk Big." *Times Literary Supplement* 19 Oct. 2001: 6a.

Campbell, Miranda. "Probing the Posthuman: Richard Powers' *Galatea 2.2* and the Mind-Body Problem." *Reconstruction: Studies in Contemporary Culture* 4.3 (Summer 2004). 31 Mar. 2005 <http://www.reconstruction.ws/043/ campbell.htm>.

Chambers, Judith. *Thomas Pynchon*. New York: Twayne, 1992.

Chénetier, Marc. *Beyond Suspicion: New American Fiction Since 1960.* Trans.

Elizabeth A. Houlding. Philadelphia: Univ. of Pennsylvania Press, 1996.

Civello, Paul. *American Literary Naturalism And Its Twentieth-Century Transformations : Frank Norris, Ernest Hemingway, Don DeLillo*. Athens, GA: Univ. of Georgia Press, 1994.

Cooper, Peter L. *Signs and Symptoms: Thomas Pynchon and the Contemporary World*. Berkeley: Univ. of California Press, 1983.

Cowart, David. *Don DeLillo: The Physics of Language.* Athens, GA: Univ. of Georgia Press, 2002.

---. *Thomas Pynchon: The Art of Illusion*. Carbondale, IL: Southern Illinois Univ. Press, 1980.

Dawes, Greg. "The Storm of Progress: *Three Farmers on Their Way to a Dance*." *Review of Contemporary Fiction* 18 (Fall 1998): 42-50.

DeLillo, Don. *Americana.* 1971. New York: Penguin, 1989.

---. "The Artist Naked in a Cage." *New Yorker* (26 May 1997): 6-7.

---. "Creation." *Antaeus* 33 (1979): 32-46.

---. "Baghdad Towers West," *Epoch* 17 (1968): 195-217.

---. "Coming Sun., Mon., Tues." *Kenyon Review* 28 (1966): 391-94.

---. *The Engineer of Moonlight*. *Cornell Review* 1 (1979): 21-47.

---. "Human Moments in World War III." 1983. In *Great Esquire Fiction: The Finest Stories from the First Fifty Years*. Ed. L. Rust Hills. New York:

Penguin, 1983. 572-86.

---. "In the Men's Room of the Sixteenth Century." *Esquire* Dec. 1971: 174-77+.

---. *Libra.* New York: Penguin Books, 1989.

---. *Mao II*. New York: Viking, 1991.

---. *The Names*. New York: Knopf, 1982.

---. "Notes Toward a Definitive Meditation (By Someone Else) on the Novel *Americana." Epoch* 21 (Spring 1972): 327-29.

---. *Ratner's* Star. New York: Knopf, 1976.

---. "The River Jordan." *Epoch* 10 (Winter 1960): 105-20.

---. "Spaghetti and Meatballs." *Epoch* 14 (Spring 1965): 244-50.

---. "Take the 'A' Train." *Epoch* 12 (Spring 1962): 9-25.

---. *Underworld*. New York: Scribner, 1997.

---. "The Uniforms." 1970. In *Cutting Edges: Young American Fiction for the 70's*. Ed. Jack Hicks. New York: Holt, Rinehart and Winston, 1973. 451-9.

---. *White Noise*. 1985. Ed. Mark Osteen. New York: Penguin, 1998.

Dewey, Joseph. "Dwelling in Possibility: The Fiction of Richard Powers." *The Hollins Critic* 2 (Apr. 1996): 1-17.

---. "Hooking the Hose of the Leviathan: Information, Knowledge, and the Mysteries of Bonding in *The Gold Bug Variations*." *Review of Contemporary Fiction* 18 (Fall 1998): 51-66.

---. *Richard Powers*. Columbia, SC: Univ. of South Caroline Press, 2002.

---. "Richard Powers 1957-." In *American Writers: A Collection of Literary Biographies: Supplement IX: Nelson Algren to David Wagoner*. Ed. Jay Parini. New York: Scribner's, 2002. 207-25.

Dodd, David. "Seeing Cosmos: Richard Powers: The First Five Novels." *Bloomsbury Review* 16 (Mar.-Apr. 1996): 27.

Dowling, Linda C. *Language and Decadence in the Victorian Fin de siècle*. Princeton: Princeton Univ. Press, 1986.

Dudek, Timothy W. "Brilliant But Unfulfilling." Online posting. 9 Jun. 2003. Amazon.com Readers Forum on *The Gold Bug Variations*. 23 Mar. 2005. <http://www.amazon.com/gp/product/customer-reviews/0060975008>.

Duff, Charles. *James Joyce and the Plain Reader*. [1932]. Folcroft, PA: Folcroft Press, 1969.

Dujardin, Édouard. *We'll to the Woods No More.* Trans. Stuart Gilbert. Intro. Leon Edel. *Les lauriers sont coupés*. [1887]. New York, New Directions, 1938.

Duvall, John N. "Baseball As Aesthetic Ideology: Cold War History, Race, and Delillo's 'Pafko at the Wall.'" *Modern Fiction Studies* 41 (1995) 285-313.

Eagleton, Terry. *After Theory*. New York: Basic Books, 2003.

---. *The Ideology of the Aesthetic*. Oxford: Blackwell, 1990.

Eliot, T. S. "Tradition and the Individual Talent." [1919]. In *Selected Prose of T. S.*

Eliot. Ed. Frank Kermode. New York: Farrar, Harcourt Brace & Company: 1975. 37-44.

Ellmann, Richard. *James Joyce*. Rev. ed. Oxford: Oxford Univ. Press, 1982.

"Fifty Issues of Epoch: A Complete Index, 1947-1964." *Epoch* 13 (Winter 1964): 119-31.

Fitzpatrick, Kathleen. "The Exhaustion of Literature: Novels, Computers, and the Threat of Obsolescence." *Contemporary Literature* 43 (Fall 2002): 518-59.

Freedman, Jonathan. *Professions of Taste: Henry James, British Aestheticism, and Commodity Culture*. Stanford: Stanford Univ. Press, 1990.

French, Marilyn. *The Book As World: James Joyce's* Ulysses. Cambridge: Harvard, 1976.

Frow, John. "'Never Draw to an Inside Straight': On Everyday Knowledge." *New Literary History: A Journal of Theory and Interpretation* 33 (Autumn 2002): 623-37.

de Goncourt, Edmond and Jules de Goncourt. *Germinie Lacerteux*. [1864]. Trans. Ernest Boyd. New York: Knopf, 1922.

---. "Preface de la première édition." *The Little Review* 5 (July 1918): 56.

Greene, Brian. *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory*. New York: Norton, 1999.

Harris, Charles B. "'The Stereo View': Politics and the Role of the Reader in *Gain*." *Review of Contemporary Fiction* 18 (Fall 1998): 97-108.

---. "Technoromanticism and the Limits of Representationalism: Richard Power's Plowing the Dark." In *The Holodeck in the Garden: Science and Technology in Contemporary American Fiction*. Ed. Peter Freese and Charles B. Harris. Normal, IL: Dalkey Archive, 2004. 110-29.

Hathaway, Baxter. "Eight Years of an Eisenhower-Republication Administration." Editorial. *Epoch* 11 (Winter 1961): 57-8.

---. "Fifty Issues of Epoch: An Editorial." Editorial. *Epoch* 13 (Winter 1964): 79-83.

---. "Introduction to Another Season." Editorial. *Cornell Review* 1 (1979): 5-10.

---. "One Curious Offshoot." Editorial. *Epoch* 11 (Spring 1961): 123-4.

Hayles, N. Katherine. *Cosmic Web: Scientific Field Models and Literary Strategies in the Twentieth Century*. Ithaca, NY: Cornell Univ. Press, 1985.

---. *How We Became Posthuman : Virtual Bodies in Cybernetics, Literature, and Informatics*. Chicago: Univ. of Chicago Press, 1999.

---. "Introduction: Complex Dynamics in Literature and Science." In *Chaos and Order: Complex Dynamics in Literature and Science*. Chicago: Univ. of Chicago Press, 1991. 1-33.

Heise, Ursula K. "Toxins, Drugs and Global System: Risk and Narrative in the

Contemporary Novel." *American Literature: A Journal of Literary History, Criticism, and Bibliography* 74 (Dec. 2002): 263-87.

Helyer, Ruth. "Refuse Heaped Many Stories High: DeLillo, Dirt, and Disorder." *Modern Fiction Studies* 45 (1999): 987-1006.

Herman, Luc, and Geert Lernout. "Genetic Coding and Aesthetic Clues: Richard Powers' *Gold Bug Variations*." *Mosaic: A Journal for the Interdisciplinary Study of Literature* 31 (Dec. 1998): 151-64.

Hermanson, Scott. "Chaos and Complexity in Richard Powers' *The Gold Bug Variations*." *Critique: Studies in Contemporary Fiction* 38 (Fall 1996): 38-51.

Hite, Molly. *Ideas of Order in the Novels of Thomas Pynchon*. Columbus: Ohio State Univ. Press, 1983.

Hofstadter, Douglas R. *Gödel, Escher, Bach: An Eternal Braid*. New York, Basic Books, 1979.

Hume, Kathryn. *Pynchon's Mythography: An Approach to* Gravity's Rainbow. Carbondale, IL: Southern Illinois Univ. Press, 1987.

Hurt, James. "Narrative Powers: Richard Powers as Storyteller." *Review of Contemporary Fiction* 18 (Fall 1998): 24-41.

Huysmans, Joris-Karl. *Against Nature*. [1884]. Trans. Margaret Mauldon. New York: Oxford Univ. Press, 1998.

Iser, Wolfgang. *The Implied Reader: Patterns of Communication in Prose Fiction From*

Bunyan to Beckett. Baltimore: Johns Hopkins Univ. Press, 1974.

Jakobson, Roman. "Two Aspects of Language and Types of Aphasic Disturbances." [1956]. In *Language in Literature*. Ed. Krystyna Pomorska and Stephen Rudy. Cambridge: Harvard Univ. Press, 1987. 95-114.

James, Henry. "The Art of Fiction." [1884]. In *The Critical Muse: Selected Literary Criticism*. Ed. Roger Guard. New York: Penguin, 1987. 186-206.

"James Joyce in 'The Little Review.'" Editorial. *The Little Review* 4 (Feb. 1918): 66.

Jameson, Fredric. *Postmodernism, Or, The Cultural Logic of Late Capitalism*. Durham, NC: Duke Univ. Press, 1990.

Johnston, John. "Generic Difficulties in the Novels of Don DeLillo." *Critique 30* (1989): 261-275.

---. "Post-Cinematic Fiction: Film in the Novels of Pynchon, McElroy and DeLillo." *New Orleans Review* 17 (Summer 1990): 90-7.

Joyce, James. *A Portrait of the Artist as a Young Man.* [1918]. Oxford; New York : Oxford University Press, 2000.

---. "Proof 5 of Installment in *Transition* Quarterly No. 1." [Excerpt from *Finnegans Wake*]. *The Little Review* 12 (Spring 1929): 50-1.

---. *Ulysses*. [1922]. Gabler, Hans, Ed. New York: Viking, 1986.

---. *Ulysses: A Reader's Edition*. Danis Rose, Ed. London: Picador, 1997.

Kant, Immanuel. *Critique of Judgement*. [1790]. Trans. James Meredith. Oxford: Oxford Univ. Press, 1952.

Keesey, Douglas. *Don DeLillo.* New York: Twayne, 1993.

---. "The Ideology of Detection in Pynchon and DeLillo." *Pynchon Notes* 32-33 (Spring - Fall 1993): 44-59.

Kenner, Hugh. *Ulysses*. Rev. ed. Baltimore: Johns Hopkins Univ. Press, 1987.

Kharpertian, Theodore D. "Of Models, Muddles, and Middles: Menippean Satire and Pynchon's *V*." *Pynchon Notes* 17 (Fall 1985): 3-14.

Knight, Peter. "Everything is Connected: *Underworld's* Secret History of Paranoia." *Modern Fiction Studies* 45 (1999) 811-836.

Kraghe, Helge. *Quantum Generations: A History of Physics in the Twentieth Century*. Princeton: Princeton Univ. Press, 1999.

Kristeva, Julia. Trans. Tom Gora and Alice Jardine. *Desire in Language: A Semiotic Approach to Literature and Art*. New York: Columbia Univ. Press, 1980.

Labinger, Jay. "Encoding an Infinite Message: Richard Powers's *The Gold Bug Variations*." *Configurations* 1 (1995): 79-93.

LeClair, Tom. *The Art of Excess: Mastery in Contemporary American Fiction*. Chicago: Univ. of Illinois Press, 1989.

---. *In the Loop: Don DeLillo and the Systems Novel.* Urbana : Univ. of

Illinois Press, 1987.

---. "Interview with Don DeLillo." *Anything Can Happen: Interviews with Contemporary American Novelists.* Ed. Tom LeClair and Larry McCaffery. Urbana, IL: Univ. of Illinois Press, 1983. 79-90.

---. "The Prodigious Fiction of Richard Powers, William Vollmann and David Foster Wallace." *Critique: Studies in Contemporary Fiction* 38 (Fall 1996): 12-37.

Lightman, Alan. *Einstein's Dreams*. New York: Warner Books, 1993.

The Little Review, Ed. Margaret C. Anderson, Jane Heap, and Ezra Pound. 12 v. (Mar. 1914 - May 1929).

Lindner, April. "Narrative as Necessary Evil in Richard Powers' Operation Wandering Soul." *Critique: Studies in Contemporary Fiction* 38 (Fall 1996): 68-79.

MacCabe, Colin. *James Joyce and the Revolution of the Word*. New York: Barnes and Noble, 1979.

Madsen, Deborah. *The Postmodernist Allegories of Thomas Pynchon*. London: Leicester Univ. Press, 1991.

McHoul, Alec, and Wills, David. *Writing Pynchon: Strategies in Fictional Analysis*. Chicago: Univ. of Illinois Press, 1990.

McInerney, Francis J. "I Waited Several Days Prior to Writing About This Book."

Online posting. 1 Jul. 2000. Amazon.com Readers Forum on *Plowing the Dark.* 23 Mar. 2005. <http://www.amazon.com/gp/product/ customer-reviews/ 0374234612>.

McKinstry, Chris. "A Wordgeek Who Gets It." Online posting. 7 Jun. 2000. Amazon.com Readers Forum on *Galatea 2.2*. 23 Mar. 2005. <http://www.amazon.com/gp/product/customer-reviews/ 0312423136>.

Maltby, Paul. "The Romantic Metaphysics of Don DeLillo." In *White Noise: Text and Criticism.* Osteen, Mark, Ed. New York: Viking, 1998. 498-516. Rpt. of *Contemporary Literature* 37 (Summer 1996): 258-77.

Márquez, Antonio. "The Nightmare of History and Thomas Pynchon's *Gravity's Rainbow*." *Essays in Literature* 8 (Spring 1981): 53-62.

Marriott, David. "*Gravity's Rainbow*: Apocryphal History or Historical Apocrypha?" *Journal of American Studies* 19 (April 1985): 69-80.

Mendelson, Edward. "Gravity's Encyclopedia." In *Mindful Pleasures: Essays on Thomas Pynchon*. Ed. George Levine and David Leverenz. Boston: Little, Brown, 1976. 161-95.

Molesworth, Charles. "Don DeLillo's Perfect Starry Night." In *Introducing Don DeLillo.* Ed. Frank Lentricchia. Durham: Duke University Press, 1991. 143-56.

Morrison, J. Scott. "A Cracking Good Tale In Crackling Prose." Online posting. 17 Jun. 2000. Amazon.com Readers Forum on *Plowing the Dark.* 23 Mar. 2005. <http://www.amazon.com/gp/product/customer-reviews/0374234612>.

Nadeau, Robert. *Readings from the New Book of Nature.* Amherst: Univ. of Massachusetts Press, 1981.

---. "Readings from the New Book of Nature: Physics and Pynchon's *Gravity's Rainbow*." *Studies in the Novel* 11 (1979): 454-71.

Neilson, Jim. "An Interview with Richard Powers." *Review of Contemporary Fiction* 18 (Fall 1998): 13-23.

The New Princeton Encyclopedia of Poetry and Poetics. Princeton: Princeton Univ. Press, 1993.

Osteen, Mark. *American Magic and Dread: Don DeLillo's Dialogue With Culture.* Philadelphia: Univ. of Pennsylvania Press, 2000.

---. "Children of Godard and Coca-Cola: Cinema and Consumerism in Don DeLillo's Early Fiction." *Contemporary Literature* 37 (Autumn 1996): 439-70.

Pancake, Ann. "'The Wheel's Worst Illusion': The Spatial Politics of *Operation Wandering Soul*." *Review of Contemporary Fiction* 18 (Fall 1998): 72-83.

Peirce, C. S. "The Architecture of Theories." [1891]. In *The Essential Peirce*. Vol. 1.

Ed. Nathan Houser and Christian Kloeser. Bloomington: Indiana Univ. Press, 1992. 285-97.

Pence, Jeffrey. "The End of Technology: Memory in Richard Powers' *Galatea 2.2*." *Modern Language Quarterly* 63 (Sept. 2002): 343-63.

Pound, Ezra. "De Goncourt." Editorial. *The Little Review* 5 (July 1918): 56.

---. "Joyce." [1918]. In *Literary Essays of Ezra Pound*. Ed. T. S. Eliot. New York: New Directions, Brown, 1968. 410-7.

---. "*Ulysses*." [1922]. In *Literary Essays of Ezra Pound*. Ed. T. S. Eliot. New York: New Directions, 1968. 403-9.

Powers, Richard. *Gain.* New York: Farrar, Straus and Giroux, 1998.

---. *Galatea 2.2*. New York: Farrar, Straus and Giroux, 1995.

---. *The Gold Bug Variations*. New York: Morrow, 1991.

---. *Operation Wandering Soul*. New York: Morrow, 1993.

---. *Plowing the Dark*. New York: Farrar, Straus and Giroux, 2000.

---. *Prisoner's Dilemma.* New York: Morrow, 1988.

---. *Three Farmers On Their Way to a Dance*. New York: Morrow, 1985.

Pynchon, Thomas. *The Crying of Lot 49*. Philadelphia: Lippincott, 1966.

---. "Entropy." *The Kenyon Review* 23.2 (Spring 1960): 277-92.

---. *Gravity's Rainbow*. [1973]. New York: Penguin Books, 1987.

---. *Mason & Dixon*. New York: Henry Holt, 1997.

---. *Slow Learner: Early Stories.* Ed. Edward Mendelson. Boston : Little, Brown, 1984.

---. *V.* Philadelphia: Lippincott, 1963.

---. *Vineland*. Boston : Little, Brown, 1990.

Redfield, Marc W. "Pynchon's Postmodern Sublime." *PMLA* 104 (March 1989): 152-162.

Rose, Chris. "As Complex as Life." Online posting. 29 Jun. 2000. Amazon.com Readers Forum on *The Gold Bug Variations*. 23 Mar. 2005. <http://www.amazon.com/gp/product/customer-reviews/0060975008>.

Ruppersburg, Hugh, and Tim Engles, eds. *Critical Essays on Don DeLillo*. New York: G. K. Hall, 2000.

Russell, Bertrand. "Questionnaire." Letter. *The Little Review* 12 (Spring 1929): 72-3.

Salzman, Arthur M. *The Novel in the Balance*." Columbia, SC: Univ. of South Carolina Press, 1993.

Simmons, Ryan. "What is a Terrorist? Contemporary Authorship, the Unabomber, and Mao II." *Modern Fiction Studies* 45 (1999): 675-695.

Slatoff, Walter. "Review of Thomas Pynchon's *V*." *Epoch* 12 (Spring 1963): 255-7.

Smith, D. C. "The Imaginary Spaces Humans Create, Furnish, and Inhabit."

Online posting. 13 Aug. 2004. Amazon.com Readers Forum on *Plowing the Dark.* 23 Mar. 2005. <http://www.amazon.com/gp/product/customer-reviews/0374234612>.

Snow, C. P. "Science, Politics, and the Novelist: Or the Fish and the Net." *The Kenyon Review*: 23 (Winter 1961): 1-17.

---. *The Two Cultures*. [1959, 1964]. Cambridge: Cambridge Univ. Press, 1993.

Snyder, Sharon. "The Gender of Genius: Scientific Experts and Literary Amateurs in the Fiction of Richard Powers." *Review of Contemporary Fiction* 18 (Fall 1998): 84-96.

Sokal, Alan, and Jean Bricmont, Jean. *Fashionable Nonsense: Postmodern Intellectuals' Abuse of Science*. New York: Picador, 1998.

Steiner, George. "The Retreat from the Word." *The Kenyon Review* 23 (Spring 1961): 187-216.

Strecker, Trey. "Ecologies of Knowledge: The Encyclopedic Narratives of Richard Powers and His Contemporaries." *Review of Contemporary Fiction* 18 (Fall 1998): 67-71.

---. "Self-Organization and Selection in Richard Powers's *The Gold Bug Variations*." *Critique: Studies in Contemporary Fiction* 45 (Spring 2004): 225-45.

Stuhlman, Frank. "I Have Not Read Much This Number." Letter. *The Little*

Review 5 (July 1918): 64.

Tabbi, Joseph. *Postmodern Sublime : Technology And American Writing From Mailer To Cyberpunk*. Ithaca: Cornell University Press, 1995.

---. "The Wind at Zwölfkinder: Technology and Personal Identity in *Gravity's Rainbow*." *Pynchon Notes* 20-21 (Spring-Fall 1987): 69-90.

Tanner, Tony. "Afterthoughts on Don DeLillo's *Underworld*." *Raritan* 17 (1998): 48-71.

---. *Thomas Pynchon*. London: Methuen, 1982.

Theall, Donald F. *James Joyce's Techno-Poetics*. Toronto: Univ. of Toronto Press, 1997.

Updike, John. "Novel Thoughts." *The New Yorker* Aug. 21/28, 1995: 105-14.

van Dijck, José. "The Language and Literature of Life: Popular Metaphors in Genome Research." In *Wild Science: Reading Feminism, Medicine and the Media*. Ed. Janine Marchessault and Kim Sawchuck. London: Routledge, 2000. 66-79.

Weisenburger, Steven. *A Gravity's Rainbow Companion: Sources and Contexts for Pynchon's Novel*. Athens, GA: Univ. of Georgia Press, 1988.

Weldon, Thornton. *Allusions in* Ulysses*: An Annotated List*. Chapel Hill: Univ. of N. Carolina Press, 1961.

White, Patti. *Gatsby's Party: The System and the List in Contemporary Narrative*.

West Lafayette, IN: Purdue Univ. Press, 1992.

Williams, Jeffrey J. "The Last Generalist: An Interview with Richard Powers." *Minnesota Review: A Journal of Committed Writing* 52-54 (2001): 95-114.

Winterson, Jeanette. *Gut Symmetries*. London: Granta Books, 1997.

Woolsey, John M. Foreword. "The Monumental Decision of the United States District Court Rendered December 6, 1933, by Hon. John M. Woolsey Lifting the Ban on 'Ulysses.'" *Ulysses*. James Joyce. [1934]. New York: Modern Library of America, 1961. xiii-xx.

Zola, Emile. *The Experimental Novel and Other Essays*. [1893]. Trans. Belle M. Sherman. New York, Haskell House, 1964.