

Invisibility, the War Machine and Prigogine: Physics, Philosophy and the Threshold of Historical Consciousness in Pynchon's Zone

Martin E. Rosenberg

Every philosophy must achieve its own manner of speaking about the arts and sciences, as though it established alliances with them. It is very difficult, since philosophy obviously cannot claim the least superiority, but also creates and expounds its own concepts only in relation to what it can grasp of scientific functions and artistic constructions. A philosophical concept can never be confused with a scientific function or an artistic construction, but finds itself in affinity with these in this or that domain of science or style of art. The scientific or artistic content of a philosophy may be very elementary, since it is not obliged to advance art or science, but it can advance itself only by forming properly philosophical concepts from a given function or construction, however elementary. Philosophy cannot be undertaken independently of science or art. It is in this sense that we tried to constitute a philosophical concept from the mathematical function of differentiation and the biological function of differentiation, in asking whether there was not a stable relation between these two concepts which could not appear at the level of their respective objects. Art, science and philosophy seemed to us to be caught up in mobile relations in which each is obliged to respond to the other, but by its own means.

—Gilles Deleuze (DR xvi)

In *Difference and Repetition*, Gilles Deleuze forges alliances among science, philosophy and the arts in order to propose a systems theory of culture-formation based on the distinction between differen(t)iation and differen(c)iation. The first term refers to spatial and temporal difference, as might be charted graphically on a geometric grid; the second term refers to the variations possible of an organism at any particular moment in its history, enabled, for example, by cell division and specialization in an embryo, or by spontaneous genetic mutation in a species.

While Deleuze identifies the first with mathematics and the second with biology, a more precise rendering of the difference between these two versions of difference can be found in Ilya Prigogine's distinction between the precise determinism typical of the time-reversible perspective in physics and the statistical accounts of complex systems typical of the time-irreversible perspective. Often associated with dynamics, the time-reversible perspective refers to the search for laws governing physical events which make sense whether looking forwards or backwards in time, like the movement of planets and comets in Newtonian mechanics, or the trajectories of subatomic particles in Richard Feynman's quantum electrodynamics. Often associated with thermodynamics, the time-irreversible perspective refers to attempts to account for more complex processes, as in nineteenth-century descriptions of entropy as an endgame, or more recent characterizations of entropy as the initial condition for self-organizing processes. Furthermore, this epistemological distinction has ideological weight, particularly if we consider how disciplines like physics may value one epistemological model more than another. Since history has its own ideological struggles, which in turn have their origin in conflicting epistemological stances, we may find Prigogine and Stengers's account of time-reversibility and time-irreversibility as competing stances useful for representing conflicting interpretations of historical events.

Deleuze and Prigogine quote each other on a number of occasions, which lends credence to Deleuze's insistence that it is necessary to forge alliances among science, philosophy and the arts. Indeed, in a recent interview (with the author, May 3, 1994), Prigogine demonstrates familiarity with Deleuze's work, and notes that these two forms of difference, as well as the terms "repetition" and "difference," are coextensive with time-reversible and time-irreversible perspectives in the sciences. Prigogine and Deleuze developed their respective models of physical and cultural processes at approximately the same time, the mid- to late sixties. Further, Prigogine himself has often speculated on the cultural work of his own concepts. That philosophers have recourse to physics and physicists have recourse to philosophy (not to mention that Deleuze writes on literature, painting and cinema, and that Prigogine is an accomplished pianist) reinforces Deleuze's argument (here as well as in *What Is Philosophy?*, written with Félix Guattari) that science, philosophy and art should form alliances since all engage the problematic of chaos, only proceed differently toward it. Some have begun to call such an interdisciplinary pursuit *epistémocritique*.¹

That Deleuze uses physical laws to describe the behavior of human subjects and of complex cultural systems raises questions about the epistemological and ideological implications of adopting tropes from physics to forge such alliances, given the relative power of scientific discourse in our epoch. While I will address these implications in my conclusion, here I want to argue that Pynchon's novel *Gravity's Rainbow*, with its sophisticated treatment of scientific and philosophical concepts, also deserves to be read as a form of epistémocritique. As an artistic construction, it draws on science and philosophy to foreground, especially in its depiction of the chaos of the postwar zone of Europe, the problematic threshold of historical consciousness as that consciousness acts to impose its own order on raw events.

The Threshold of Historical Consciousness

The Zone of *Gravity's Rainbow*, filled with material and human refuse in the aftermath of the Second World War, represents the historical space between two epochs, one an endgame between England and Germany, the other an emerging contest between the United States and the Soviet Union. An explicit triangulation with physics, Deleuze's philosophy of history, and Pynchon's depiction of the Zone leads to a profoundly subversive view of the Second World War and its aftermath.

A short detour will establish a context for Deleuze's philosophy of history. As Hayden White describes the subversive nature of Michel Foucault's historical project: "By denying *all* of the conventional categories of historical description and explanation, Foucault hopes to find the 'threshold' of historical consciousness itself" (239). Using archeological (synchronic) and genealogical (diachronic) methods to destabilize the assumptions of traditional historiography, Foucault seems to pursue Fredric Jameson's search for an "absent cause" modeled on the Lacanian "Real," a search that necessarily restricts itself to the Real's "prior textualization, its narrativization in the political unconscious" (Jameson 35; see also Lacan 80).²

Foucault's method is to turn attention "away from vast unities like 'periods' or 'centuries' to the phenomena of rupture, of discontinuity. . . . [O]ne is now trying to detect the incidence of interruptions" (AK 4). Rather than being the impartial sifter of the "raw material" of "dispersed events" from a fundamental ground of "real" moments and documents at the mercy of "the stigma of temporal dislocation that . . . was the historian's task to remove,"³ Foucault's method is "a deliberate operation on the part of the historian" (8) to pursue moments

that resist the attempts to assert continuity with past and future. Yet rupture is where the threshold of subjective and historical consciousness (what Lacan and Jameson believe “resists symbolization absolutely” [Jameson 35]) reveals itself, when the contract between the historian and the reader of history disintegrates. Seeing the Zone of *Gravity’s Rainbow* in terms of Jameson’s notion that history constitutes an unobservable “absent cause” somehow resistant to the tempting formulations of an *arche* and *telos*, that is, as analogous to the vacuum state in physics, we confront directly the implications of such correspondences among physics, philosophy and history.

In “Practicum Philosophicum,” Foucault argues that Deleuze seeks to scrutinize holes appearing in the energized systems of cultural signification, and goes on to indicate the difficulties inherent in representing what must be unrepresentable. That is, the job of the revisionist historian is to render palpable to a culture what remains invisible to it:

It is this expanding domain of intangible objects that must be integrated into our thought: we must articulate a philosophy of the phantasm that cannot be reduced to a primordial fact through the intermediacy of perception or an image, but that arises between surfaces, where it assumes meaning. (LCP 169)

Thus Deleuze’s work (including that done with Guattari) can be likened to the Dada project of disrupting all cultural contracts as an approach to what Marcel Duchamp calls “blankness” in order to scrutinize holes appearing in the energized systems of signification.⁴ According to Foucault, Deleuze proposes a rigorous exploration of the infinite possibilities inherent in any cultural moment, particularly of the potentialities suddenly available through the chaos of cultural rupture, a potential “that causes every interior to pass to the outside and every exterior to the inside” (LCP 169; cf. Pynchon, GR 373). Yet the difficulties of such a project, its necessarily speculative dimension, suggest that fiction might serve as the proper cultural context for such an analysis. The space opened up in *Gravity’s Rainbow* between England and Germany’s old game and the United States and the Soviet Union’s new game provides us with a historical moment of rupture to explore. Peter Stallybrass and Allon White describe the moment of cultural rupture as a crossroads, the “primary site of contradiction, the site of conflicting desires and mutually incompatible representation” (4). The Zone exemplifies this crossroads phenomenon in its disorderly mingling of structures and flows, of state apparatuses and the

sanctioned violence of alliance warfare, of singular transgressions by nomadic subjects and marginal local alliances of those subjects in opposition to the violence generated by those apparatuses.

What makes scientific and philosophical analogues to the structures and flows of Pynchon's Zone worth exploring are the ways science and philosophy offer identifiable tropical formations for modeling cultural structures and historical processes. Recourse to these tropical formations makes the complex fictional representations of human history in *Gravity's Rainbow* more precisely visible. In fact, much Pynchon scholarship has been devoted to finding textual evidence for these analogues, in the form of source studies. Tom LeClair's *Art of Excess*, for example, does attempt to explicate the use of science in the representation of cultural processes. But the next step has yet to be taken adequately: to show the systematic relations among the various scientific and philosophical analogues as those relations imply models of subjectivity and culture-formation. One such analogue needing further explication is that between the vacuum state in physics and the idea of a threshold of historical consciousness.

The Vacuum State and the "Real"

N. Katherine Hayles has applied the field concept in quantum mechanics and in general relativity to reveal unsuspected patterns in Pynchon's Zone. Quantum mechanics (microscopically) and general relativity (macroscopically) attempt to graph events in relation to the vacuum state. These disciplines employ various matrices, like Feynman or S-Matrix diagrams, and fourth-dimensional geometries, respectively, to impose spatial-temporal order on what is often chaotic and counterintuitive. One might conceive of the vacuum state as a thin membrane separating existence from non-existence. I use the word "membrane" because the word "matrix" confronts a paradox. On the one hand, according to the *OED*, a matrix is a "two dimensional plane in the fourth dimensional geometry of event-particles"—a dense phrase addressing two issues: the unity of force and substance ("event-particles"), and the problem of representation (the geometrical reduction of four dimensions into two). On the other hand, an archaic meaning of matrix is uterus or womb—an apt genealogy for a term signifying the representation of the vacuum state, a void that also possesses potential.

Werner Heisenberg refers to the vacuum state as a box that is "empty and full at the same time" (quoted in Conant 40). Although the vacuum state remains invisible, unobservable, its presence leaves traces. The Lamb Shift, described by an equation used to predict and

calculate the effect the vacuum has on subatomic particles, can be measured precisely. It quantifies, in effect, "virtual" energy potential. In other words, though we cannot see the vacuum, in some mathematically tangible way it exists as the *arche* and *telos* of all physical phenomena. This trope of the vacuum state as Lacan and Jameson's "absent cause," as the condition of cultural blankness that is not as blank as we think it is, hints at the archetype of the mother-sow that not only gives birth but devours its own farrow. The narrator of *Gravity's Rainbow* describes a book Weissmann brings from Weimar Germany to Herero Südwest Africa, Rilke's *Duino Elegies*, as "a gift from Mother" (99); it feeds Blicero's theology of the Oven with an overwrought romantic vision of transcendence through self-annihilation. Robert Oppenheimer invoked Shiva the Destroyer, the mother-devourer, after observing the successful Trinity test near Los Alamos, an event that prefigures the ICBM hanging in infinite regress over the movie theater in which sit all the past, present and future readers of *Gravity's Rainbow*. Further, this particular archetype has a mathematical analogue.

Mathematical principles called operators govern particle interactions "through" the vacuum state as field. Derived from Hamiltonian equations used to determine vectors in classical mechanics, they compute the transformations of the particles themselves as they move in and out of the "events." While there are many kinds of operators, they can be described individually as combinations emphasizing one of three fundamental computations, creator operator, propagator operator, and destroyer operator, that govern events. In contrast with Feynman's dynamic, time-reversible perspective, one of Prigogine's projects is to demonstrate how time itself can function as an operator distinct from the calculations of trajectories (BB 188-90, 219-31).

Having recourse to the non-dialectical relation between time-reversible and time-irreversible perspectives in physics, as well as the non-dialectical relation between Deleuze's "difference" and "repetition," provides the epistémocritic with a certain logic to the circulation of tropes capable of representing the threshold of history, as well as to the rupture of cultural systems that foreground that threshold. The Zone of *Gravity's Rainbow*, as an artistic construction of the chaos of history, represents the condition of cultural contingency in terms of physical laws exemplifying time-irreversibility, and represents the static condition of state power formations in terms of physical laws exemplifying time-reversibility. *Gravity's Rainbow* revels in the promise of cultural contingency, as in the "fork in the road" (556), a phrase that has precise significance in the physics of time-irreversibility. In this way, *Gravity's Rainbow* is typical of avant-garde

tactics of resistance to overt and subtle forms of power. At the same time, it diagnoses the pathological conditions underlying the oppressive inertia of power formations, making concrete Deleuze's dictum that, in subjects as well as cultural systems, "Repetition is pathos and the philosophy of repetition is pathology" (DR 290).

Invisibility: Where Reversibility and Irreversibility Meet

The concept of invisibility helps demonstrate the "alliances" among the philosophy of Deleuze, the science of Prigogine and the fiction of Pynchon, providing at the same time an introduction to the distinction between time-reversible and time-irreversible perspectives on physical and cultural systems. Pynchon actually names Deleuze and Guattari in *Vineland*. The context for the reference concerns the need for a punk band to remain disguised while performing at a Mafia wedding; if their punk identity is discovered, there may be "blood on the wedding cake" (97). The band resorts to performing from "the indispensable *Italian Wedding Fake Book*, by Deleuze & Guattari" (97)—presumably a collection of Italian wedding-song outlines transcribed by Deleuze and Guattari—so they can remain invisible to their hosts yet still earn their fee. This passage raises interesting questions about the relation between transgression and complicity, but the crucial issue here is the linkage of Deleuze and Guattari to the concept of invisibility. Pynchon's interest in invisibility, with reference to physics and philosophy, finds its first sustained articulation in *Gravity's Rainbow*.

We may understand the distinction between visible and invisible characters in the Zone of *Gravity's Rainbow* by noticing their allegiance either to one of the nations involved in the war or to the state of contingency in the political chaos of the Zone. For example, both the English Pointsman and the German Weissmann, in performing loyally in their respective nations' war efforts, seek ever to control the chaos around them. By contrast, the Argentinean anarchist Squalidozzi, on the lam in postwar Germany, one step ahead of the Zone police, is known by his traces in the war's refuse:

For days, as it turned out, the gangsters had known Squalidozzi was in the neighborhood: they could infer to his path, though he himself was invisible to them, by the movements of the police, which were not. Blodgett Waxwing—for it was he—used the analogy of a cloud chamber, and the vapor trail a high-speed particle leaves. (385)

The link between invisibility and political marginality is underscored by Slothrop's contrary trajectory, and his near-disappearance by

“absorption” into the Zone as a carnivalized vacuum state four-fifths of the way through the novel.

Slothrop, “the stray freak particle, by accident, drifting against the major flow” (51), finally beginning to scatter (509), only to reemerge multiple—“there’s no telling which of the Zone’s present-day population are offshoots of his original scattering” (742)—follows a trajectory that cannot be plotted as part of official history. He is no longer observable, and the same invisibility characterizes many other preterite and anonymous characters in the Zone, even whole ethnic groups propagating across the effaced boundaries of old Europe.⁵

Gravity’s Rainbow explores minutely the political chaos in the Zone of Europe as if it were the detritus of an abstract yet palpable multinational war machine: a global mechanical dissipative structure.⁶ Pynchon’s fascination with the effaced boundaries of the Zone also hints at his interest in the social and political processes that become possible when the war machine’s “work” is suspended. This turbulent hiatus occurs after the disintegration of the old game between England and Germany, but before the emergence of the new game between the United States and the Soviet Union.⁷

Gravity’s Rainbow also explores how individuals and groups in the Zone flourish nomadically and aggregate. They survive in a state of contingency amidst the human and material refuse of the Zone, and yet remain largely invisible to the Allied powers staking out rival claims to the remaining material and human capital. This new rivalry is exemplified by the American and Soviet race to appropriate the rocket technology and physicists found at Peenemünde and Nordhausen, the parts for the new machine, the pieces to be used in the new game.

Invisibility has great significance in Prigogine’s formulation of how randomness and contingency signal the beginning of time and its irreversibility in micro- and macroscopic systems that are otherwise described in terms of precision, causality and the reversibility of time (BB xiii; OC 213–33). It has equal significance for Deleuze and Guattari in their formulation of how contingent nomadic individuals and aggregating rhizomes emerge in opposition (in-difference) to the repetitive mechanisms of state power (TP 3–25; 351–423). These aggregating processes become possible beyond the reach of the state mechanisms; furthermore, these processes and mechanisms have both mental and physical existences, within the subject and intersubjective—psychological and cultural. We can therefore interpret the bizarre events in Pynchon’s Zone in terms of an ideological conflict between time-reversible dynamic and time-bound thermodynamic models of physical events, making those interpretive models correspond to human affairs.⁸

Prigogine won the Nobel Prize in Chemistry (1977) for demonstrating how the theory of non-equilibrium thermodynamics can explain statistically processes that seem related to the endgame of entropy, yet which, in contrast, generate order spontaneously out of chaos. Taking this formulation to its broadest implications, Prigogine argues that, although classical and quantum dynamics interpret phenomena as essentially mechanical and governed by precise, time-reversible laws, time-bound, irreversible processes actually exist at all levels of nature. These processes can be understood, however, only by recourse to theories of probability. While inorganic and organic dissipative structures studied in the fields of chemistry and biology provide much of the evidence for this formulation of thermodynamics, Prigogine argues in *From Being to Becoming* for "embedding dynamics within a vaster formalism":

One may say that irreversibility starts where the basic concepts of classical or quantum mechanics (such as trajectories or wave functions) cease to be observables. . . . [T]here is a microscopic formulation that extends beyond the conventional formulations of classical and quantum mechanics and *explicitly* displays the role of irreversible processes. (xiii)

According to Prigogine, time is irreversible in all physical systems. The problem lies with the inability of physicists to locate time's emergence in such a way as to identify the contingencies time poses for those systems, as well as for the epistemological models brought to bear on those systems. In effect, where the irreversible arrow of time emerges remains beyond the ability of physicists to observe: it is invisible.

In dynamics, therefore, we have the assumed ability to observe and predict with precision and certainty the behavior of any system; in thermodynamics, we have recourse to statistical accounts of complex systems, so that both the systems and the results of their analysis remain contingent until equilibrium or, in the case of non-equilibrium thermodynamics, a steady-state is observed. In the design of the internal combustion engine, we have a relation between dynamics and thermodynamics that illustrates through metaphor: first, the hegemonic domination of the time-reversible perspective within applied physics; second, Freud's agonistic model of the subject as a mechanical dissipative structure constituted of (dynamic and reversible) drives forcefully modulating unconscious (thermodynamic and irreversible) processes; third, a way of understanding the originary tropes for corporate fascism.

Prigogine argues that, as engineering became the context for the question of thermodynamic processes (mechanical, thermal or

chemical), two constraints on the observation of those processes emerged.⁹ First, the classical method of accounting for every element in a system was replaced by statistical approximations called "macroscopic parameters." Second, "boundary conditions" needed definition to account for the relation between the system and its surroundings (OC 105-06). In engines, these constraints refer, first, to the need for statistical analysis to predict the behavior of the energy utilized by the engine, and second, to the need to account for the active movement of that energy from one part of the engine to another, as well as the loss of energy from the engine altogether.

Internal combustion engines require two systems, each with a different energy level, to accomplish work. If both systems can be the source of heat flow from hot to cold, then the engine is reversible in the dynamic sense. Yet the Second Law also describes a universal tendency to erase thermal difference through diffusion, resulting in a limit to the utility of controlling heat to produce work. If engines depend on the Second Law to do work and yet have to fight the Second Law to do work, then two constraints result: engines function inefficiently; there is a limit to the amount of energy available. Furthermore, friction threatens the integrity of the mechanical system, as do imperfections in the dynamic system itself: there are limits to precision even in the manufacturing of the engine parts. Such threats necessarily lie beyond the realm of observation: one can never locate with certainty where rust will begin, or where the control of entropy or heat is inefficient, unless one is willing to suspend the operation of the system so it exists outside time.

Thus the industrial revolution required a war of domination, waged by applying the principles of dynamics to mechanical dissipative structures, against the inefficiencies that plague those systems. These inefficiencies are due, in turn, to processes governed by the same law of thermodynamics that enables work to be generated by dynamic machines in the first place. In the nineteenth century, the contradictions inherent in the application of dynamic systems and thermodynamic processes culminate in a world view, best described by Lord Kelvin, that the universe itself tends toward the degradation of mechanical energy. As Prigogine writes:

This world is described as an engine in which heat is converted into motion only at the price of some irreversible waste and useless dissipation. Effect-producing differences in nature progressively diminish. The world uses up its differences as it goes from one conversion to another and tends toward a final state of thermal equilibrium, "heat death." (OC 115-16)

The philosophical implications of this irreversible process were not lost on the nineteenth-century mind. Aside from the shift from a fascination with system and classification in the eighteenth century to the seeming domination by time of the imaginations of all the disciplines in the nineteenth century, the association of time with disorder, decay and death shaped the imaginations of social philosophers like Henry Adams and Oswald Spengler well into the twentieth century. Here we may anticipate the cultural as well as clinical implications of Deleuze and Guattari's polemical statement that "Everything is a machine" (AO 2).

Randomness often seems a threat to the precision of a dynamic system, as when a change in either the boundary conditions or the macroscopic parameters brings a mechanical dissipative structure like a Ferrari spontaneously toward a state of equilibrium, the maximum disorder of rust. Yet, for Prigogine, randomness also signals the moment when a physical, chemical or biological bifurcation point projects alternative futures or histories for such systems as fluid turbulence, catalytic processes or even embryos. These futures, in turn, may indicate increasing orderliness as well as disorderly chaos. Yet that moment is never observable with any certainty because the statistical nature of natural phenomena can never be explained mathematically in terms of the strict causal laws the dynamic perspective formalizes to explain the functioning of mechanical systems.

Explicitly in the introduction to *Slow Learner*, and implicitly in *Gravity's Rainbow*, Pynchon reveals his interest in Henry Adams's conceit that historical processes also remain perpetually contingent and therefore can be interpreted as the perennial threat to "culture" (SL 13, 18-19). In *Gravity's Rainbow*, world order is a steady-state symmetry of national and personal interactions attempting to control and even to thrive on the random violence and chaos of war. The efforts by PISCES to understand/control both the random (pro)creative activities of their pawn Slothrop and the destruction caused by the seemingly related V-2 strikes on London reveal the bias of official state power toward precise dynamic, symmetrical and mechanistic forces, while that power remains closed and vulnerable to the entropic processes of history, which by definition must be contingent.

Pynchon's seemingly amoral vision of Second World War antagonists as parts of a multi-national war machine, and of the preterite strategies of resistance against it, is congruent with Deleuze and Guattari's meditations on power in *Anti-Oedipus* and *A Thousand Plateaus*. They argue that power "has three aspects or zones":

(1) its zone of power, relating to the segments of a solid rigid line; (2) its zone of indiscernibility, relating to its diffusion throughout a microphysical fabric; (3) its zone of impotence, relating to the flows and quanta it can only convert without being able to control or define. It is always from the depths of its impotence that each power center draws its power, hence their extreme maliciousness, and vanity. Better to be a tiny quantum flow than a molar converter, oscillator, or distributor! (TP 226)

State power is coextensive with that state's powers of observation. The "zone of power," indicating the coercive force of the state, is continuous with the "zone of indiscernibility," the capillaries of power (described by Foucault) that are beyond the realm of concrete observation ("microphysical") because they remain within the realm of discourse, binding the populace together through various institutional and ideological regimes. Within or beyond these two zones lies the "zone of impotence," where cultural "flows" of desire and human "quanta" cease to be observable to those regimes and thus lie beyond the control of state power. Slothrop, Squalidozzi and Tchitcherine exemplify the behavior of such quanta. Just as the traditional discipline of physics remains committed to removing uncertainty and imprecision from the description of nature at the quantum level, continuing to search for the final particle from which all others are "built," the state fears the "zone of impotence" as its source of random activity, its socio-political entropy, its historical uncertainty as a system.

For Oswald Spengler, committed to nineteenth-century assumptions about physics (and whose thinking resembles Pointsman's), the statistical formulations that, by the 1920s, stood at the heart of both thermodynamics and quantum mechanics bespeak the collapse of a culture for which "absolute scientific exactitude" (417) constitutes the central assumption. A physics based on contingency and uncertainty is, for Spengler, a symptom of decline, of "cultural entropy," presaging *Götterdämmerung*: "What the myth of *Götterdämmerung* signified of old . . . the theory of Entropy signifies to-day" (423-24). Randomness, a lack of precision associated with the theory of entropy but now seen at the heart of all the human and natural sciences, symptomizes that decline. Spengler sees no important distinction between the philosophical significance of the statistical methods underlying quantum mechanics and the significance of those same methods used by thermodynamics. The historical appearance of these statistically-based physical theories symptomizes a decline of the West (a circular assumption that derives its metaphorical power by reference to entropy, the Second Law of Thermodynamics). Here, decline is troped

by a loss of control. And in a screwy way, Spengler's confusing, self-contradictory account of imprecision as the common denominator in quantum mechanics and thermodynamics is close to the mark, for *the* problem in the philosophy of science, according to Prigogine, concerns reconciling the fundamentally contingent nature of time's arrow with reversible, geometrical accounts of physical processes. As we will see, Spengler's zany physics matches Pynchon's blurring of the boundaries between the dynamics of quantum events (with reference to symmetry-breaking) and irreversible processes from thermodynamics, with the difference that Pynchon simply inverts Spengler's conceit for his own imaginative ends.

Deleuze and Guattari emphasize an important distinction, within the realm of war, between the state as a mechanical dissipative apparatus feeding on human and material capital, and the zone of death and destruction produced by that war machine as refuse or waste. The chaos of war as a scene also creates the initial conditions that enable action invisible to and opposing the war machine: it constitutes the site of that machine's impotence. Thus this war scene or Zone exists simultaneously as a realm produced by precise if violent rules and as a state of structural disintegration and social turbulence where individual subjects may exist anonymously as nomads and aggregate into rhizomes (TP 351-423).

Besides explicit references to war as a machine, *Gravity's Rainbow* contains two particularly interesting representations of war as a mechanical dissipative structure that exemplify the ideological and epistemological implications of the time-reversible perspective: allusions to the symmetrical and reversible movements of chess pieces as they form and reform in patterns of violence; and symmetrical plot trajectories of characters and of nations as if they were sub-atomic particles capable of graphic representation in Feynman diagrams. These examples link the time-reversible geometrical ideology of dynamics to the complicity of individuals and nation-states engaged in war. Yet, as we confront each dissipative structure, we will find that structure being deconstructed by the narrative, so that disrupted chess games, asymmetrical particle trajectories, and impossible social systems give the lie to the tropical "grounds" for the machinery of war in physics.

We also notice, in the refuse of Europe created by the war machine, the invisible and contingent status of the nomads Squalidozzi, Slothrop, Geli Tripping and Tchitcherine, among others. These characters wander and then aggregate into temporary alliances, like chance love-dalliances, larger orgiastic convolutions, and black-market activities, at the margins of the nation-state war machines. The "great,

frontierless streaming" (GR 549) of the displaced peoples in the Zone becomes both vital and turbulent, a field far from equilibrium. These anonymous subjects are the refuse of the warring state; yet, collectively, they embody all virtual cultures and ideologies, in a reified sense of carnival.¹⁰ This reification lies, not with carnival per se, but with the way tropes referring to time-irreversible thermodynamic systems represent the promise of carnival liberation for this mass of humanity from the matrices of the war machine.

Thus Pynchon's plotting techniques in the sections set in the Zone can be explained scientifically in Prigogine's terms and politically in Deleuze and Guattari's terms. That is, the ways invisible nomads in *Gravity's Rainbow* emerge spontaneously, interact, and aggregate correspond with time-irreversible processes and with radical social theory. The possibilities for order generating itself spontaneously out of chaos—the full-fledged insurrection of the subjugated Herero rocket troops, the black-market dealings of Slothrop and Squalidozzi, Slothrop's chance link to Tchitcherine through his affair with Geli, Tchitcherine's behavior as "a giant supermolecule with so many open bonds available at any given time, and in the drift of things . . . in the dance of things" (GR 346)—all indicate in precise ways how the anonymous individuals in the Counterforce might thrive locally in opposition to the totalizing processes of the state.

Analysis of *Gravity's Rainbow*, however, must eventually confront the formation within the Zone of orders that codify the time-irreversible perspective of non-equilibrium thermodynamics. By demystifying the natural-law claims inherent in the use of time-reversible tropes to describe and legitimate cultural order, we will find that Pynchon's own implicit claims for legitimacy are grounded in time-irreversible tropes of cultural order. Thus, by resorting to physics, the text demonstrates self-consciousness of its own complicity with the dominant ideological apparatuses it so clearly seeks to transgress.

Reversible Systems A. Chess

In *Gravity's Rainbow*, key indications of war as both precise structure and chaos are the many references to chess. One of which is Marcel, "a mechanical chessplayer dating back to the Second Empire." Patterned on the artist and chess master Marcel Duchamp, this robot has "a rather remote manner." His "exquisite 19th-century brainwork" is not well suited to linguistic play: "much too literal with humans" (675). Marcel, "who may be a bit repressed" (677), is accused of having no "'soul'" (679), but seems to be the source of an

allusion to Kabbalah with the earnestness Jack Burnham ascribes to the historical Duchamp.¹¹

These allusions to the avant-garde artist set the stage for making connections among the other references to chess. These include an iron queen of a railroad carriage giving the lie to Spengler by drawing the preterite masses to the endgame of thermodynamic doom (GR 3), and Weissmann delaying the end of a chess game with Ilse to keep her from Pökler (407–08). The underground hero der Springer is described as the “knight who leaps perpetually . . . across the chessboard of the Zone” (376), while Slothrop plays chess with Pökler (576), uses a plastic knight given him by Säure Bummer as an underground ID when he meets der Springer (494), and, like der Springer, quantum leaps around the zone as well. Slothrop’s Soviet counterpart, Tchitcherine, talks chess metaphors with Wimpe, the drug salesman (344), and plays chess with Mravenko, “the most maniacal, systemless chess player in Central Asia” (611). All these references suggest that Duchamp’s chess treatise on the geometry of kings’ movements at endgame, *Opposition et les cases conjuguées sont réconciliées*, might help model the tension between reversible and irreversible perspectives with reference to the blankness of a cultural field represented geometrically.

Opposition et les cases conjuguées sont réconciliées describes a non-dialectical plotting of repetitive, symmetrical rituals of “opposition” and the contingent disruption of those rituals as “breach of opposition.” “Opposition” and “breach of opposition” help delineate the rules governing the avoidance patterns of the two kings that at this late stage in the chess game are stripped of all protection save for one or two immobile pawns. These pawns, though paralyzed and helpless, remain powerful enough to end the endgame by transforming themselves into queens if they can march safely across the board. The importance of the pawns, however, recedes into the background, since “opposition” refers only to the positional balance between the kings in a geometry of cowardice: what goes on in the minds of the players is more important than what is on the board. Furthermore, one cannot win following Duchamp’s strategy; one can only avoid defeat through endless repetition. “Breach of opposition” refers to a disruption of that regal equilibrium, a moment of difference in the form of a positional disadvantage that precipitates the end of the endgame, a confrontation with the blank chessboard that the players avoid at all cost by moving the kings in a way that seems like the random meandering of molecules in a state of terminal equilibrium or systems death.

Duchamp’s chess treatise also constitutes a rhetoric of the aporia, of the charged moment he calls, in *The Green Box* notes to *The Large Glass*, “exposure” (WMD 28), a corollary to “blankness.” Art, the

interference of creative and hermeneutical activities of artist and observer, is the "delay" of "exposure" (26). The chess treatise's strategic vision of the laws governing the artist and observer, and the reader sitting in a movie theater in Los Angeles in 1973, watching the movie *Gravity's Rainbow*, is to delay the end of the endgame as long as possible, dividing the last delta-t, keeping the ICBM in infinite regress above the roof. The end, of course, may be death, but it may also be worse—endless meandering: "just waking up one day, and knowing that Queen, Bishop, and King are only splendid cripples, and pawns, even those that reach the final row, are condemned to creep in two dimensions, and no Tower will ever rise or descend" (GR 494).

The narrative of *Gravity's Rainbow* focuses initially on how various characters interpret the relation between Slothrop's map graphing his sexual dalliances and Roger Mexico's map of V-2 strikes on London. Mexico uses a map "ruled off into 576 squares" (GR 55), which, assuming it is symmetrical (24 x 24 squares), resembles an arrangement of nine chessboards, three by three. The fact that the patterns of events, sexual (pro-creative) and destructive, noted on the two maps precisely coincide unnerves everyone who has "the need to know."

Pointsman assumes a causal relation. Thus he plots to keep Slothrop under surveillance to discover that causal relation. But Mexico's understanding of an order based on statistical analysis of random events (the Poisson equation) sets up an ideological struggle between Pointsman and Mexico over reversible Newtonian (dynamic) and irreversible statistical (thermodynamic) perspectives on the "eventness" of all phenomena (a concept associated largely with the quantum mechanics of Niels Bohr). While the Poisson equation is not assimilable to the irreversibility of thermodynamics, it shares with Heisenberg's work and with various accounts of thermodynamics a concept of contingency and randomness in the behavior of systems.

At least in one context, by creating the circumstances in which chess players can overdetermine the trajectories of their kings up to the point of their incompetence (when contingency intrudes in the form of a mistake), Duchamp's chess treatise spoofs the attempt to use the ideology of time reversibility to control, as a machine controls heat, the contingencies of physical and cultural events. The crucial strategy in chess, especially at endgame, involves avoiding defeat, which in turn requires maintaining symmetrical "equilibrium" (a term from thermodynamics, it can mean either maximum disorder or stasis) between the two kings, regardless of the position of the pawns. As described in Duchamp's treatise, computing the geometry of opposition at endgame requires the imposition of mirror symmetry on an otherwise

asymmetrical chessboard by conveniently losing one row or file, and, in some cases, by extending the geometry of the board to imaginary squares beyond its borders (Fig. A).

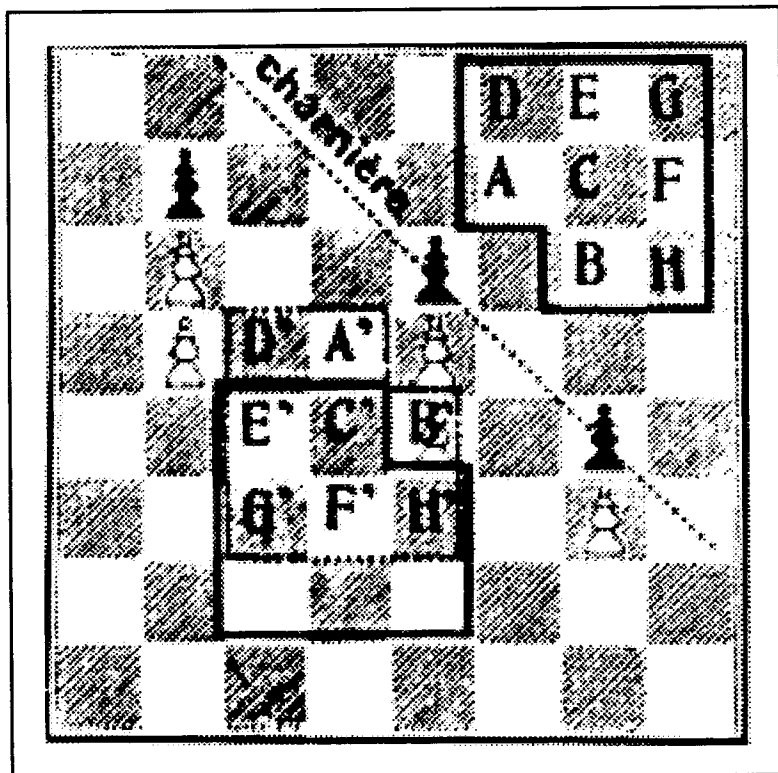


Fig. A

By seeing in terms of chess the coincidence of creative and destructive events in the same square, and embedding that square in a formal pattern over a larger, perfectly symmetrical order of squares (three chessboards on a side), we can understand how the geometry of Slothrop's and Mexico's maps encourages Pointsman to assume it is possible to control those events. By encompassing these local images of random, asymmetrical and irreversible events—"winning" and "losing," as in Slothrop getting "lucky" and a block of London getting atomized—the overall grid of London suggests a static, symmetrical order absorbing and containing irreversible events, similar to the way an engine controls the irreversible processes of entropy to produce work, similar as well to the tacit agreement of two chess

players to employ the same geometry of opposition to restore equilibrium. We have here, first, a game theory of war, and second, a description of war as a dissipative structure sustaining itself with the flows of mayhem and suffering. Chess therefore tropes the fascist implications of war as a dissipative structure involving the complicitous participation of warring nations.¹²

But notice the hostility Katje's hypothetical Herero counterpart in Weissmann's Grimm fantasy has for the game:

Perhaps the black girl is a genius of meta-solutions—knocking over the chessboard, shooting the referee. But after the act of wounding, breaking, what's to become of the little Oven-state? Can't it be fixed? Perhaps a new form, one more appropriate. (102)

Again, when Weissmann keeps Leni from Pökler, Pökler fantasizes storming the *generaldirektor's* office and crossing the line into insubordination:

Hardly any news of Leni. They had been separated, Ilse said, during the winter. She'd heard a rumor that her mother had been moved to a different camp. So, so. Present a pawn, withdraw the queen: Weissmann, waiting to see how Pökler would react. This time he had gone too far: Pökler laced up his shoes and calmly enough went out looking for the SS man, cornered him in his office, denounced him before a panel of kindly, dim governmental figures, the speech eloquently climaxing as he threw chessboard and pieces all into Weissmann's arrogantly blinking face. (417-18)

But even such a would-be transgressive act, Pökler goes on to fantasize, can be accommodated by the system: "Pökler's impetuous, yes, a rebel—but Generaldirektor it's his kind of fire and honesty we need" (418).

Such references to disrupting or transforming the game of chess occur with characters at first acting in complicity with their respective states at war, but then refusing to participate any longer, and contemplating going underground and becoming fugitives. For example, Katje refuses to continue working for the Germans and/or the Dutch underground on the "right" side of the war, where her activities included sending three Jewish families east to demonstrate her fealty to the Reich:

Indeed, why did she leave Schußstelle 3? We are never told why. But now and then, players in a game will, in lull or crisis, be reminded how it is,

after all, really play—and be unable then to continue in the same spirit. . . . Nor need it be anything sudden, spectacular—it may come in gentle—and regardless of the score, the number of watchers, their collective wish, penalties they or the Leagues may impose, the player will, waking deliberately, perhaps with Katje's own tough, young isolate's shrug and stride, say *fuck it* and quit the game, quit it cold. (107)

Elsewhere in the novel, Wimpe, Tchitcherine's mentor, tries, opportunistically, to explain the discipline of organic chemistry in terms of chess, necessarily premised on the laws of non-equilibrium thermodynamics:

"Think of chess," in his early days around the capital, looking for a comparison that Russians might take to, "an extravagant game of chess." Going on to show, if his audience was receptive . . . how each molecule had so many possibilities open to it, possibilities for bonding, bonds of different strengths, from carbon the most versatile, the queen, "the Great Catherine of the periodic table," down to the little hydrogens numerous and single-moving as pawns . . . and the brute opposition of the chessboard yielding, in this chemical game, to dance-figures in three dimensions, "four, if you like," and a radically different idea of what winning and losing meant. (344)

Wimpe offers no less than to transform the ideological warfare between the time-reversible geometrical perspective of dynamics and the time-bound statistical formulations of thermodynamics by merging them in an ideology of cooperation. But his words are heeded only by Tchitcherine in a Soviet culture committed to chess and war. Chess, therefore, underscores the complicitous relation between antagonists. To escape that complicity requires recourse to another game and another set of rules, like the guerrilla tactics of Go, based as it is on contingency of place, anonymity of identity, aggregation of forces and lines of flight. We may observe these tactics in the shenanigans of characters on the lam in the Zone.

First, we should extrapolate this initial image of war as a chess game, a symmetrical dissipative structure encompassing asymmetrical events, to the entire European theater, as we switch from the first, London section of *Gravity's Rainbow* to the sections devoted to events on the continent. We will do so by reference to another time-reversible model, Feynman diagrams of quantum electrodynamic interactions, the symmetries of which Richard Feynman himself has described in terms of chess (CPL chap. 2).

B. Feynman Diagrams

The value of the Feynman diagram lies with its extreme flexibility. Designed to explain the bizarre and paradoxical behavior of elementary particles, it can represent both microscopic and macroscopic events. The Feynman diagram glimpses the world from the point of view of the vacuum state. It can represent the events of Newtonian physics as a "special case," but the matrices of Newtonian mechanics cannot "see" what the Feynman diagram reveals.

Its specific function is to map events of interacting sub-atomic particles, as they transform each other and as they are transformed by mathematical operators embedded as laws governing the vacuum state as field. The ideological assumptions inherent in such a model are obvious. As Feynman says of the goals of the theory and the experimentation it spawns:

It is natural to wonder how far we can push this process of splitting events into simpler and simpler subevents. What are the smallest possible bits and pieces of events? Is there a limited number of bits and pieces that can be composed to form all the phenomena that involve light and electrons? Is there a limited number of "letters" in this language of quantum electrodynamics that can be combined to form "words" and "phrases" that describe nearly every phenomenon of Nature?

The answer is yes: the number is three. There are only three basic actions needed to produce all the phenomena associated with light and electrons. (Q 83-84)

The three basic actions are: 1) a photon moves from one place to another; 2) an electron moves from one place to another; 3) an electron emits or absorbs a photon (Q 85-86). At the risk of oversimplifying Feynman's model, we can reorganize it to say that an electron or photon can be created/emitted, move from place to place, or be destroyed/absorbed. For example, when a photon is operated on by a virtual potential of the vacuum (the Lamb Shift), it "shakes" apart, spontaneously creating paired particles, an electron (e^-) and a positron (e^+). Inversely, when an electron and a positron collide, both are annihilated, producing a photon in the process. These two events can be graphed along a normal time-space axis (Figs. B and C).*

*The editors would like to thank Kevin R. Fait for executing Figs. B-H and J.

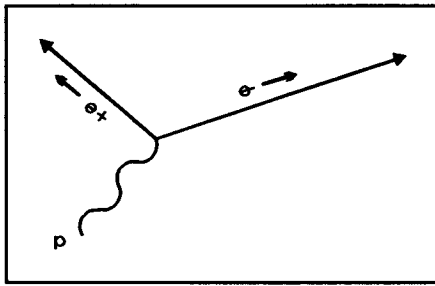


Fig. B

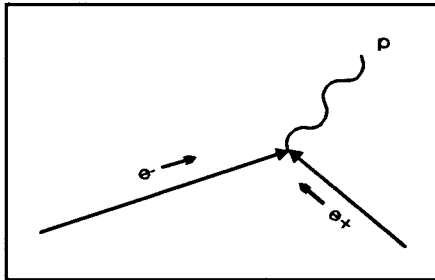


Fig. C

However, the unusual property of the Feynman diagram is its ability to be interpreted from any side of the implied rectangle. Thus, side a in Fig. B is also side c in Fig. C. This interpretive innovation completely disrupts all normal distinctions between cause and effect, time and space, unitary particles and the wave function of energy, so that all that can be defined as really there are events as transformations, according to the First Law of Thermodynamics. This helps explain Pynchon's anthropological concern with Herero cosmology:

"There are peoples—these Hereros for example—who carry on business every day with their ancestors. The dead are as real as the living. How can you understand them without treating both sides of the wall of death with the same scientific approach?" (GR 153)

Herero ancestor-worship thus underscores the irony of Wernher von Braun's metaphysics of the conservation of energy, since the spiritual comfort von Braun derives from his studies in applied physics informs and inspires his transformed allegiance from German to American, and justifies his gift of rocket technology, married to the nuclear technology developed by America's other German physicists, which in turn

threatens to transform us all in an irreversible event. The First Law of Thermodynamics is small comfort for those sitting in the movie theater in Los Angeles almost thirty years after the main events of the novel, with an ICBM hanging the last delta-t above the roof.

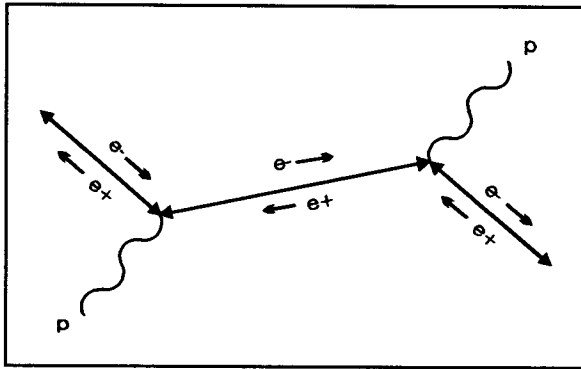


Fig. D

According to the logic of the Feynman diagram, a positron ($e+$) simultaneously functions as an electron ($e-$) moving backwards in time. Therefore, any event can be interpreted as an act of creation and as an act of destruction, simultaneous causes and effects propagating backwards and forwards in time. The distinction between future and past, and between space and time is much less sharp on the level of elementary interactions than it seems on the scale of Newtonian physics. The same Feynman diagram can represent four different, equally valid physical events, depending on which dimension we choose to call time forward, time backward, or space. Here we understand that an electron is a positron traveling forwards in time. Using the space-time histories in Feynman diagrams, we can examine the process of a photon creating an electron-positron pair, then the electron meeting a second positron and annihilating into a photon again. Before the process, we have a photon and an electron or a positron, depending on the orientation of the diagram; the same is true when the process is over. In the intermediate stage, we have two electron-positron pairs being either created or destroyed, and two photons either shaking apart or being produced from the annihilated particles (Fig. D). Extending the logic of these diagrams to demonstrate the time-reversible perspective embedded in Feynman's system of analysis, we get a picture of one actor—an electron (which has the properties of both a wave and a particle)—existing in three

different locations at the same time, or at three different times in the same location (Fig. E).

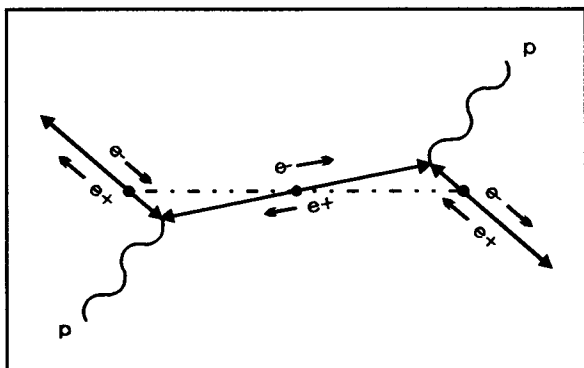


Fig. E

Such a quantum mechanical view of the field as a tissue of reversible events conceivably generated by just two actors, a self and an other, has explicit analogues in *Gravity's Rainbow*:

Here now is Crutchfield or Crouchfield, the westwardman. Not "archetypical" westwardman, but *the only*. Understand, there was only one. There was only one Indian who ever fought him. Only one fight, one victory, one loss. And only one president, and one assassin, and one election. True. One of each of everything. You had thought of solipsism, and imagined the structure to be populated—on your level—by only, terribly, one. No count on any other levels. But it proves to be not quite that lonely. Sparse, yes, but a good deal better than solitary. (67)

This example plays on the historical implications of the Feynman diagram showing an electron or positron in three places at the same time or at three times in the same place. A diagram like Fig. D indicates powerfully the shift from a personal to a statistical model of history, or more probably the straddling of both, extrapolated to the *n*th dimension in Crutchfield's bawdy song:

One little hustler in San Berdoo,
 One little chink run away from the railroad
 With his ass just as yellow as Fu Manchul
 One with the clap and one with a goiter,
 One with the terminal lepro-see,
 Cripple on the right foot, cripple on the left foot,

Crippled up both feet 'n' that makes three!
 Well one little fairy, even one bull dyke,
 One little nigger, one little kike,
 One Red Indian with one buffalo,
 And a buffalo hunter from New Mexico (68)

These historically reversible and timeless symmetries are a catalogue of imperial oppression, which also captures the kernel vision of Slothrop's ancestor William, whose Tract *On Preterition* attempts to reveal the master-slave disequilibrium at the heart of such symmetries:

Nobody wanted to hear about all the Preterite, the many God passes over when he chooses a few for salvation. William argued holiness for these "second Sheep," without whom there'd be no elect. You can bet the Elect in Boston were pissed off about that. And it got worse. William felt that what Jesus was for the elect, Judas Iscariot was for the Preterite. Everything in the Creation has its equal and opposite counterpart. How can Jesus be an exception? could we feel for him anything but horror in the face of the unnatural, the extracreation? Well, if he is the son of man, and if what we feel is not horror but love, then we have to love Judas too. Right? (555)

Everything may have "its equal and opposite counterpart," but the opposition in history becomes unequal, like master and slave, and gets chronicled by Jesus and not Judas, by the elect and not the preterite. The most visible modes characters use to interpret the events of the novel, Newtonian and Pavlovian dependence on causality, and Puritan dependence on typology (which determine significance looking forward and backward, respectively, in time), demonstrate their limited utility, indeed their fictiveness.

We have now an imaginative view of history as a tissue of events, of one pair of self and other, and one event occurring everywhere and at any and every time. This completely disrupts our normal frame of reference, the frame that insists on relentless diachrony, an insistence extending to the epistemological conditions that usually enable us to enjoy fiction, film and traditional historiography. Thus, one of the implications of the Feynman diagram, and of quantum mechanics generally, concerns its extension of the Newtonian world view of timelessness. At some distinctly alien level of intelligence, nothing ever really happens at all. This may be why the central character of *Gravity's Rainbow* is called Slothrop, though the name does appear in Pynchon's early story "The Secret Integration." Slothrop renounces, by association, the "Fascist ideal of Action, Action, Action, once

[Richard Halliburton's] own shining reason for being. No more. No more" (GR 266).

Andre Sakharov has described this universe as far from equilibrium, that is, in some abstract sense, alive (cited in Prigogine, OC 230). Pökler's mentor, Mondaugen, adds a new dimension to the Poundian belief that the artist is the antenna of the race, inverting the electromagnetic energies. In his "electro-mysticism" (GR 404), Mondaugen seeks a signifiatory equilibrium that is somehow salutary, like Duchamp's blankness, and identified on some fundamental level with the "folk-consciousness" (GR 130) the war state makes inaccessible by creating interference fields:

Think of the ego, the self that suffers a personal history bound to time, as the grid. The deeper and true Self is the flow between cathode and plate. The constant, pure flow. Signals—sense-data, feelings, memories relocating—are put onto the grid, and modulate the flow. We live lives that are waveforms constantly changing with time, now positive, now negative. Only at moments of great serenity is it possible to find the pure, the informationless state of signal zero. (404)

The interpretation of the connection between the subject and the field and of the events propagating through the field depends on which way we hold the implied rectangle of the Feynman diagram. Future and past are relative to the standpoint of observation: the reversible perspective reveals the deeply comforting reality that the world consists of vertices and paths only. Pynchon transforms these approaches to the event into historical terms.

Pointsman lives in the world of the classical matrix, of either/or, willfully superimposing a grid on historical and psychological processes to delineate the movements from a to b without the uncertainties inherent in Mexico's form of statistical analysis. He is bewildered by apparent time-reversals and by juxtapositions of creation and destruction that seem to violate cause and effect. A trained psychologist and disciple of Pavlov, he cannot accept either Pierre Janet's mysticism or Mexico's statistical analysis. For Pointsman, the concept of "complementarity," the simultaneous coexistence of opposites, is a form of "surrender" (GR 49–50).

The competing world-view, however, which appears with Mexico's reliance on the Poisson equation as a statistical model of reality to explain random events, raises its own problems. As a tool for analyzing the past, it is quite accurate, but as a predictor of the future, it is, to some, regrettably imprecise. When Roger tries to explain to Jessica their chances of being hit by the rocket, she refuses to accept

that they remain at the mercy of randomness, that they can know their chances in relation to the whole distribution but not for each individual rocket screaming across the sky: "Why is your equation only for angels, Roger? Why can't we do something, down here? Couldn't there be an equation for us too, something to help us find a safer place?" (54).

Helplessness constitutes a crucial effect for the emerging voices of the new world-view that can embrace randomness. The identification of fascism with "Action, Action, Action" also means that, when world history approaches a bifurcation point, a fork in the road, official history becomes the narrative of the road taken, while the history of *Gravity's Rainbow* describes the road not taken.

It might be possible to construct a Feynman diagram complex enough to account for all the activity in *Gravity's Rainbow*, but such a model would be as complex as the novel itself, as convoluted as one of its incestuous orgies, and as difficult to decipher. But, if we arbitrarily close off or frame one particular event and one pair of nations or actors at a time, we can distinguish between a real and a virtual particle, and thus between official and unofficial history, by tracing the movements of those nations or actors as they enter and leave the diagram. We will discover that, from the perspective of official history, the activities of the nation-states are real and visible, while the activities of preterite characters like Slothrop, Squalidozzi, Pökler and Tchitcherine remain virtual and invisible.

This sets up for our interpretive pleasure an opposition between official and unofficial historical discourses. The fork in the road implied by the ways official history prevails suggests how asymmetrical, time-bound processes emerge out of the fearful symmetry of the quantum field, even if those random fluctuations result in the propagation of the system to still another war event. The irony of having *Gravity's Rainbow* open and close with the ICBM hanging above the movie theater containing the novel's own readers lies in the apocalyptic confrontation: we as readers will be unable to perceive the process culminating in mutual annihilation after the fact; our "saving grace" lies with our ability to cognize the general laws revealed in Pynchon's hidden, preterite movie, before it is "too late" (GR 3).

We experience history in *Gravity's Rainbow* through moving backward in time by generally direct and accurate historical reference and forward in time by topical allusions to analogous events in parallel cultural histories. Two oppositions of nation-states are central: England and Germany annihilating each other; the United States and the Soviet Union emerging from the refuse created by that annihilation. As a rule, the geographies and official histories of England and Germany are

portrayed with detailed accuracy, while we infer the future of the United States and the Soviet Union by metaphor and allusion through the lives of the unofficial, virtual-historical characters Slothrop and Tchitcherine, each "only the stray freak particle, by accident, drifting against the major flow," the might-have-beens of their respective nations.

The resulting graphic depiction of narrative and historical lines of force constitutes a field theory of narrative and history reminiscent of the vectors on Duchamp's chess board.¹³ As Slothrop, Bodine and Solange comment on the many plots and subplots surrounding them:

"This is some kind of a plot, right?" Slothrop sucking saliva from velvet pile.

"*Everything* is some kind of a plot, man." Bodine laughing.

"And yes but, the arrows are pointing all different ways," Solange illustrating with a dance of hands, red-pointed finger-vectors. (603)

Feynman diagrams can represent the interferences between nations and characters in *Gravity's Rainbow*.

To understand these interactions of nations and characters, we must recognize the difference between real and virtual photons and electrons. Real and virtual particles constantly interact in the world of Feynman diagrams. In Fig. F, we have two examples of virtual particle interactions: the first is the virtual exchange of a photon between two electrons; the second is the emergence of a vacuum bubble created by two electrons colliding head-on.

Assuming the ontological stability of the vacuum state independent of the particles/events propagating through it, we can make the following claim: All lines in Feynman diagrams have to begin somewhere (created from vacuum) and end somewhere (destroyed, returned to vacuum). Therefore, there is ultimately no real change. Everything observed even at the level of quantum electrodynamics is really the intermediate states of a fluctuation. Only from the perspective of a local observer do things happen. For our purposes, however, real photons and electrons enter and leave the diagram; virtual photons and electrons do not. Thus the description of Slothrop as "the stray freak particle, by accident, drifting against the major flow" is a corollary for his disappearance well before the end of the novel, and for the peculiar and officially "invisible" trajectories of other characters associated with the counterforce in the Zone.¹⁴ They are virtual, while Pointsman, Blicero and other cogs in the war machine are real.

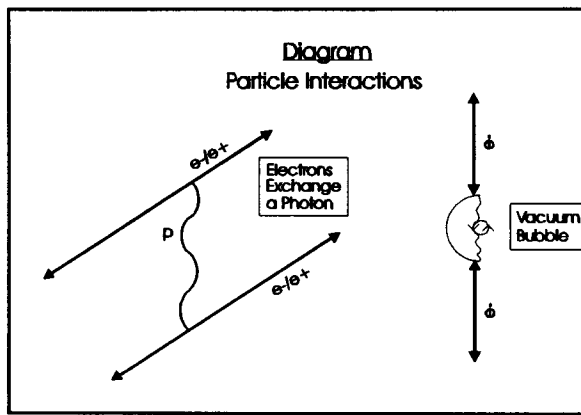


Fig. F

Using the same Feynman diagram as in Fig. E, we can now represent the historical and narrative symmetries of *Gravity's Rainbow* (Fig. G). Here we have Americ/ka entering the event of the Second World War and, in its convulsion, "shaking apart" into a negative (e-) real character moving forward in time, the immigrant Wernher von Braun absorbed by the United States upon the annihilation of Germany, and a positive (e+) virtual character of indefinite trajectory, Slothrop. Turning the diagram upside down, we have the Soviet Union entering the event, splitting into two Tchitcherines, one negative character responsible for a treaty (at Rapallo, wartime home of Ezra Pound) with Weimar Germany moving forward in time, one positive character "from Nihilist stock" (GR 338) also of indefinite trajectory. The ways the now indeterminate Slothrop and Tchitcherine converge, mediated through Geli Tripping, and unmediated when they meet at Peenemünde and exchange clothing, represent some of the microscopic coupling and macroscopic aggregating processes at work in the Zone that remain invisible to the war state. Furthermore, an earlier bifurcation, before the sinking of the Russian fleet in the Russo-Japanese War, splits apart the offspring of a sailor, the Russian Tchitcherine and the Herero Enzian. A secondary plot involves Tchitcherine's desire to collide with his half-brother in the Zone (reminiscent of the "Lazarus" episode of the original *Twilight Zone*), which, given their representations on a Feynman diagram, would be, mercifully, impossible.

Through a slight displacement of trajectories, Wernher von Braun and the Rapallo Tchitcherine can be seen as propelling towards the second event, the ICBM hanging the last δ -t above the theater. The Russian diplomat, "a long-term operator," believes in a static political order, a steady-state structure sustained by a steady diet of

bureaucrats: "a State that would outlive them all, where someone would come to sit in his seat at the table just as he had slipped into Trotsky's—sitters would come and go but the seats would remain" (GR 338).

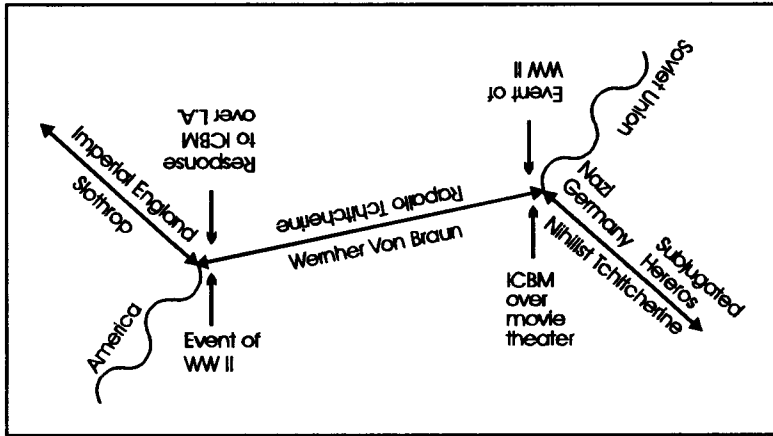


Fig. G

We can also use the Feynman diagram to represent the symmetrical trajectories of England and Germany, matching references to British colonialism with references to German domination of the Südwest. British imperialism, seen through the pre-war duties of characters like Pirate Prentice, leads to the collapse of the perpetual sunshine of the "Commonwealth" and to obsequious acquiescence to the Americans and their kitsch-culture. German imperialism, solidifying a racist ideology and leading to the genocide of the Hereros, then propels the Reich to the Holocaust and the self-annihilation professed by the Rilkean Weissmann/Blicero. More important, however, are the ways the past activities centered on master-slave relations identified with the old game of England and Germany allude to future events in the new game of the United States and the Soviet Union. Generally, the references move from the explicit past (pre-war) to the implied future (postwar). A number of such "Kute Korrespondences" (GR 590) occur.

Most crucial are the topical references to American history. The German colonial war in the Südwest, besides prefiguring genocidal atrocities against the Jews, also prefigures American atrocities in Vietnam, even using Vietnam-era idiom. As Enzian recounts:

"Forty years ago, in Südwest, we were nearly exterminated. There was no reason. Can you understand that? *No reason.* We couldn't even find

comfort in the Will of God Theory. These were Germans with names and service records, men in blue uniforms who killed clumsily and not without guilt. Search-and-destroy missions, every day. It went on for two years.” (362)

The freshness of the references to an unpopular war, to incompetent, guilt-ridden draftees, to “search-and-destroy missions,” suggests that America propelled itself towards another event that was the culmination of tendencies fostered during the World War, inverting the experience of Germany, whose self-annihilation can be seen in retrospect through its imperial and racist adventures in the Südwest. Thus we see how the “progress” of America and Germany can be graphed upside down opposite each other on the same Feynman diagram. A similar pattern is suggested with Russian hegemony over Central Asia as the successful extension of policies thwarted by the Japanese in 1904–05, and British hegemony over India and elsewhere leading to England’s overextension and collapse during the Second World War.

These and other symmetrical allusions to actual and fictional events help collapse the distinctions among national histories, a collapse accelerated by the wartime perfection of the multi-national corporation and the emergence of a more frightening, paranoid sense of an abstract war-machine dissipative structure run by invisible propagator-operators propelling individuals and nations from one destructive event to another, feeding on the material chaos and human suffering created by those events. We can understand the chaos of the Zone in terms of Deleuze and Guattari’s opposition between the chess-like mechanism of the war engulfing all concerned and the Go-like processes of historically virtual, nomadic individuals aggregating (see below), reminiscent of Prigogine’s description of spontaneous self-organizing processes emerging out of chaos (OC 12–14).

Irreversible Systems A. Time Asymmetries

Even Feynman diagrams that graph what is impossible to observe with precision can depict irreversibility in the form of time-asymmetries. These asymmetries in turn can be used to depict how, in *Gravity’s Rainbow*, paired individuals bifurcate, careen off, annihilating and absorbing each other in local, slightly asymmetrical processes: so that Wernher von Braun may prevail and Slothrop scatter; so that the Tchitcherine who helped negotiate the Rapallo Treaty may prevail and the nihilist Tchitcherine (and his half-brother) scatter. This suggests

that, even at the invisible quantum level of history, time-future is favored over time-past, and asymmetry and the irreversibility of time emerge.

One historical bifurcation point or fork in the road in *Gravity's Rainbow* is the moment in 1939 when the fictional Slothrop wishes the historical Jack Kennedy could have rescued his harmonica lost down the toilet at the Roseland Ballroom, "kept it from falling, violated gravity somehow" (65). This moment implies the real possibility of an alternative to the history of Nixon's presidency and the ICBM hanging over the movie theater in Los Angeles, a possibility that perhaps ended with Kennedy's assassination. The movie theater in Los Angeles contains the readers of *Gravity's Rainbow* watching an anti-history of the Second World War, so the reference to Jack Kennedy may allude also to the death, not only of his brother Bobby, who was assassinated in Los Angeles in 1968 (the foreclosing of yet another conceivable historical alternative), but also of his brother Joseph Kennedy, Jr., killed while attempting to launch a radio-controlled B-24 bomber filled with high explosives that was to be guided over the channel and dropped on Peenemünde. The successful dropping of this lethal drone on the center of Nazi rocket technology might have ended V-production. It might even have killed Wernher von Braun, whose chilling metaphysics open *Gravity's Rainbow*, and who helped give the ballistic technology to the Americans, fueling the arms race that culminates in the ICBM over the movie theater in Los Angeles.

The disruption of symmetry at the level of sub-atomic particle interactions enables us to connect the ideology of the prevailing characters to their respective states (visible in history—for example, Wernher von Braun, Walter Rathenau, John F. Kennedy) and those states' attempts to impose their hegemony on the postwar Zone. Conversely, we can connect the ideologies and activities of the anonymous, even virtual characters (visible in the novel—for example, Slothrop, Wimpe, the nihilist Tchitcherine) with laws governing the turbulence of the zone, laws distinct from those governing the state as a dissipative structure. Here we move from the complicitous relations inherent in war as a dissipative structure to the mechanisms of the war machine itself.

Enzian recognizes in the immediate postwar Zone a shift from wartime cooperation to antagonisms presaging a new game:

Perhaps it's theater, but they *seem* no longer to be Allies . . . though the history they have invented for themselves conditions us to *expect* "postwar rivalries," when in fact it may all be a giant cartel including

winner and loser both, in an amiable agreement to share what is there to be shared. (326)

Once the nomadic meanderings resolve to the precise trajectories of the chessboard in preparation for the new game, the Zone as a field of all possibilities becomes the virtual zone of roads not taken. Tchitcherine becomes aware of an emerging rocket-state, a "*Rocket-cartel*. A structure cutting across every agency human and paper that ever touched it. Even to Russia"; but he "will never get further than the edge of this meta-cartel which has made itself known tonight" (566). Yet he participates in processes that exist independent of and, for the most part, invisible to the war machine. These processes occurring in the Zone, processes erotic, economic and political, are distinct from the fecal and necro-eroticism of the English and Germans, distinct precisely because, while the Zone is closing up, it still allows for contingency and spontaneity. In this field of all possibilities, we may discover contingencies of nomadic and rhizomatic behavior that emerge in resistance to the microscopic and macroscopic formulations of the war machine.

B. The Zone as an Open System

Whenever we discuss thermodynamics, the condition of the system is crucial. The endgame scenario of equilibrium thermodynamics concerns itself largely with closed systems, while the self-organizing processes associated with non-equilibrium thermodynamics always refer to open systems. Not surprisingly, then, *Gravity's Rainbow* refers specifically to the "open" state of the Zone, effaced as it is of national boundaries that were once closed frontiers. Squalidozzi articulates the virtual potential of the Zone as he speculates about the possibilities created by cultural rupture:

"In ordinary times," he wants to explain, "the center always wins. Its power grows with time, and that can't be reversed, not by ordinary means. Decentralizing, back toward anarchism, needs extraordinary times . . . this War—this incredible War—just for the moment has wiped out the proliferation of little states that's prevailed in Germany for a thousand years. Wiped it clean. *Opened it.*" (264-65)

Instead of mapping off a land-claim to build a center of his own, like the Herero rocket-worshippers, Squalidozzi hopes to keep the Zone's boundaries effaced, to rejoice in its free-play and prevent it from closing off into smaller zones of opposition that reflect the postwar

order of things: "We want it to grow, to change. In the openness of the German Zone, our hope is limitless. . . . So is our danger" (265).

C. Contingency and Aggregation: Nomads and Rhizomes

We have already discussed the nomadic wanderings of Slothrop, Tchitcherine, Squalidozzi, Geli and others associated with the Zone. But Deleuze and Guattari argue that the nomadic state represents, in fact, the initial condition for processes of cultural self-organization just beyond the gaze of state power. Geli instructs Slothrop about forms of organization larger than the individual. They become lovers in a war-reconfigured town, their open-air boudoir reflecting the manifestations of a new, spontaneous ordering (GR 291). While Slothrop is irritated when Geli reaches orgasm with Tchitcherine's name on her lips, the references to the open system of their love-nest, the green life spiraling up the mountain, the spring-energy of her thighs like saplings all tie their coupling to organic dissipative processes in contrast to the dissipative wastefulness of machines. Geli tells Slothrop, "It's an arrangement. . . . It's so unorganized out here. There have to be arrangements" (290). Temporary alliances become the constituents of processes generating order out of the chaos/refuse of the war machine, rhizomatic activity taking place virtually beneath the noses of official order—with sexual love being the fundamental rhizome aggregating nomads.

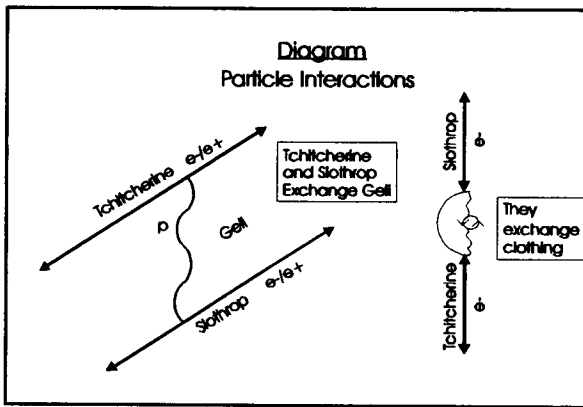


Fig. H

Slothrop's relation with Geli and Geli's relation with Tchitcherine help link aggregation to statistical processes even at the level of particle symmetries represented by Feynman diagrams. While the

bifurcation point indicating the emergence of alternative histories favors Wernher von Braun rather than Slothrop, the Rapallo rather than the nihilist Tchitcherine, the indefinite yet mirroring trajectories of the American and Soviet nomads can be represented as virtual interactions, a quantum mechanical "bonding" (Fig. H). Slothrop and Tchitcherine can be represented graphically as propagating particles. In the first diagram, they interact at a distance by exchanging Geli as a photon. In the second diagram, Slothrop confronts Tchitcherine during the mission to rescue der Springer, they exchange clothing, and Tchitcherine speaks the lines Slothrop lip-synchs (512-13). They become, in effect, interchangeable, reinforcing the anonymity of their marginal or preterite status in relation to the emerging superpower hegemony of their respective homelands.

Furthermore, the identification of love as a rhizomatic activity occurs in the grotesque but upbeat carnival of orgies. While possessing traces of sado-masochism associated with the toxicity of fascist bonding, these scenes are rendered with profound imagination, indicating the endless interweavings of flesh and signification, of hetero- and homo-eroticism that represent the opening of the flows of desire freed from what Deleuze and Guattari call the tyranny of Oedipal triangulation that functions coextensively with the corporate state apparatus while actually undermined by it (AO 51-56, 262-72). Orgies also provide the site for the death of geometry as coextensive with phallogocentric and logocentric order. Slothrop finds himself, during his dalliance with Bianca, inside his own phallus, identified with the Grail rocket:

Sliding her arms around his neck, hugging him, she starts to come, and so does he, their own flood taking him up then out of his expectancy, out the eye at tower's summit and into her with a singular detonation of touch. Announcing the void, what could it be but the kingly voice of the *Aggregat* itself? (470)

Slothrop experiences eroticism here that forces him figuratively out of the eye at the top of the pyramid, and the novel portrays him completely abandoning the politics and epistemology of supremacy. The hieroglyph of the rocket, simultaneously phallic and *aggregat*, personal and statistical, static and in trajectory, functions as the crossroads of the two ideologies, a crossroads that matches Slothrop's own paradoxical status in history.

In *Gravity's Rainbow*, love is the correlate to the thermodynamic arrow, the double integral SS (designating entropy doubled just as V is doubled) being "the shape of lovers curled asleep" (GR 302). Yet it is

in the Zone's black market that rhizomatic activity takes on an explicitly political dimension. Prigogine observes the importance of time in the non-local and contingent processes of self-organization in a chicken embryo, or in the aggregation of slime mold, the irreversible arrow of time distinct from the trajectories in classical and quantum dynamics. This contingency of duration remains distinct from the strict causality that speaks to reversible mechanics, a duration Bergson considers the motivating force of all evolutionary processes. For Deleuze and Guattari, the rhizome represents the "becoming" that cannot be defined simply as "evolutionary" (though it is that), but as another kind of warfare. Their distinction among "becoming intense," "becoming animal" and "becoming imperceptible" (TP 232-309) coincides with the way entropic processes threaten dynamic systems by manifesting the condition of pure contingency. It also coincides with the way living systems self-organize according to the laws of non-equilibrium thermodynamics and yet, in their earlier histories, remain undetectable by the monolithic reach of those systems of observation we associate with the physical sciences. Yet we must not forget the political implications of visibility and invisibility associated with such processes, for the boundary between what is visible and what is invisible may not be so easily drawn. *Gravity's Rainbow* illustrates dramatically the cultural analogue to the permeable boundary between observable and unobservable processes.

Becoming visible while emerging amid the vestiges of an ancient carnival ritual in a small town in the Zone, the black market also becomes vulnerable to interference by officials of the state. Slothrop participates in the ritual dressed as a Pig-Hero, paying homage to that animal's low status and his own preterition. Images of the effulgence of life abound as the spontaneous flows of celebrants begin to engage in other processes:

Slothrop returns from the brown back room of a pipesmoke-and-cabbage café, and an hour's game of hammer-and-forge with—every boy's dream—TWO healthy young ladies in summer dresses and woodsoled shoes to find the crowd begun to coagulate into clumps of three and four.

...

These little vortices appearing in a crowd out here usually mean black market. (569)

The activities of the black market, while "a little impersonal" (570), reflect the nomadic ethos of displaced persons getting by through "arrangements." But the visibility of the carnival as the persistence of social aggregations deliberately inverting official order brings on official

observation, which in turn brings on the police to suppress the black market fostered by the effacement of boundaries between high and low. Eventually backed by Russian reinforcements, the indigenous officials work efficiently:

The eddies in the crowd break up fast, jewelry ringing to the pavement, cigarettes scattered and squashed under the feet of stampeding civilians.

...

No wonder. The cops go at busting these proceedings the way they must've handled anti-Nazi street actions before the War, moving in, mmm ja, with these flexible clubs, eyes tuned to the finest possibilities of threat . . . jumping little kids three-on-one, shaking down girls, old people, making them take off and shake out even boots and underwear, jabbing and battering in with tireless truncheonwork among the crying kids and screaming women. (570)

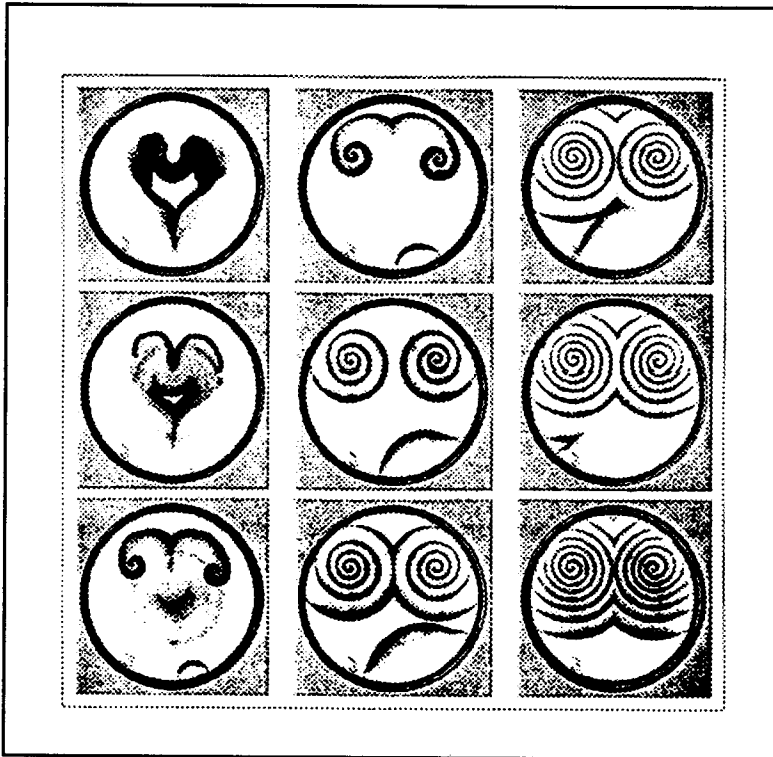


Fig. 1: Chemical scroll waves (Prigogine, BB 200)

The eddies emerging out of social turbulence here exemplify what Prigogine identifies as steady states achieved far from equilibrium, organic dissipative structures obeying the laws of non-equilibrium thermodynamics typifying the time-irreversible perspective (Fig. 1). Yet the spontaneous emergence of analogous structures in cultural systems also inscribes the limits to marginal and invisible activity within the zones of power, indiscernibility and impotence Deleuze and Guattari describe: the coincidence of traditional carnival celebrations and black market arrangements is too much for even the police to ignore, and the machinery of state power rolls in to crush what otherwise exists beyond their "gaze." Other possibilities emerge in Pynchon's Zone which make further claims for the role of irreversible processes as applied to human affairs even more problematic.

The existence of a rocket-state apparently immune initially to interference from the official regions of the Zone impresses the nomads who stumble upon it. Although its invisibility may be due to its location in another time or even on another planet, its utopian claim is undercut by Orwellian irony:

Strangely, these are not the symmetries we were programmed to expect, not the fins, the streamlined corners, pylons, or simple solid geometries of the official vision at all—*that's* for the ribbon clerks back on the Tour, in the numbered Stollen. No, this Rocket-City, so whitely lit against the calm dimness of space, is set up deliberately To Avoid Symmetry, Allow Complexity, Introduce Terror (from the Preamble to the Articles of Immachination)—but tourists have to connect the look of it back to things they remember from their times and planet—back to the wine bottle smashed in the basin, the bristlecone pines outracing Death for millennia, concrete roads abandoned years ago, hairdos of the late 1930s, indole molecules, especially *polymerized* indoles, as in Impiplex G—

Wait—which one of them was thinking that? Monitors, get a fix on it, *hurry up*— (297–98)

Amid this celebration of spontaneous orderings out of chaos codified in a constitution, an idle reference to the Impiplex G associated with the conditioning of Infant Tyrone triggers the alarms of Thought Police, all in a city in a zone of impossibility. The ambivalence of the passage underscores the dream of a natural law that allows maximum freedom and spontaneity while undercutting that dream at the same time by depicting a policing of that spontaneity.

This ambivalence about the ideology of irreversibility is further emphasized in *Gravity's Rainbow* by reference to the children's resort, Zwölfkinder, a refuge from adult power, a steady-state carnival

inversion of power: "In a corporate State, a place must be made for innocence, and its many uses. In developing an official version of innocence, the culture of childhood has proven invaluable" (419). Here, self-consciousness intrudes on the narrative's reification of an ideology of self-organization. Still, while the ideological status of the Rocket-City and the children's resort emerges in their self-reflexive description, other processes at the microscopic level seem to represent the "becomings" of the counterforce in precise ways. Yet by linking imaginatively the contingency of self-organizing systems with symmetry-breaking in quantum mechanics, Pynchon's text engages in imaginative science, in fact, making the same zany associations we noted in Spengler, only inverting the emphasis to celebrate contingency and randomness.

As Slothrop continues his nomadic flight, the Zone begins to indicate the irreversibility of his trajectory and couplings. Further down his time-line, he stumbles upon the very same harmonica he lost down the crossroads toilet at the Roseland Ballroom (GR 622-23), then keeps by himself, growing a beard, living in the countryside where animals flock to him as if he were St. Francis. He finds a graffiti that speaks to one of his Zone identities, "ROCKETMAN WAS HERE" (which he first thinks "he'd written . . . himself and forgot"), to which he adds the mandala hieroglyph (see Fig. J). This symbol affords two possible interpretations: 1) "Slothrop besieged"; 2) "the A4 rocket, seen from below" (GR 624). The first interpretation may refer to Slothrop's invisibility, on the lam from the officials, but may also indicate the growing difficulties he faces maintaining the singularity of his personality in the chaotic flows of the Zone. The second interpretation refers to the end of all endgames faced by every one of the moviegoers at the beginning and end of *Gravity's Rainbow*, and, paradoxically, to the power of interpretation, and of the geometry of calculus, to suspend the final rocket in infinite regress.

Crucially, the hieroglyph of the Rocket/*Aggregat* designates a carnival crossroads and the bifurcation point that indicates possible alternative time-lines, one of which may preserve us from the Last Judgment (GR 625). At the culminating moment "later in the day," Slothrop serves as the crossroad where the phallic sky impregnates the green mother earth, and "he stands crying, not a thing in his head, just feeling natural" (626). Slothrop then virtually disappears from the novel.

Signifying Slothrop's crossroads transfiguration, the Rocketman hieroglyph resembles the visualization of an event-particle in S-Matrix theory, which indicates an event by an empty circle, thus inscribing the limits for observing particle interactions. Representing quantum

electrodynamics at a level more subtle than Feynman diagrams, these matrices form onto a graph much like the anonymous buttons on a Go board (Fig. J).

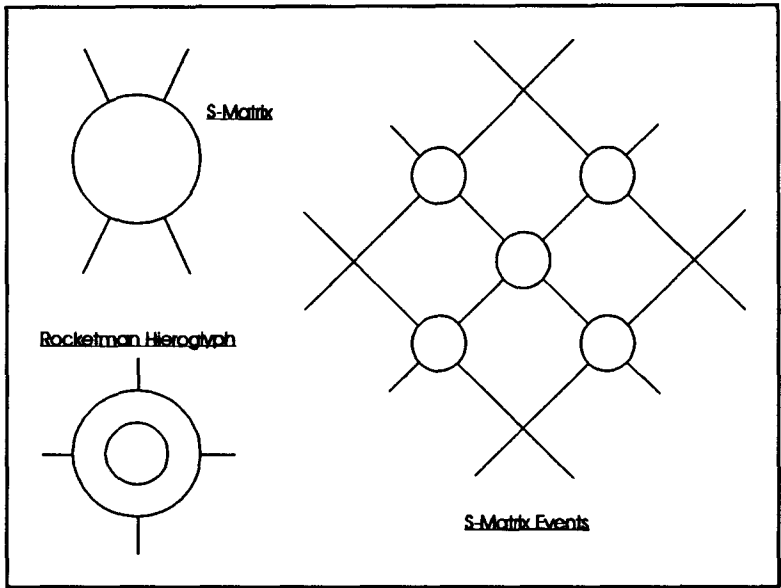


Fig. J (Based on Zukav 246-50)

These anonymous, impersonal regions at the horizon of observation suggest the hidden realm evoked in folk rumors elaborating on what might have become of Slothrop as he disappeared. Some hold that he is scattered throughout the matrices of the Zone, replicating and aggregating as he reemerges only to dissolve once again:

(Some believe that fragments of Slothrop have grown into consistent personae of their own. If so, there's no telling which of the Zone's present-day population are offshoots of his original scattering. 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. . . . There is no way to tell which of the faces is Slothrop's: the only printed credit that might apply to him is "Harmonica, kazoo—a friend." . . .) (742)

The parentheses framing this passage indicate the underground function of rumor, while Slothrop's signature harmonica and the other

preterite folk instrument, the kazoo, indicate Slothrop's persistence "among the gray and preterite souls . . . adrift in the hostile light of the sky, the darkness of the sea" (742). His contingent participation in a rock band identifies that countercultural activity with Deleuze and Guattari's rhizome, and also makes this text resonate with the reference to Deleuze and Guattari in *Vineland*, where, as we have seen, Billy Barf and the Vomitones attempt to play in disguise at a Mafia Wedding without knowing the ethnic dance tunes, and then resort to a Deleuze and Guattari fake book to remain invisible to their hosts yet still earn their fee.

Deleuze and Guattari on Chess and Go

Given the possible emergence of Go as an alternative model of culture-formation (in opposition to chess) in Pynchon's text, we must confront directly Deleuze and Guattari's own meditation on chess and Go as competing game theories of warfare (TP 352–53). As I have argued elsewhere,¹⁶ the tropes they use to describe the function of chess pieces coincide precisely with time-reversible systems, while the tropes they use to describe the function of Go pieces coincide with time-irreversible systems. By valorizing Go over chess, Deleuze and Guattari both embrace and disguise their allegiance with tropes of irreversibility, as if to render invisible their reification of those irreversible tropes as they refer to processes of resistance to the zones of power and indiscernibility. They refer to chess as *physis* and Go as *nomos*, and yet, clearly, the tropical formations informing these two discourses are both derived from physical processes, though from opposing epistemological and ideological stances. This is where the issue of complicity comes in with respect to avant-garde discourses, both the artistic constructions of Pynchon and the philosophical concepts of Deleuze and Guattari—two of the three corners of this alliance (to use a geometric trope).

By valorizing Go over chess to champion *nomos* over the claims for *physis* by the state, Deleuze and Guattari would subvert dominant culture's assumptions about the "natural" status of that state and its power. They pose avant-garde philosophy to demystify state power, denying the stability of the correspondence between the reversible laws of dynamics and the forces governing culture—with reference to Saussure's use of chess tropes to describe the laws governing signs (Saussure 22, 88, 110) and Feynman's use of chess tropes to describe quantum electrodynamics. Yet to do so, Deleuze and Guattari must also have recourse to the irreversible processes exemplified by the

condition of contingency, randomness and aggregation as necessary prerequisites for nomadic and rhizomatic tactics of resistance to cultural machinery.

Conclusion: The Physics of Seduction

In the writings of Deleuze and Guattari and in the fiction of Thomas Pynchon, we find a commitment to the ideological use of certain kinds of tropes from the time-irreversible perspective in physics to stake out polemically an agonistic position toward dominant culture, which, since the industrial revolution, has had recourse to tropes from the reversible perspective to justify the conditions of domination. These works foreground a certain problem, in theories of both the avant-garde and postmodernism, of an emergent, complicitous embrace of the very conditions of domination which make such posturing possible. They illustrate the circumstances for what Jean Baudrillard calls "seduction." For Baudrillard, the conditions of sexual seduction are premised on the condition of nakedness, which, in turn, resembles the premise of the transparency of discourse to truth. Shedding light on Deleuze and Guattari's wish to disguise the physics of Go and of the various discourses of becoming, Baudrillard writes:

The world is naked, the king is naked, and things are clear. All of production, and truth itself, are directed towards disclosure, the unbearable "truth" of sex being but the most recent consequence. Luckily, at bottom, there is nothing to it. And seduction still holds, in the face of truth, a most sibylline response, which is that "perhaps we wish to uncover the truth because it is so difficult to imagine it naked." (S 181)

Historically, clothing has always troped tropes; hence Baudrillard's remarks on the ways discourse proceeds paradoxically to both unveil and conceal meaning, that is, to render motive invisible:

Seduction is that which extracts meaning from discourse and detracts it from its truth. It would thus be the opposite of the psychoanalytic distinction between manifest and latent discourse. For latent discourse diverts manifest discourse not *from* its truth but *towards* it and makes it say what it did not wish to say. . . . Interpretation is that which, shattering appearances and the play of manifest discourse, will set meaning free by remaking connections with latent discourse. (OS 149)

The reverse of interpretation is seduction, where:

the manifest discourse, the most "superficial" aspect of discourse . . . acts upon the underlying prohibition (conscious or unconscious) in order to nullify it and to substitute for it the charms and traps of appearances. . . . [T]o seduce signs is here far more important than the emergence of any truth. (OS 149)

Baudrillard raises the major question addressed by an epistémocritique of Deleuze and Guattari's alliances as well as of Pynchon's poetics. He says, "Interpretation overlooks and obliterates this aspect of appearances in its search for hidden meaning. This is why interpretation is so characteristically opposed to seduction, and why every interpretive discourse is so unappealing" (OS 149). One of the chief attractions of Deleuze and Guattari's discourse is its interpretive mode, and one of the chief attractions of the discourse of Pynchon's novel is its uncanny verisimilitude as an antihistory of the Second World War, with a paradoxical commitment to both satirical excess and conventional historical accuracy. Both discourses engage in transgressive unmasking and demystifying of cultural signficatory rituals. And yet, as Baudrillard goes on to claim:

The havoc interpretation wreaks in the domain of appearances is incalculable, and its privileged quest for hidden meanings may be profoundly mistaken. For we needn't search in some beyond . . . to find what diverts discourse. What actually displaces it, "seduces" it in the literal sense, and makes it seductive, is its very appearance: the aleatory, meaningless, or ritualistic and meticulous, circulation of signs on the surface; its inflections, and its nuances. (OS 149-50)

By creating specific channels for the circulation of signs among science, philosophy and the arts, while at the same time ignoring the power of scientific discourse in our epoch to overdetermine other discursive formations like philosophy and art, Deleuze and Guattari's writings and Pynchon's fictions become complicit in sustaining the mystery of scientific discourse while at the same time attempting to demystify other discursive formations which have become powerful *because* of their traditional recourse to those very same scientisms: as in Marx and Freud, in Spengler and in Adams.

When we find in *A Thousand Plateaus* and in *Gravity's Rainbow* the simple inversion of scientific concepts these other theorists use to unveil the tropical bases for their models of subjectivity and culture-formation, we do not have to look far to find at the same time a veiling of the tactic of grounding, with the very kind of tropes used by their targets, for such transgressive ends. Thus, Baudrillard observes:

The idea of chance first emerged as the residue of a logical order of determination. But even hypostasized as a revolutionary variable, it still remains the mirror image of the principle of causality. Its generalization, its unconditional "liberation," as in Deleuze's "ideal game," is part of the political and mystical economy of residues at work everywhere today, with its structural inversion of weak into strong terms. Chance, once perceived as obscene and insignificant, is to be revived in its insignificance and so become the motto of a nomadic economy of desire. (S 146)

But there is no question of the enduring power of these oppositional discursive practices, at the level of epistemology and ideology, despite the ironic deflation of their representation in *Gravity's Rainbow*, and their systematic deconstruction in *Vineland*, as I argue in a forthcoming essay.¹⁶ When Deleuze and Guattari pose the "filiations" of the tree against the "alliances" of the rhizome as competing discursive practices (TP 25), knowing full well that the intransitive and finally geometrical nature of arboreal formations implies reversible systems while the conjunctive nature of the rhizome implies the spontaneous aggregation of root networks of prairie grasslands or of nomadic cells into slime by simple addition associated with irreversible systems, they are both veiling and unveiling. They are in the act of observing tropical phenomena while at the same time preventing the tropicality of their own discourse from becoming observable. And yet we observe continually how pervasive these two models are, across disciplinary formations and transgressive practices as well.

In *Vineland*, a novel obsessed with seduction and complicity, Prairie lies waiting for the man who may be her absent father to descend from a flying machine governed by the rules of internal combustion, lies waiting in a "small meadow" that "shimmered in the starlight," staring up into dancing spruce and alder (384). Between the reversible perspective of the arbor and the irreversible perspective of the grassroot rhizome, we find in Prairie's waiting the unceasingly hopeful play of signification within a circumference that limits the circulation of tropes flowing among the disciplines of physics, philosophy and art, as these tropes refer to each other, if to each other only, in the endlessly repeated anticipation of a historical difference to come.

—Eastern Kentucky University

Notes

¹See, for example, the special issue of *SubStance* (71/72 [1993]) on epistémocritique.

²The most thorough attempt to date to apply a Lacanian model of subjectivity and culture-formation to *Gravity's Rainbow* is Hanjo Berressem, *Pynchon's Poetics*, esp. 15–29, 119–50. While Lacan's notion of the Real is indeed subtle, I find Berressem's reliance on Lacan incapable of representing the zone as a scene of precise contradictions. An epistémocritical alliance of the systems theories of Prigogine and of Deleuze and Guattari better foregrounds those contradictions in *Gravity's Rainbow*. Berressem's own recourse to Deleuze and Guattari in explaining Pynchon's fictional Zone is wanting on several fronts, but most important, it simply does not capture the range and specificity of the possible alliances. For example, such alliances are constructed necessarily according to the principle of deterritorialization and reterritorialization, but see Berressem's misapplication of deterritorialization.

³"[L]et us say that history, in its traditional form, undertook to 'memorize' the *monuments* of the past, transform them into *documents*, and lend speech to those traces which, in themselves, are often not verbal, or which say in silence something other than what they actually say; in our time, history is that which transforms *documents* into *monuments*. In that area where, in the past, history deciphered the traces left by men, it now deploys a mass of elements that have to be grouped, made relevant, placed in relation to one another to form totalities" (AK 7).

⁴In "The Great Trouble with Art in this Country," Duchamp writes:

Dada was an extreme protest against the physical side of painting. It was a metaphysical attitude. It was intimately and consciously involved with "literature." It was a sort of nihilism to which I am still very sympathetic. It was a way to get out of a state of mind—to avoid being influenced by one's immediate environment, or by the past: to get away from clichés—to get free. The "blank" force of Dada was very salutary. It told you "don't forget you are not quite so blank as you think you are!" (WMD 125)

⁵See Phillip K. Dick's widely anthologized 1952 short story "The Variable Man" for an analogous treatment of a fugitive from justice in terms of the behavior of sub-atomic particles and the Heisenberg uncertainty principle.

⁶Prigogine defines a dissipative structure as self-organization that can occur spontaneously in chaos or turbulence that is far from equilibrium, or far from the maximum disorder we normally associate with the endgame of entropy (OC 12–14). Yet an internal combustion engine is also a dissipative structure: by the dynamic laws of cause and effect, it utilizes the thermodynamic turbulence of entropy or heat to produce work. We should therefore distinguish between organic and mechanical dissipative structures as we construct correspondences to social and political structures.

⁷This essay is particularly indebted to the following work: Hayles 111–37, 168–97; LeClair 36–68; Moore 149–218; Friedman; Friedman and Puetz; Nadeau. While Hayles explores the field concept in Pynchon's work, and provided me with a hint for applying quantum symmetries and time to plot

trajectories in *Gravity's Rainbow* in her chapter on Nabokov, her perspective on physics is almost exclusively geometrical and dynamic, and Prigogine is mentioned only in a footnote. LeClair notices the ideological warfare, but identifies it as a struggle between physics and Gaia, assuming the principles of open systems associated with Lovelock's theory of the earth as a single macrosystem lie outside physics proper. Moore comes closest to my formulation, but his discussion of physics is more encyclopedic; he does not delineate the rhetorical lines of argument with reference to Pynchon's avant-garde appropriation of tropes from physics, as this essay attempts to do.

⁸The view of dynamics and thermodynamics as ideologies derives from Prigogine's works that target a wider audience, like *From Being to Becoming* and (his collaboration with Isabelle Stengers) *Order Out of Chaos*. Whatever one makes of Prigogine's grandiose project to merge the time-reversible and time-irreversible perspectives, which he calls "being" and "becoming," these works devote much of their energies to demystifying the hegemony of the time-reversible dynamic perspective over the time-bound thermodynamic perspective in the natural sciences. One may underscore Prigogine's critique by pointing out that, despite the influence of his work on the physics of self-organizing systems, in terms of non-equilibrium thermodynamics, he was awarded the Nobel Prize in Chemistry.

⁹Joseph Tabbi has shown how engineering serves as a crucial source of referents in *Gravity's Rainbow*. More interesting, however, are the ways the legacy of the industrial revolution offers engineering as the site for the ideological supremacy of one epistemological stance over another. Machines, for example, use dynamic laws associated with time-reversibility (as in the reversible functioning of precision-tooled machine parts) to control thermodynamic processes associated with time-irreversibility (as in the energy generated by heat or entropy in a steam engine) to produce work.

¹⁰For this use of carnival, see Bakhtin's valorization of the crossroads phenomenon exemplified by the Lenten carnival, in which official culture officially sanctions the effacement and even inversion of all hierarchical structures in society. See also Stallybrass and White's discussion of the suppression of Lenten carnival in Europe and the reconfiguration of the carnivalesque in the low and base.

¹¹I would like to thank Prof. Burnham for letting me read parts of his as yet unpublished manuscript on Duchamp and Kabbalism some fifteen years ago. Several of his essays on Duchamp have also been very helpful. Illustrating the intertextual relations in *Gravity's Rainbow*, Marcel, in his guise as a cigarette machine, passes the following message to a spectator:

"I'm sure you wouldn't want Them to know about the summer of 1945. Meet me in the Male Transvestites' Toilet, level L16/39C, station Metatron, quadrant Fire, stall Malkuth. You know what time. The usual Hour. Don't be late." (680)

Duchamp's female alter ego, Rose Sélavy, was captured in full regalia by the photographer Man Ray. The term "Metatron," and the references to one of the four elements ("Fire") and to "Malkuth" originate in various kabbalisms, though of syncretic origin, mixing Jewish, neoplatonic Christian, and Gnostic sources.

¹²See also Ezra Pound's Vorticist polemic "The Game of Chess" (1915, 1926) with its values of repetition and periodicity informing the rituals of violence. The poem describes a Deleuzian war machine.

¹³For an excellent application of the symmetries of particle interactions to narrative structure, see Hayles 111-37 on Nabokov's *Ada*, with its positive and negative time-lines. Duchamp and Nabokov played chess together on several occasions. Pynchon may have benefited from reading Nabokov's novel about chess, *The Defense*.

¹⁴While Hayles's explanation of Slothrop's disappearance as related to the Schwarzschild radius of a black hole is plausible, it has no explanatory power beyond Pynchon's allusion to the term (GR 286) and to the personal singularity of Slothrop. My explanation of Slothrop's progress in relation to that of other characters encompasses Hayles's contribution by noticing that the black hole also serves as a portal to an anti-universe propelling backwards in time, which helps explain an imaginative *deus ex machina* by which electron-positron pairs emerge out of an event in opposite directions, one elect, one preterite. The black hole and its Schwarzschild radius thus become the micromechanics of historical bifurcation points (see Hayles 195).

¹⁵"Dynamic and Thermodynamic Tropes of the Subject in Freud and in Deleuze and Guattari," *Postmodern Culture* 4.1 (1993): 43 par.; "Chess and Go: Physis-Nomos in Deleuze and Guattari's Game Theory of War," paper presented at the MLA Special Session on chaos theory and the writings of Deleuze and Guattari, Dec. 1993, forthcoming in *SubStance*.

¹⁶"The Physics of Seduction: Gravity and the Geometry of Complicity in *Gravity's Rainbow* and *Vineland*," paper presented at Narrative: An International Conference, Apr. 1993, forthcoming in *Pynchon Notes*.

Works Cited

- Bakhtin, Mikhail. *Rabelais and His World*. Trans. Helene Iswolsky. 1968. Bloomington: Indiana UP, 1984.
- Baudrillard, Jean. "On Seduction." *Jean Baudrillard: Selected Writings*. Ed. Mark Poster. Stanford, CA: Stanford UP, 1988. 149-65.
- . *Seduction*. Trans. Brian Singer. New York: St. Martin's, 1990.
- Bergson, Henri. *Creative Evolution*. Trans. Arthur Mitchell. New York: Holt, 1911.
- Berressem, Hanjo. *Pynchon's Poetics: Interfacing Theory and Text*. Urbana: U of Illinois P, 1993.
- Burnham, Jack. "Unveiling the Consort." *Artforum* Mar. 1971: 55-60.

- . "Unveiling the Bride." *Artforum* Apr. 1971: 42–51.
- . "Duchamp's Bride Stripped Bare." *Arts Magazine* (Part I) Mar. 1972: 28–32; (Part II) Apr. 1972: 41–45; (Part III) May 1972: 58–63.
- . "The Semiotics of Endgame Art." *Arts Magazine* Nov. 1972: 38–39.
- Conant, James B. *Modern Science and Modern Man*. New York: Columbia UP, 1952.
- Deleuze, Gilles. *Difference and Repetition*. Trans. Paul Patton. New York: Columbia UP, 1994.
- and Félix Guattari. *Anti-Oedipus: Capitalism and Schizophrenia*. Trans. Robert Hurley et al. Minneapolis: U of Minnesota P, 1983.
- . *A Thousand Plateaus: Capitalism and Schizophrenia*. Trans. Brian Massumi. Minneapolis: U of Minnesota P, 1987.
- . *What is Philosophy?*. Trans. Hugh Tomlinson and Graham Burchell. New York: Columbia UP, 1994.
- Duchamp, Marcel. *Opposition et les cases conjuguées sont réconciliées*. Brussels: L'Echiquier/Edmund Lancel, 1932.
- . *The Writings of Marcel Duchamp*. Ed. Michel Sanouillet and Elmer Peterson. 1973. New York: Da Capo, 1989.
- Feynman, Richard P. *The Character of Physical Law*. Cambridge: MIT, 1965.
- . *QED: The Strange Theory of Light and Matter*. Princeton: Princeton UP, 1985.
- , Robert B. Leighton and Matthew Sands. *The Feynman Lectures on Physics*. 3 vols. Reading, MA: Addison-Wesley, 1963–65.
- Foucault, Michel. *The Archaeology of Knowledge*. Trans. A. M. Sheridan Smith. New York: Pantheon, 1972.
- . *Language, Counter-Memory, Practice: Selected Essays and Interviews*. Ed. Donald F. Bouchard. Trans. Donald F. Bouchard and Sherry Simon. Ithaca: Cornell UP, 1977.
- Friedman, Alan J. "Science and Technology." *Approaches to Gravity's Rainbow*. Ed. Charles Clerc. Columbus: Ohio State UP, 1983. 69–102.
- and Manfred Puetz. "Science as Metaphor: Thomas Pynchon and *Gravity's Rainbow*." *Contemporary Literature* 15.3 (1974): 345–59.
- Hayles, N. Katherine. *The Cosmic Web: Scientific Field Models and Literary Strategies in the 20th Century*. Ithaca: Cornell UP, 1984.
- Jameson, Fredric. *The Political Unconscious: Narrative as a Socially Symbolic Act*. Ithaca: Cornell UP, 1981.
- Lacan, Jacques. *Le Séminaire livre I: Les Écrits techniques de Freud*. Paris: Seuil, 1975.
- LeClair, Tom. *The Art of Excess: Mastery in Contemporary American Fiction*. Urbana: U of Illinois P, 1989.
- Moore, Thomas. *The Style of Connectedness: Gravity's Rainbow and Thomas Pynchon*. Columbia, U of Missouri P, 1987.

- Nadeau, Robert L. "Readings from the New Book of Nature: Physics and Pynchon's *Gravity's Rainbow*." *Studies in the Novel* 11.4 (1979): 454-71.
- Prigogine, Ilya. *From Being to Becoming: Time and Complexity in the Physical Sciences*. San Francisco: Freeman, 1980.
- and Isabelle Stengers. *Order Out of Chaos: Man's New Dialogue with Nature*. New York: Bantam, 1984.
- Pynchon, Thomas. *Gravity's Rainbow*. New York: Viking, 1973.
- . *Slow Learner*. Boston: Little, Brown, 1984.
- . *Vineland*. Boston: Little, Brown, 1990.
- Saussure, Ferdinand de. *Course in General Linguistics*. Ed. Charles Bally and Albert Sechehaye. Trans. Wade Baskin. New York: McGraw-Hill, 1966.
- Spengler, Oswald. *The Decline of the West*, vol. 1: *Form and Actuality*. Trans. Charles Francis Atkinson. New York: Knopf, 1926.
- Stallybrass, Peter and Allon White. *The Politics and Poetics of Transgression*. Ithaca: Cornell UP, 1986.
- Tabbi, Joseph. "The Wind at Zwölfkinder: Technology and Personal Identity in *Gravity's Rainbow*." *Pynchon Notes* 20-21 (1987): 69-90.
- . "'Strung into the Apollonian Dream': Pynchon's Psychology of Engineers." *Novel* 25.2 (1992): 160-80.
- White, Hayden. *Tropics of Discourse: Essays in Cultural Criticism*. Baltimore: Johns Hopkins UP, 1978.
- Zukav, Gary. *The Dancing Wu Li Masters: An Overview of the New Physics*. 1979. New York: Bantam, 1980.