The Leibniz Connection: Nazi Symbolism, Calculus and Leibnizian Worldmaking in *Gravity's Rainbow*

Bernd Klähn

Modern Subjectivity and Mathematical Calculus

Modern history is a conglomeration of dichotomies and dualistic confrontations. When occidental culture moved through the long phase of seemingly static medieval repetitions and cycles, gradually but thoroughly preparing its own Judaeo-Christian background for the transformation into a postantique condition, the severing of the subject from the evident and immediate coherence of the world and the cosmos turned out to be a decisive move within this evolution. This trend culminated, according to the familiar description of occidental culture, with the subject in the foreground, initiating an endless iteration of conflicts between subject and object as a well-designed follow-up.

In this process of modernization, the subject underwent several rites of initiation. First was the subjectifying impetus of the Reformation, substituting for the authority of the priesthood the inner authority of the pious subject. Second, another trend toward upgrading the subject's autonomy occurred in the realm of the arts, where the Renaissance stressed the creative subject, able, after all, to show its own talents beyond the simple reproductive depiction of biblical scenes. In opposition to such inward turnings of world- and self-view, two developments concerned the expansive world-awareness of the growing subject: the explosion of the given world into an early-modern globalism that recognized Europe as a tiny geographical spot on the world map, and the cosmological de-centering and de-limiting of the Greek and medieval cosmos into an endless universe, with the earth somewhere (dis-)located inside it.

The ideological compensation for this antagonistic development of subjective contraction and worldly expansion was reflected preeminently in the maturing of modern science and philosophy, as well as modern aesthetics, where the emerging novel took the role of accounting for both developmental strands in a multidimensional process of adaptation and appropriation. As a matter of fact, the beginning of modern thinking in the seventeenth century was marked by the intersection of the natural sciences, philosophy and narrative competence in the works of such scientifico-philosophical writers as

Descartes, Galilei, Huygens, Newton and Leibniz. And so, from the beginning of modernity, a basic problem for all ways of worldmaking was that of understanding the double movement of subjective convergence and worldly divergence.

At this historical point, modern sciences had to adjust their ways of understanding the world. This is when totally new strategies of bringing the given material into an adequate form came into being. It was the moment of the birth of calculus, which is, first, the mathematical mode of describing changing movements of individual objects by differentiation, and, second, the mode of combining different events, sequences, spatial terrains into one coherent quantitative form by integration. Calculus, seen this way, is the formalistic answer to the dialectical pressure of subject-contraction and world-expansion. The invention of this groundbreaking way of looking at the material world and the processes going on within it is ascribed to Isaac Newton and Gottfried Wilhelm Leibniz independently, though even during their lives they engaged in an unprecedentedly bitter debate about the right of priority, realizing that calculus was not just some interesting new mathematical method but a revolutionary reorientation in viewing the material world—a kind of Copernican turn in mathematical ideology and scientific world-understanding.

Exactly here, Pynchon's *Gravity's Rainbow*—a novel packed with allusions to classical mathematical physics—moves into focus. For some readers, these extremely formalistic elements of the novel simply demonstrate the multiplicity of late-modern worldviews, scattered with scientific fragments and their enormous social and political effects. For others, this physico-mathematical material supports a coherent matrix of subsurface plot-making deeply hidden within a network of interweaving and overlapping patterns of cultural interferences. To those who carry this latter position even further, these structural configurations are not confined to secondary levels of fictional composition: out of their entwined modes of modern scientific and colloquial ideology emerges a narrative and constructive grid that constitutes one of the fundamental structures of the novel's design and makes *Gravity's Rainbow* one of the most beautifully and controversially concocted critiques of (post)modern times.

The following pages outline how basic modes of *calculus* (the term Leibniz coined to describe his new mathematical method for physics) are employed in *Gravity's Rainbow* to underline that basic tension of modern times which results in the parodic and farcical repetition of history, the desperate enterprise to sum up once again what could not be summed up before. To understand the idea, we have to take a close look at Pynchon's novel, especially at those parts where Leibnizian and

Newtonian versions of calculus show their relevance to its overall narrative design.

Pynchon's Postmodern Calculus: The Leibniz-Newton Connection

The relevant scientific subplot in *Gravity's Rainbow* is centered around early-modern problems of mechanics and concerns the motion of bodies under gravitation and the motion of light under the influence of matter. The first kind of interaction results in different trajectories—circles, ellipses, parabolas and hyperbolas—in gravitational fields. The second results in the splitting of light into its component colors, yielding spectra and—in special conditions—stationary interference patterns. In both cases, physicists had to solve the problem of changing temporal and spatial conditions and—especially in the case of light—the summing up of an enormous multitude of influences with the help of a straightforward quantitative technique.

Thus differentiation and integration, on an epistemological as well as a mathematical level, acquire the status of formalized representatives of the implicit dualities of modern worldmaking. If *Gravity's Rainbow* is —perhaps even primarily—a narrative approximation of modern and modernist dichotomies within the process of occidental world-structuring, the inclusion of these modes of formalization into the overall aesthetic design is more than just a plausible addendum.

Consequently, aside from these primary concerns with modern calculus, modern worldmaking and postmodernist narrativity, this essay follows a second line of argument. It sketches how far interdisciplinary competence in postmodernist fiction may expand the horizons of narrative composition. The narrative foundations of *Gravity's Rainbow* exemplify the meticulously constructed adaptation of scientific forms of self- and worldmaking, enclosing, for instance, refined formalistic means in the narrative grid of the text. The central components of this mathematical co-foundation are correlated with narrative, formalistic and even iconic elements which dissolve the algorithm's abstract character while connecting it with a basis of narrative imagery.

The Novel's Basic Framework

Facing the devastating plurality of *Gravity's Rainbow*, it is intellectually consoling to condense the plot to a few elementary ingredients. Set mainly in a nebulous European space at the end of the Second World War, *Gravity's Rainbow* puts one of the so-called *Vergeltungswaffen* (retaliation weapons) of the Nazi Regime—the first ballistic missile, the V-2 rocket—at the center of events. The novel's

episodes wind and twist around the rocket's scientific, technical and military history and the mathematical and physical backgrounds of its imagining, planning, construction, launching and striking.

The main structural lines of *Gravity's Rainbow* may be grouped around Tyrone Slothrop (subplots and secondary protagonists are numerous), an American lieutenant whose libidinous adventures correlate strangely with V-2 rocket-strikes, which regularly follow within a few days. The allied behavioral psychologist Edward Pointsman investigates this phallic rocket-prognosticator, steering Slothrop's irritated self-analyses into German territory. Criss-crossing the lunar landscapes of defeated Germany, Slothrop—like other protagonists—searches for the ominous Schwarzgerät, a component of the V-2 with the serial number 00000. Locked into a paranoid system of persecution and flight, Slothrop vanishes in the Zone long before the end of the novel.

The obvious presumption is that a leading principle correlates this medley of topics while subtly resisting or evading conventional terms of interpretation such as point of view, story, plot, character, space and time. Intended as a heuristic supplement to such interpretive means, the following considerations are based on a close look at cross-over connections *within* the physical and mathematical elements of the novel. Horizons normally not the object of critical regard are approached by following the tracks of an interpretation which pays attention to the scientific sub-codes of the novel and their dualistic manifestations of modern history as self-parody. This entails some specialized analyses that concentrate on those formal representations of physical phenomena in the text—integrals and differentials—that correspond to the basic traits of the novel's narrative program.

Calculus—the Details

Since *Gravity's Rainbow* was first published, critics have emphasized the constitutive importance of its scientific and technological groundwork. But unfortunately, in most cases, the influence of scientific topics on the novel's narrative design has been underestimated. Evading a detailed analysis of formulas and formalisms, most readers have failed to penetrate the structural imagery of the formulas and detailed physical considerations which populate the novel and correlate with its artistic conception. To fill one of these gaps, the following considerations present an outline of the constitutive relevance of the quantitative formalisms woven into the architectural design of the novel.

The explicit inclusion of physical topics, their insertion into the strata of narrative formation, occurs on different levels of abstraction in *Gravity's Rainbow*. The most conspicuous elements are mathematical formulas that mark the narration with strong punctuating accents. Verbalized variants of these formulas appear as transcriptions, hiding their abstract core under a cover of typographical monotony but never denying their formalistic roots. These passages emerge out of the text's flow with an acute signalizing effect: their highly developed cryptographics do not yield readily to interpretation because of their refined mathematical background, which includes the theory of probability, vector analysis and calculus.

For readers attuned to the physics of *Gravity's Rainbow*, each of the four parts of the novel exhibits at least one eye- and mind-catching mathematical formalization. In part 1, "Beyond the Zero" (1–177), it is an equation for Poisson's distribution, using a power series (140); in part 2, "Un Perm' au Casino Herman Goering" (179–278), the parameters for a stable ballistic trajectory appear in the form of a differential equation (239); part 3, "In the Zone" (279–616), presents a simple integration problem in the form of a graffito with verbal components (450); and in part 4, "The Counterforce" (617–760), an equation is translated into a verbal travesty of mathematical physics (700). The following considerations concentrate on the third formula, the integral equation in part 3, revealing the inner logic of this extremely formalistic, playful and even culturally packed equation, and analyzing the way it is immersed in the self-criticizing subtext of the antimodern(ist) narrative discourse.[1]

"In the Zone" transforms quantifying, fictionalizing formalisms into an iconic discourse, gradually approaching the main equation of the novel. The first step on the way to this equation is taken when mathematical descriptions of elementary kinetics are applied to the rocket's control system. This introduction is macabre and perplexing. Starting with "'the SS emblem,'" the process of narrative construction shifts to the "'double integral sign'"; then comes the central reference to the classic meaning of any integral sign (a deformed sigma), the summing up of an infinite number of extremely small elements: "'Summe, Summe, as Leibniz said'" (GR 300). This presents to the ear not only a rhythmic stuttering, accumulating similar acoustic impacts, but also a simulation of the buzzing and humming of an insect or a flying technical object, as well as evoking, on another level of sense-making, an old German lullaby,[2] thus correlating ideological, mathematical and military cycles in a simple humming repetition: "Summe, Summe." All this makes the double integration a multidimensional allusion to key concepts of twentieth-century

ideology: mathematics and lullabies, calculus and rocket trajectories, Nazi terror and Teutonic identity, German mathematico-philosophical ingenuity (Leibniz) and its English adversary/complement (Newton)—all of them in one boat: "'a light plane, a two-seater'" (GR 486). This fragile array of superficially antagonistic and dichotomous elements makes Pynchon's integrational characterization of modern world-construction a narrative that aims to lay bare the ubiquitous reductionism of occidental approaches to the complexity of the given world.

For a clear understanding of the following analyses, some simple facts about the mathematical technique of calculus should be kept in mind. First, calculus is a method developed by two physicists in the course of analyzing the movement of bodies. So it is not an abstract mathematical procedure but a formalized way of understanding change in nature—on a very simple level of quantification that works with elementary concepts. Second, calculus consists of two complementary strategies: *differentiation*, which permits development of a precise idea of change and evolution in simple systems; and *integration*, which centers on the idea that the reverse approach may yield an unchanging situation, thus offering a formal means of summing up differences in a final, simple result, often a constant.

The rest of this essay focuses on the latter aspect of calculus and looks at Pynchon's treatment of mathematical integration within the patterns of fictional composition. From one point of view, integration is a method for taming and understanding developing systems that seem extremely complicated because of their enormous dynamic content. But from a more critical perspective (like Pynchon's view of modern structures), integration is a formal crystallization of modernity's tendency toward self-paralysis. Seen from this angle, it becomes the main icon of a dynamically changing epoch that brings itself to a sclerotic ending. In the fictional worlds of *Gravity's Rainbow*, the modes of formal integration encapsulate a condensed version of this fundamental critique. By using the language of calculus as modernity's own true language, Pynchon puts his critique of modern self-paralysis into coded messages full of political and cultural allusions.

As *Gravity's Rainbow* is centripetally constructed around the (illusory) reality of rockets, their trajectories—characterized by a continuous change of speed and direction—become a touchstone for the implementation of the critical discourse in the fictional world. Again, formal integration seems to offer an easy resolution of this complexity. Pynchon gives us a modern physicist's well-designed solution, which confines this complexity in an ordinary constant: the length of the rocket's path. As the double integration of the acceleration a(t) over

time yields the distance to be covered—$s(t) = \int\int a(t)dt^2$: "To get to distance from acceleration, the Rocket had to integrate twice" (GR 301) —this formal operation symbolizes a loss of dynamism and verve, a move toward final paralysis. The transfer of this kinetic relation to the similar process of electrical discharge enabled technicians to set the point of fuel cutoff for a rocket without any additional signal from outside. Thus double integration achieves the symbolic quality of a hermetic, systemic self-control, showing additional characteristics of self-doubling and self-reproduction. The SS emblem as the iconic culmination of this ongoing process is—as will be shown later—not accidental, but a stringently perverted continuation of the self-doubling strategies of modernity's inner hiatus between subject and world, "the method for finding hidden centers" (GR 302).

Pynchon's discourse of double integrations and their symbolic connotations points to an ideological background closely connected with a precise understanding of modernity and modern times. It starts from a concept of the modern mind, which no longer believes in any form of intellectual, ethical or scientific progress, but presents a scenario of slowly degenerating and integrating forms of human interaction and behavior, reflected in the narrative construction of *Gravity's Rainbow*. These constitutive elements converge in an equation which is at once abstract hieroglyph, icon and graffito, that is, an image of the concretely given and its abstract idea. By transliterating a subversive code of colloquial symbolism into the form of an iconic scientific representation, this equation opens up new perspectives for an—even jocular—integration of modern sciences into the codes of postmodernist narratology.

The said equation—a kind of cryptic writing on the wall—is found "[a]mong the hilarious graffiti of visiting mathematicians." It is a basic integral equation, expressed explicitly as $\int(1/(\text{cabin}))d(\text{cabin}) = \log \text{cabin} + c = \text{houseboat}$" (GR 450), giving the solution for the integration problem $\int(1/x)dx$, which yields, indeed, $\log_e x + c$. In a first step, the text substitutes the term cabin for the variable x, which means that the term after the first equals sign presents the correct algorithm for a special calculus problem.

Leaving aside, for the moment, the figurative and ambivalent allusive frame of this equation, we have two adjacent thematic fields in which similar equations are relevant: the theory of gravitation and the theory of ballistics. The former gives us the so-called rocket equation, reflecting the form of Pynchon's equation and allowing calculation of the total mass of the rocket at Brennschluss—condensed synecdochically in the word cabin: $v_e = c \int(1/m)dm = c \ln(m_o/m_e) + v_o$. Another connection concerns Newton's theory of gravity. Though

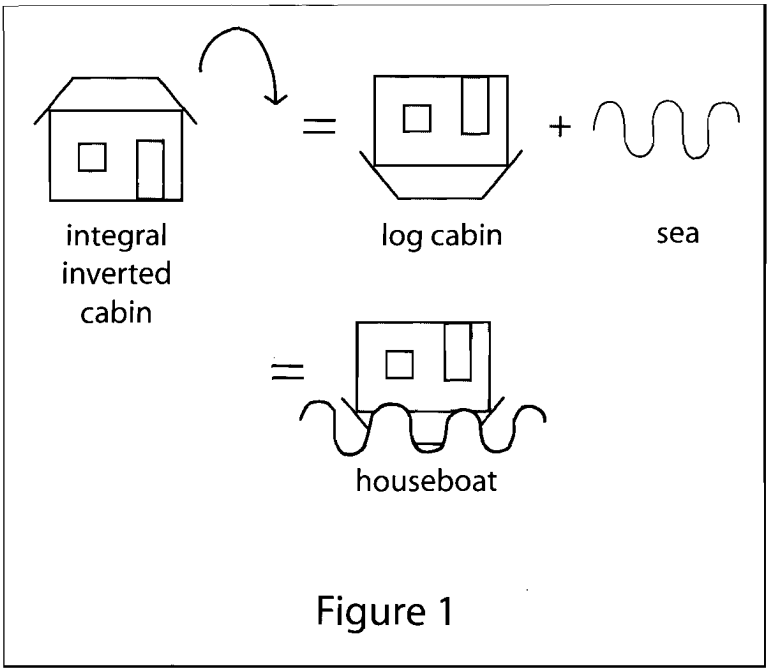

Figure 1

gravity is a main theme in *Gravity's Rainbow*, Pynchon keeps the quantitative aspects hidden, aside from implicit allusions like the equation above, where we have Newton's law of gravity camouflaged and connected with the central idea of double integration. Taking Newton's law of gravity in the classic form—$F = cm_1m_2/r^2$—and integrating twice with respect to r (the distance of both involved masses, a standard procedure for any student of physics), we reach the mathematical formula $\int\int Fdr^2 = C_1\int\int(1/r^2)dr^2 = C_2\int(1/r)dr = C_2 \ln r + c$.

The structure of the equation combines two cardinal concepts in Pynchon's novel: Newton's theory of gravitation and the ballistics of rockets. But the graffito and the formula's design provide good reasons to transgress mere mathematical and physical considerations and to take the figurative step to another level of meaning. This deeper sense is hidden in the second part of the equation, where the correct result of the mathematical operation is identified as the word houseboat. To understand this equivalence, we have to leave the strictly mathematical mode for the verbal representation of the formula: "integral inverted cabin = log cabin plus c = houseboat," or, in the final version, "an

integral inverted cabin is a log cabin plus sea, is a houseboat"—which yields the straightforward iconic representation given in Fig. 1.

This correlation of physicalistic formalism and playful language, combining elements in a bizarre and self-referential reconstruction, may seem rather exotic. But on closer inspection, mathematical physicalism and playful punning converge on different levels of narrative composition, manifesting a physico-mathematical encoding of the novel's central topics. And in fact, another iconic relation joins the central integral equation to the concept and material appearance of a rocket (Fig. 2). Vertically deployed for launching, a rocket resembles a house turned upside down, the chimney thrusting out burning gases at the bottom, while the entrance is localized at the top. And even the standard notation for the function 1/x (reciprocal of x) looks like the stylized image of a rocket waiting for liftoff.

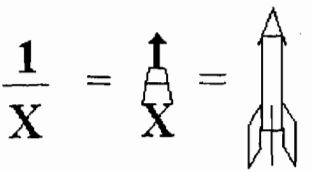

Fig. 2

As an American manned spaceship, this rocket will come down in the ocean, floating like a boat in the sea, hermetic housing for astronauts. The last step yields a result that is almost banal in its interpretive scope: the hermetic cabin represents the closed subject-concept of modernity, a kind of Leibnizian monad, ready for takeoff and self-destruction, for transcendence and immersion in a limitless universe. The ballistics of modern orientational means converge in a houseboat, a still closed system floating in a turbulent environment, prepared to dispense with the hermeticism of the integrated ark of the parabolic arch.

This simple, playful formula thus twists together mathematical, physical and figurative strands, adjusting them to a narrative design supported by iconic immediateness and formalistic grounding. At the same time, the graffito character of the equation weakens the rigidity of the formal construction, underlining the playful use of formulas and

their antisymbolic presuppositions and means. In *Gravity's Rainbow*, formalistic language and physicalistic reductionism become the shrinking skeletons of a linguistic formation that cannot be disconnected from the dualistic modes of self- and world-orientation. Modern worldmaking thus seems deeply embedded in a subliminal dichotomy of icono-formalistic orientations, bound up in modes of doubling, manifesting the irreparable cultural hiatus in modern subject-contraction and world-expansion in forms of perennial contradiction on different levels of cultural worldmaking, reaching, finally, the aesthetic horizon of parody and farce.

Parody and Farce: The Leibniz-Newton Discourse

Which brings us to the classical background of the Leibniz connection—not only a connecting element but a constitutive pillar in Pynchon's foundational pre-, intra- and postmodern critique of occidental culture. The idea is as simple as Pynchon's central iconic equation discussed above: the idea that the formalism of calculus represents the dynamic inner core of modern dichotomous and hiatal worldmaking, encompassing within its own formalistic structure two conflicting strategies to heal modernity's split into self- and world-understanding.

Leibniz's significance in the process of modernization has to do with his concepts of monadic subjectivity and the pre-established harmony of the outer world, showing the influence of Cartesian philosophy throughout. On the other hand, like Descartes before him, Leibniz was a splendid mathematician, able to apply the formal procedures of mathematics to elementary changes (motions of bodies) in outer reality. In his "Nova methodus pro maximis et minimis," he introduced the principle and nomenclature of calculus into the realm of mathematics and physics, inventing the delta and d notation for small changing elements and using the stretched S as a symbol for the summing up of small rectangular elements into a precisely defined area under a given curve. Thus he invented the notation and the mathematical background for calculus—the derivative and the integral—focusing his interests on integral calculus.

In Pynchon's integral $\int(1/x)dx$, there seems to be no special feature —until we consider Newton's notation for integral calculus. In Newton's first publications on the theory of calculus, "Two Treatises of the Species and Magnitude of Curvilinear Figures" (published as a supplement to his *Opticks*), he uses a totally different notation, writing the $\int xdx$ as $1/x$ (one over x), though without a fraction bar. Combining the two notations, $\int(1/x)dx$ may be read as a double integration,

welding Leibnizian and Newtonian dualisms into a pivotal center of meaning: $\int(1/x)dx = \int\text{Leibniz}\int\text{Newton} = \int(\int xdx)dx = \int(1/2)x^2dx = (1/6)x^3$, leading us back to the main topological area where *Gravity's Rainbow* resides. First, we have a parabola, but this time in an intensified form, a kind of cubic travesty of the x^2–parabola of a rocket. Second, in the logical sequence of the integration, the first four terms of the Poisson distribution—Pynchon's first equation in the novel—appear, underlining the tight connections among rocket trajectories, rocket impacts, the German-English calculus war, and Hitler's brutal and farcical revenge two hundred and fifty years after Leibniz's defeat by Newton. Thus there can be no reasonable doubt that Pynchon's equations are from the very beginning bound up in a tight network of interrelated allusions and patterns.

Putting these results in the form of a short sketch, we have the fascinating convergence of the inverse trends (Leibnizian and Newtonian) within calculus, and the correct description of the resulting parabola in one iconic and parodic formula, written by visiting mathematicians—and we supposedly know now who they are. Expanding these formal results into the critical discourse of modernism and its manifestations of the modern subject's contractions and incompatibilities within an expanding environment, we realize that this confrontation between two ways of coming to terms with a changing world and a changing conception of it results in two different ways of mathematical worldmaking. On the one hand, double integration leads, on the physical level, to the parabola that is said to be compatible with the rainbow, one of Newton's favorite themes in *Opticks*. On the other hand, the circular structure of the rainbow is only *similar to* a parabola. The latter is a kind of parody of the circle, approximating its perfect curve, which is constant, in the form of a gradually diminishing curve, thus symbolizing the concept of change in modern thinking, irrelevant to the circles of antique cosmology. On the whole, the rainbow remains an icon of perfection, with its regular curvature and orderly multiplicity of colors which, put all together, give the impression of a submerged unity, that is, uniform whiteness.

Through the convergence of double integration and SS emblems in *Gravity's Rainbow*, Pynchon insinuates a strong immanent correlation between modern quantitative variants of worldmaking in the mathematical-natural sciences and the political-ideological world-deformation of Nazi ideology. At the risk of an extremely reductive simplification, the ideological basis of the Third Reich may be epitomized as an overstrained and perverted extrapolation of modernity's basic conflict between subject and world, coercing the expanding geographical and ideological spaces into an enveloping

Teutonic holism, degrading all the infinitely small elements of society to standardized deltas, making them vanish in the summing up to a *Deutsches Volk*, while on the other hand an equivalent strategy of differentiation sardonically complements the process of integration by singling out small ethnic and cultural differences. Expanding these into insurmountable anthropological incompatibilities, double integration appears as "the ancient rune that stands for the yew tree, or Death" (GR 302). Here Auschwitz comes to mind, not only as a calculated perversity but also as some estranged prolongation of modern calculus and its undifferentiated need for summing up—even the delta-ys of millions of murdered Jews.

Leibniz's basic philosophic idea informs his invention of calculus. The idea he called the "principle of continuity" refuses to admit any discontinuous change in history or nature: "Denying this principle will result in a world full of gaps . . . where only mere accident will give asylum."[3] This principle becomes the leitmotif for these forms of world-orientation, smoothing out any discontinuity to a sum of infinitesimally small, identical elements. Society, ideology, world: everything on a large scale seems to be continuously constructed out of the same basic elements, the indistinguishable individuals of a given ensemble.

In Pynchon's narrative calculus, double integration reflects "a Nazi inspiration like the parabola, but again also a symbol belonging to the Rocket" (GR 299). Nazi ideology is a mode of bringing modernity to an end. Endeavoring to stabilize a given situation or an achieved status by repeating its processual moves, this well-calculated summing up—a kind of second copy of history—manifests a twofold hermetic desanthropomorphism, the fatal fact of things happening twice in history: "the first time as tragedy," as Marx said, "the second time as farce."[4] It is the farce of modern and modernist approaches to old myths and new fashions—a farce present even in the iconic repetitions of soldiers marching in step and in the monotonous cadence of calculus: the rhythmic and identical cutting up of a given spatial or temporal sequence into a sum of infinitely tiny pieces.

Gravity's Rainbow abounds in examples of the doubling of historical, situational, scientific, personal, ideological and other constructive levels and elements, including Hänsel and Gretel, kinetics and cinema, the inverted Pavlov, London and Los Angeles, monads and cabins, as well as all those other dualisms and dialecticals mentioned above: Leibniz and Newton, integrals and derivatives, parabolas and circles, gravitation and optics, SS and double integration, tragedy and farce. Or, in Pynchon's straightforward version: "'Marxist dialectics? That's *not* an opiate, eh?' // 'It's the antidote'" (GR 701).

And summing it all up, Pynchon's quoting of Leibniz's authentic phrase "Summe, Summe"[5] yields the final farcical form, which Marx would probably have liked as a special version of the German ideology. For the German word *Summe*, the Teutonic variant of the Latin *summa*, parodies the basic self-referential statement of modern times, Descartes's "Cogito; ergo sum." Splitting "Summe" into "sum" and "me" leads to the ontological skeleton of Descartes's credo of certainty, reducing the rationalistic self-certainty of reason to the humming, almost buzzing sound of a circling bumblebee. At the same time, it brings the respective *linguae francae* of medieval and modern times—Latin ("sum") and English ("me")—into the context of a new post-Cartesian self-evidence where the subject's final self-certainty ends in the farcical dyslalia of a history of modernity happening twice. Gravity and rainbow coincide in a fraudulent coalition, while German bloodshed and history culminate in terrible and sometimes terribly ridiculous moments of pre- and postrational anthropomorphic articulations: "To integrate here is to operate on a rate of change so that time falls away: change is stilled" (GR 301).

Or—as Pynchon says Leibniz said—"Summe, Summe."

—*University of Bochum*

Notes

[1]In part 1 of the novel, V-2s are falling on London, and the Poisson distribution is introduced as a means to calculate "rocketfalls per square" (GR 140). Remarkably, the equation for Poisson's distribution in the novel is given in the form of a power series [$f(m) = Ne^{-m}\{1 + m + m^2/2! + m^3/3! + \ldots + m^{n-1}/(n-1)!\}$] and not in the exponential form [$f(x) = (ßx/x!)e^{-ß}$], which serves as a standard representation in most textbooks and analytic discussions. The reason for Pynchon's preference is obvious: though mathematically equivalent, the exponential representation does not make explicit to the eye what the power series does. The power series splits the total probability of rocketfalls into single terms, showing the overall pattern of destruction by superposing all single impacts. At the same time, the terms of the sum expand and broaden out, resembling the widespread distribution of rocketfalls, which becomes more and more distinct with each further strike. Thus a simple choice of mathematical notation may be used to give an almost sensuous concreteness to the overt symbolic abstractness of an equation.

[2]"Summ, summ, summ, Bienlein summ herum" ("Buzz, buzz, buzz, little bee, buzz around").

[3]"Si on le nie, le monde aura des *hiatus* . . . qui obligeront de recouvrir . . . au pur hazard" (Leibniz, Schriften 261).

[4]The original passage of typically Marxian dialectics reads, "Hegel bemerkt irgendwo, daß alle großen weltgeschichtlichen Tatsachen und Personen sich sozusagen zweimal ereignen. Er hat vergessen hinzuzufügen: das eine Mal als Tragödie, das andere Mal als Farce" (115).

[5]"Summe, Summe" seems rather improbable, though: Leibniz wrote almost all his mathematical texts in Latin or French. Thus "summa, summa" or "somme, somme" might be more likely; but in that case the central parody of the novel would remain more deeply hidden.

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