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Abstract:

Gravity is a prominent physical concept in *Gravity's Rainbow*, as already announced by the novel's title. If the second part of the title – the poetic image of the rainbow – is bound up with mathematical formulas and the parabolic path of the Rocket, so conversely, this paper argues, Pynchon's novel introduces a relation between gravity and fiction. This paper explores *Gravity's Rainbow's* use of the changing historical understandings of gravitation from the seventeenth to the twentieth centuries by examining the novel's illustration of Newton and Leibniz's opposed concepts as well as its references to gravity as understood in Einstein's theory of relativity. When tracing the notions of gravity as force, fictitious force, and frame of reference, a particular focus lies on the relation of physical imagery to ethical questions and on the way *Gravity's Rainbow* provides a physico-ethical explanation of Slothrop's disappearance from the novel.

Gravity in *Gravity's Rainbow* – Force, Fictitious Force, and Frame of Reference; or: The Science and Poetry of Sloth

Nina Engelhardt

Introduction: “Gravity’s Rainbow”

The title *Gravity's Rainbow* might seem to forcibly combine a scientific term—gravity—with the poetic image of the rainbow. The relation of the eponymous rainbow to the Rocket, the mathematical formulas used to calculate its parabolic path, and the destruction of its impact are commonly noted,¹ while this essay takes the reverse angle and focuses on the more immediately scientific component of the novel's title and the less readily noted relation of gravity to fiction. Examining the role of fiction in the scientific understanding of gravity will shed more light on the way *Gravity's Rainbow* exhibits a two-way exchange between science and literature that the title already suggests: the science and technology connected with the Rocket “invade” the poetic image of the rainbow, while at the same time aspects of fiction enter scientific notions of gravity.

The breakdown of the division between remits of science and fiction is not an end in itself in *Gravity's Rainbow*, but it is intricately related to ethical questions. In this essay I argue that concepts, metaphors, and models from the physical concept of gravity are invested with ethical meaning around one of the novelistic characters' appeal to “[b]e compassionate” (GR 587): the physico-ethical facet prominently informs the disappearance of the “main protagonist” Tyrone Slothrop, and physics also functions as a narrative model in a more intricate and ethically informed way than hitherto acknowledged.

Slothrop, the closest we get to a main protagonist in *Gravity's Rainbow*, begins to act less and appear less around three quarters into the novel until he is broken down entirely and “[s]cattered all over the Zone” (GR 845). Various thematic strands connect to the trajectory of Slothrop's life, and his dispersal has accordingly been interpreted from a variety of angles. In this introduction I shall present ways in which Slothrop's disappearance has been

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discussed in relation to science and to ethical terms around the Biblical sin of sloth that his name invokes. I then argue in the main part of the essay that the intricate interrelation of these perspectives in *Gravity's Rainbow* necessitates a combined physico-ethical analysis and that examining the interplay between physical and ethical concerns around the prominent concepts of gravity and sloth sheds new light on Slothrop's disappearance. The examination also allows for a more detailed insight into the narrative structure of *Gravity's Rainbow* as well as into Pynchon's view of the role of fiction in a time increasingly dominated by technology and science.

Interpretations of Slothrop's disappearance can be roughly divided into positive and negative evaluations of his growing inaction and final disintegration, both when considering it in relation to science and concerning the ethical category of sloth. Margaret Lynd, for example, claims that science is to blame for Slothrop's dispersal when she sees his freedom and agency curtailed by scientific conditioning to the point that he disintegrates as soon as he is no longer controlled from the outside: "Slothrop, is so deeply conditioned [...] that exposure to the anarchic environment of the Zone causes him finally to dissipate" (64). Slothrop is conditioned to react to the V2 Rocket as a stimulus, and Lawrence Kappel takes the relation further when claiming that Slothrop is identical to the Rocket and therefore subject to gravity: "he is the rocket returning to earth, to its birthplace and burying ground, submitting to gravity" (246). In contrast to Lynd reading Slothrop's disappearance in negative terms, Kappel proposes it to signify a release from the forces that act on the Rocket and to be an "ultimate escape from control" (248) for Slothrop. Ali Chetwynd arrives at a similarly positive conclusion when focusing on Slothrop's connection to the Rocket arc, the parabolic shape that the Rocket describes from launch to impact and that is often read as a geometrical metaphor of cause-and-effect relationships and binarism. Opposing these interpretations, Chetwynd considers the Rocket launch site as the gravitational centre that acts as an interface between negative and positive realms and holds that Slothrop's passing the site signals his turn "into a distended positive force that could be widely scattered" (127). I shall not refer directly to Slothrop's conditioning or relation to the Rocket here but rather focus on the physical concept of gravity that, however, informs notions of causal connections on which conditioning relies and has part in determining the Rocket's path.

Another strand of criticism focuses on the religious and ethical implications of sloth, invoked in Slothrop's surname and the topic of one of Pynchon's few nonfictional publications, namely the 1993 article "Nearer, My Couch,

to Thee” for *The New York Times*. As one of the seven capital sins, sloth has religious meanings; most importantly for Pynchon, in the Puritan understanding, sloth is absence of conviction and indifference and inactivity in the face of suffering. Edward Mendelson’s early interpretation takes up this religious and ethical notion of sloth when he argues that Slothrop’s lack of action shows carelessness regarding others and that the cause of his disintegration is therefore to be found in “his own betrayals” (Mendelson 183). Recent Pynchon criticism has seen a trend towards positive interpretations of Slothrop’s idleness, reading it not as sin but as signifying non-compliance and resistance against the elite that in its shadowy dominance is only known as “They” in the novel and that has near complete control over industry, politics, and the non-privileged. Christopher Leise makes this argument in his examination of Pynchon’s reactivation of suppressed strands of Puritanism and goes as far as reading Slothrop’s inaction and dispersal as signifying “salvific” resistance in the face of oppressive forces: “the narrative refigures the capital sin of Sloth into a context wherein its characteristic ambivalence becomes a productive stance of resistance against dogmatism” (128). Luc Herman and Steven Weisenburger in their analysis of domination and freedom in *Gravity's Rainbow* are far from describing Slothrop’s dispersal as salvific but argue that it at least enunciates “a minimalist claim of negative freedom” that equals minimal resistance: “It is selfish by definition, hence elementally political for it rejects domination and claims the right only to abide by one’s own lights” (212). In the following examination of sloth in relation to the physical concept of gravity I consider both positive and negative aspects of sloth and show how the physico-ethical dimension of *Gravity's Rainbow* supports the darker reading of Mendelson, Herman and Weisenburger.

At the basis of this essay is the argument that scientific and ethical aspects are inextricably related in *Gravity's Rainbow*, most of all in the concepts of gravity and sloth, and that they have to be considered together in a physico-ethical analysis. To this end, I shall analyse the precise metaphorical role of different conceptions of gravity in *Gravity's Rainbow*, from the seventeenth-century debate between Isaac Newton and Gottfried Wilhelm Leibniz to the theory of relativity formulated by Albert Einstein, and examine the consequences of this development for notions of force, resistance, sloth, and grace. A first step will introduce the relation of gravity to concepts of force and fiction and to ethical considerations around the distinction between Elect and Preterite in Pynchon’s novel. Then I will contrast this presentation of seventeenth-century understandings of gravity with developments in Einstein’s theory of relativity, which qualifies the pessimistic

and optimistic readings of the novel to which Newtonian and Leibnizian understandings of gravitation respectively give rise. The role of sloth in Slothrop's disappearance and the precise relation to the physical concept of gravity are the focus of the next section, before I elaborate on the novel's employment of sloth and gravity in relation to the combination of opposites that is so characteristic of Pynchon's writing. In a last step, I argue that the detailed attendance to the role of gravity and the physico-ethical dimension of Pynchon's novel also affords a more nuanced understanding of the model of the ethical value of fiction that *Gravity's Rainbow* puts into practice. In this respect Pynchon's widely noted questioning of novelistic ontology has to be reconsidered in the light of the use of gravity as a metaphor and structural device. Alertness to the physico-ethical dimension here attests that the ethical dimension takes precedence even over the ontological.

The Gravity of Their Control: Force or Fiction?

The seventeenth century saw the beginnings of the modern understanding of gravity and its wider importance when Newton formulated the law of universal gravitation and it quickly advanced to hold a central position in natural theology: "soon after its publication [Newton's] work became closely associated with the cause of Christian apologists" (Gascoigne 221). British physicotheologists cited Newton's work and the phenomenon of gravity in proofs for God's existence, and theological implications also form a crucial part in Newton and Gottfried Wilhelm Leibniz's famous debate over concepts of gravity. *Gravity's Rainbow* calls up such physicotheological discussions, while it explores the role of gravity not in theological but in ethical considerations.

Both Newton and Leibniz are mentioned in *Gravity's Rainbow*, in relation to their differing views of gravity as well as regarding their quarrel over the invention of the calculus. Newton is more immediately bound up with religion and ethics when his name is introduced in connection with William Slothrop's criticism of the Puritan doctrine that a small group of Elect are given God's grace and rule over a mass of disadvantaged Preterite. Tyrone Slothrop's forefather William strives for equality when preaching on the holiness of the Preterite without whom, so he argues, "there'd be no elect" (GR 658). The mentioning of Newton in this context implies that the physicist was similarly concerned with the balance of opposites: "It was a little early for Isaac Newton, but feelings about action and reaction were in the air" (GR 657). Indeed, Newton's third law of motion states that an action always occurs together with a simultaneous reaction of opposite direction. It

shares the insight with William Slothrop that opposite forces arise in pairs. William's ethical notion and Newton's physical principle are thus presented as equivalent reflections of a general attitude in the seventeenth century. As I shall argue, this interrelation of physics and ethics remains central to understanding the Slothrop family and in particular Tyrone Slothrop's disappearance from the novel.

Gravity's Rainbow sets up Newton's third law of motion as sharing a notion of equality with William Slothrop's acknowledgement of the importance of the Preterite. Newton's law of universal gravitation, however, provides the base for the Elect's control over them. The authority of the Elect relies on a belief that Their force determines the behaviour of the Preterite: "The illusion of control. That A could do B" (GR 36). Historically, Newton's formulation of the law of universal gravity played a decisive part in the rise of mechanism and causality and thereby enables the Elect's control over the Preterite. The *universal* character of Newton's law means that gravitation has the same effects on all bodies, on the earth as well as on other planets. Historians of science explain the far-reaching consequences: "By introducing the concept of universal gravitation Newton swept aside the separation of celestial and terrestrial motions which had been assumed for the previous two thousand years" (Gondhalekar viii). The notion of everything being governed by the same laws also implied that the order presumed to rule the heavens should similarly be found on earth, and consequently the discovery of the law of universal gravitation spurred scientific investigations into the regularity of nature and the detection of scientific laws. By supporting views of regular, law-like natural processes, Newton's law of universal gravitation enabled the advent of mechanistic and deterministic worldviews and of the belief that the world is ruled by causality.

As a historical base of causality and consequently of belief in the Elect's ability to control, gravity is a main underlying force in *Gravity's Rainbow*—metaphorically as well as physically: "Does no one recognize what enslavement gravity is[?]" (GR 540), a character complains, and together with various others tries to escape from its enslavement. Some characters work on the Rocket as a vehicle for flight that, as Wernher von Braun put it, might "free man from his remaining chains, the chains of gravity which still tie him to this planet. It will open to him the gates of heaven" (Sanders 133). If overcoming gravity is impossible, however, the Rocket will be forced back to earth and end in explosion—as it does in the form of the V2 rocket in the Second World War. *Gravity's Rainbow* voices both the hope of defying gravity with the Rocket and the fear of its destructive potential; so the view attributed

to the Manichaeans applies to the possibilities presented in the novel too: “a good Rocket to take us to the stars, an evil Rocket for the World’s suicide” (GR 862). The wider implications of the concept of gravity for notions of causality and control and, conversely, freedom and self-determination inform early discussions of gravity, most notably the debate between Leibniz and Newton. Pynchon uses the historical context to contrast ideas of force, causality, and control with notions of occult quality, correspondence, and fiction.

Leibniz famously opposed Newton’s conception of gravitational force, largely because of its philosophical and theological implications. Instead of a cause-and-effect relationship, Leibniz proposed the idea of a “*constant and regulated relation*” (*Briefwechsel* 109, my translation) between events to explain the phenomena of gravitation. Philosopher of science Ian Hacking summarises the rival idea: “actively rejecting any law of gravity, Leibniz had the idea of ‘constant conjunction’. Minds and bodies ‘express’ each other, and one body, in being, as we say, ‘affected’ by another, is better described as ‘expressing’ the other” (184). Leibniz further explained: “One thing expresses another, in my manner of speaking, when there is a *constant and regulated relation* between what is true of the one and what is true of the other” (*Briefwechsel* 109, my translation).² Such a relation is a correlation or, in the terms of *Gravity's Rainbow*, a “Kute Korrespondence[.]” with which people explain that they are “at the mercy of a Gravity” (GR 699) they do not really understand. Leibniz’s concept then is not based on a causal link, but, so philosopher Nicholas Jolley explains, Leibniz proposes that “the states of substances are harmonized by God so that they give the appearance of causal interaction” (49). Leibniz specifically objected to Newton’s notion of a *force* of gravity. In a letter to the philosopher Samuel Clarke, he opines that adherents to the idea of “*attractions*” have to believe them to be “effected by *miracle*; or else have recourse to absurdities, that is, to the *occult qualities* of the schools; which some men begin to revive under the specious name of *forces*; but they bring us back again into the kingdom of darkness” (*Philosophical Writings* 377). In his reply, Clarke explains that he understands “attraction” as “barely the effect, or the phenomenon itself, [...] whatever be or be not the cause of it” (*Leibniz-Clarke Correspondence* 115). Clarke’s reply points to a problem in Newton’s theory that Leibniz tried to circumvent with his alternative explanation of gravitation: while for Newton “gravity was a force whose reality was proved beyond doubt by phenomena” (Alexander xix), it could only be accounted for and understood properly if it had a determined origin, and Newton was precisely unable to clarify this point. Newton admitted: “to us it is enough, that gravity does really exist, and acts according to the laws which we have explained, and

abundantly serves to account for all the motions of the celestial bodies, and of our sea" (*Mathematical Principles* II 392). But, as Newton put it in a letter to Richard Bentley, "the cause of gravity is what I do not pretend to know" (*The Works of Richard Bentley* 210).

Since the cause of gravity remained obscure, Leibniz dismissed Newton's view of gravity as a force that "does really exist" (Newton, *Mathematical Principles* II 392). For Leibniz, the interaction of gravity only appears to be causal, while it "really" is a relation that could be otherwise but whose harmonisation by God ensures its constant working. Accordingly, Leibniz felt that Newton's unsatisfactory treatment of gravity implies it to be a "miracle" and that "it is a strange fiction to regard all matter as having gravity" (*Philosophical Writings* 228). Leibniz rejected Newton's view mainly due to its philosophical and ethical implications: while causal relations strengthen the mechanistic worldview and threaten human freedom and self-determination, his own concept of a constant and regulated relation does not imply causality and a determining force and therefore leaves room for free will. With his own notion of gravitation, Leibniz could accordingly argue that human beings are free and morally responsible for their actions.

In *Gravity's Rainbow*, notions of "Kute Korrespondence[]" (GR 699) and chance are pitted against those of causality and control. Appropriate to Gottfried Wilhelm Leibniz's rejection of gravity as a causal force, in Pynchon's novel, Leibniz's namesake Gottfried is the first passenger in the Rocket and eludes the grip of gravity: "Gravity dips away briefly" (GR 901). Equally appropriately though, the constant relation is once again reaffirmed: "This ascent will be betrayed to Gravity" (GR 900). So Gottfried approaches the heavens and enjoys a moment of free flight, but it is made clear that the Rocket will not elude the "enslavement" (GR 540) of gravity, and that regardless of whether it is understood as a causal force or Kute Korrespondence gravity has very real consequences.

The opposition of Newton and Leibniz's understandings of gravitation suggests a necessary reevaluation of the historically contingent belief in causality on which the control of the Elect is based. If universal "gravity does really exist" (Newton, *Mathematical Principles* II 392), then it legitimately gives rise to belief in causality. If, however, as Leibniz proposed, gravity is a "strange fiction" (*Philosophical Writings* 228) and universal gravitation only appears to be causal, then the power of the Elect is causeless, and liberation from Their system might be possible—without, however, supporting hope of actually eluding the grip of gravity in free existence and flight: Gottfried's flight in the Rocket reaffirms the universal physical phenomenon in *Gravity's*

Rainbow, and Leibniz's notion of gravity, which allows for freedom and self-determination, is not presented as a viable way to overcome the effects that Newton attributed to a universal force. At least, however, Gottfried's Rocket "rises on a promise, a prophecy, of Escape" (GR 900), and the historical context of competing concepts of gravity shows that it is not a force that is unproblematically in control, and by extension neither are the Elect. Indeed, as I discuss in the next section, later developments reveal that gravity is not a force at all.

Fictitious Forces: *Gravity's Rainbow*

The ignorance as to the cause of what Newton called the force of gravity persisted into the twentieth century. In *Gravity's Rainbow*, the narrator claims that we are "at the mercy of a Gravity we have only begun to learn how to detect and measure" (GR 699), and the astronomer and science writer David Darling summarises that, up to the twentieth century, for scientists "gravity was no more than an empty name for a phenomenon they didn't really understand" (141). Albert Einstein's work finally significantly advanced the understanding of gravity, and his theory of relativity made explainable Newton's inability to give the cause of gravity and affirmed Leibniz's scepticism as to understanding gravity as a force.

In *Gravity's Rainbow*, Einstein's theory of relativity is not specifically mentioned, although it clearly informs the text. Numerous critics have noted the importance of the theory of relativity for Pynchon's writing, so much so that Susan Strehle stated in 1992: "One can read more general discussions of relativity theory and quantum mechanics in the criticism of Pynchon's fiction than anywhere else in the literature section of the library" (24). In Simon de Bourcier's recent book *Pynchon and Relativity*, the author provides a very useful overview of studies on relativity in Pynchon's work and substantially adds to the research by examining how "the dramatic change in the way science understands time that comes about with Albert Einstein's Theory of Relativity helps to explain the way time works in these fictional texts" (1). Other than such focuses on time and space, this paper examines relativity in *Gravity's Rainbow* in relation to Pynchon's far less well-explored but immensely fruitful use of the concept of gravity.

If Einstein's scientific work demonstrates the limits of any previous understanding of gravity, *Gravity's Rainbow* presents the character Lyle Bland's twentieth-century explorations as showing that gravity has remained strange and that Leibniz was justified when describing it as due to an "occult quality" (*Leibniz-Clarke Correspondence* 184). Lyle Bland rediscovers the old

magic in Masonic rituals and “find[s] that Gravity, taken so for granted, is really something eerie, Messianic, extrasensory in Earth’s mindbody” (*GR* 698). His mystical access to gravity allows him to learn how to control it, while “[t]he rest of us [...] must go on blundering inside our front-brain faith in Kute Korrespondences” (*GR* 699). Where most people are left with an unsatisfactory causeless correlation, Bland, by accepting its mysterious nature, in a way even learns to defy gravity: “Lyle Bland rose up out of his body, about a foot, face-up” (*GR* 697). He also arrives at a deeper and, from a contemporary view, more accurate understanding of gravity when he feels that his gravity-defying journeys are travels in time as well as space: “The Bland who came back to rejoin the inert white container he’d seen belly-up on the sofa, thousands of years beneath him, had changed forever” (*GR* 697). Travels in time—“thousands of years”—and space—“beneath him”—point, of course, to Einstein’s theory of relativity and the profoundly changed understanding of gravitation to which it has given rise.

Crucially for physics and, in *Gravity's Rainbow*, for the Elect as they base their power on causal relationships with roots in Newton’s formulation of the law of universal gravitation, Einstein dispensed with the understanding of gravity as a *force*. According to the theory of relativity, there is no force of gravity that attracts objects, but there are only distortions in four-dimensional space-time. As Arthur Eddington, the foremost populariser of the theory of relativity in the 1920s, explained: “Einstein’s law of gravitation controls a geometrical quantity *curvature* in contrast to Newton’s law which controls a mechanical quantity *force*” (*The Nature of the Physical World* 133). In the famous story that has Newton sit under a tree and develop his law of universal gravitation from seeing a falling apple, Newton concludes that the apple falls to the ground because the force of gravity attracts it. Since the cause of such a gravitational force remained obscure, Eddington explains, “Newton had to invent a mysterious force dragging the apple down” (*The Theory of Relativity* 25). In Einstein’s theory of relativity, the apple falls down not because of a force that attracts it, but it moves because of a curvature in space-time. The mass of the earth creates a ‘dent’ in space-time, and the apple has no choice but to follow that curve and come to rest in that ‘dent.’ Einstein’s law is therefore concerned with a geometrical curvature, and the theory of relativity thus dispenses with the understanding of gravity as a force.³

Leibniz’s calling the force of gravity “a strange fiction” (*Philosophical Writings* 228) finds reverberations in the aftermath of Einstein’s formulation of his theory. An introductory textbook to mathematics from 1938 echoes the term ‘fiction’ in relation to gravitational force: “Today it is believed by

many scientists that gravitational force is merely a fiction and that we live in a type of space in which the behavior of bodies can be explained without recourse to that fiction” (Cooley et al. 597). If anything, the contemporary understanding is even more radical; for example, the physicist Michio Kaku states: “In some sense, gravity does not exist; what moves the planets and the stars is the distortion of space and time” (“Theory of Everything”). Since, however, gravity *appears* to act as a force, it is now scientifically termed a *fictitious force*.

It is consistent with the changed scientific understanding of gravity that when about to launch with the Rocket, Leibniz’s namesake Gottfried in *Gravity's Rainbow* not only remembers an apple—the fruit so tightly connected to gravity since Newton formulated the law of gravitation from observing the fruit—but remembers it in terms of the curved space described by relativity theory: “He’s remembering the skin of an apple, bursting with nebulae, a look into curved reddening space” (GR 895). Appropriate to the different understandings of gravity raised in *Gravity's Rainbow*, it is Gottfried who experiences that there is no *force* of gravity, while the image of curved space at his departure points to the geometrical curvature in space-time that explains why the Rocket will ultimately fall back to earth even if the force of gravity is ‘fictitious.’

Einstein’s concept of gravity as a curvature in space-time suggests an added layer of meaning in the title of *Gravity's Rainbow*: the curved shape of the rainbow can indeed be understood as a property of gravity. Moreover, with the developments in relativity theory, both components of the title *Gravity's Rainbow* are related to their supposed opposites: the poetic image of the rainbow is charged with the technological and scientific concerns surrounding the Rocket, and the physical concept of gravity has to be understood as a fictitious force.

The Principle of Equivalence: Physics and Ethics

Lyle Bland learns the secrets of gravity when lying on his sofa and letting his mind rise out of his body—an approach not all that dissimilar from flights of literary fancy or, indeed, to Einstein’s *Gedankenexperimente* or thought experiments. In his discussion of time, relativity, and the logic of fictional worlds, de Bourcier argues that thought experiments and certain fictions “interrogate the structure of the world [...] and] point out the paradoxes and contradictions that flow from making certain assumptions about that structure. They thus interrogate explanatory mechanisms which we might otherwise take for granted” (63). When *Gravity's Rainbow* establishes gravity

as a metaphor for Their control, its use of Einstein's thought experiments and their examination of possible contradictions in beliefs about gravity works to question the explanatory mechanisms of power, control, and authority. More importantly, however, the physical mechanisms that these thought experiments illustrate are intricately connected to ethical questions; in particular, physical principles inform the ethical dimension of Slothrop's dispersal.

In its physico-ethical interrogations of certainties *Gravity's Rainbow* makes use of one *Gedankenexperiment* in particular: Einstein's famous elevator experiment. In this thought experiment, Einstein imagines a person inside an elevator-like room that floats in space. A person in such an elevator is suspended in mid-air, while in a similar elevator on earth, the person rests on the ground due to the effects of gravity. Einstein then imagines the elevator in space to accelerate, which results in the person inside feeling pushed downwards and coming to rest on the floor—just as in the elevator on earth. Einstein concluded that the effect of acceleration equals the effect of gravity.

Slothrop's final scene in *Gravity's Rainbow* is not the chronologically last appearance before he scatters, but he is mentioned some fifteen pages before the end of the novel when Seaman Bodine remembers trying to save Slothrop from disintegrating into fragments. The passage is saturated with physical imagery and framed by two passages in which references to elevators point to the interrogation of explanatory mechanisms of gravitation in Einstein's thought experiment. So the scene following Bodine's memory of Slothrop puts into perspective their last conversation with a reference to Einstein's elevator experiment: "A wine rush: a wine rush is defying gravity, finding yourself on the elevator ceiling as it rockets *upward*, and no way to get down" (*GR* 882). Acceleration of the elevator rocketing upward should have a passenger end up on the floor, but the wine rush brings them to the ceiling and, by following an alcohol-distorted path in personal 'space-time,' defies the gravity-like effects of acceleration. The reason why a person in an elevator usually feels pressed down is not acceleration as such but the fact that the body does not accelerate together with the surroundings—the person stays in the same spot while the elevator floor comes closer. So passengers feel the effects of gravity because of their own inertia.

The people in *Gravity's Rainbow* who find themselves defying gravity and 'fly' to the elevator ceiling are prepared to resist the approaching police and occupation convoy. Slothrop is precisely not part of the group and their opposition, even if his nickname "Rocketman" or "Rocky" suggests that his place is in the elevator that "rockets" (*GR* 882) upwards. Rather than

acting according to his nickname, Slothrop's surname invokes the resisting force that is responsible for the fact that passengers end up on the floor when an elevator accelerates: the term 'sloth' in "Slothrop" points to the physical concept of inertia. And indeed, the Slothrop family has a tradition of growing inaction that is already implied in their name. The relation to inertia is highlighted by the physical terminology that pervades the passage describing their family history: the first Slothrops are "assimilated in life to the dynamic that surrounded them" (GR 32), they move along with the changing world, and the elements "powering the American mobility" also "claimed the Slothrops, clasped them for good to the country's fate" (GR 32-33). Yet, the Slothrops "did not prosper," they do not move on in the world, and later, the family does not even keep up with its dynamic course: "out of some reasoned *inertia* the Slothrops stayed east" (GR 33, my emphasis). Tyrone Slothrop's disappearance from the quickly developing post-war world and from the progress of the novel can thus be seen as the culmination of his family's staying behind in a changing world.

Tyrone Slothrop might bring his family's tradition of—in the broadest sense—physical inertia to its conclusion by dropping out of the progress of the novel's world, but he is also subject to an emotional and moral form of inertia. Before he vanishes from the text, he has given up making any impact on the world or lives around him: "Decisions are never really *made*—at best they manage to emerge, from a chaos of peeves, whims, hallucinations and all-round assholery. [...] It does annoy him that he can be so divided, so perfectly unable to come down on one side or another" (GR 802). Since he does not support any side, Slothrop is described as one of "the glozing neuters of the world" (GR 802). Historically, for Puritans neuters are people "that halt between two opinions [...] the Lord abhorres such lukewarme tame fooles" (Hooker qtd. in Miller 58), and whose "'[d]eadness of heart' was the most insupportable curse" (Miller 58). In Puritan terms, not having an opinion and not "com[ing] down on one side or another" is thus a sign of the "[d]ullness, coldness, emptiness [that] were more to be lamented than any specific sin" (Miller 58). Slothrop experiences the same consequences of indetermination: "He is growing less anxious about betraying those who trust him. He feels obligations less immediately. There is, in fact, a general loss of emotion, a numbness he ought to be alarmed at, but can't quite... *Can't...*" (GR 582). Being subject to emotional inertia as well as incapable of taking decisions and actions, Slothrop fails to realise the appeal to "'[b]e compassionate'" (GR 587). Unable to give enough weight to demands for compassion and to his decisions, Slothrop ceases to care and affect his surroundings—he remains emotionally and physically inert.

In the passage that concludes with the allusion to Einstein's elevator experiment, Seaman Bodine tries to persuade Slothrop to take action, defy inertia and gravity and 'fly.' While the glozing Neuters in their indecisiveness have no impact on the world, Bodine praises the questionable actions of the bank-robber John Dillinger that at least are a protest against the unsatisfactory state of things: "he still did what he did. He went out socked Them right in the toilet privacy of Their banks. Who cares what he was *thinking* about, long as it didn't get in the way?" (GR 879) According to Bodine, Slothrop's neutrality and lived equality is threatened to remain a bloodless enterprise if it bars him from acting on the world. He therefore wants Slothrop to have a cloth stained with Dillinger's blood and to understand that "what we need isn't right reasons, but just that *grace*. The physical grace to keep it working. Courage, brains, sure, O.K., but without that grace? forget it" (GR 879-80) Bodine himself has already learned the message from the blood-stained cloth and now wants to pass it on to Slothrop to save him from bloodless neutrality and deadness of heart: "I'm out of the Dumbo stage now, I can fly without it. But you. Rocky. You..." (GR 880). Bodine fails to reinfuse Slothrop with blood, and so "Rocky" Slothrop does not have blood and compassion enough to overcome gravity and 'fly,' but instead remains emotionally inert. Short of the human feeling and active frame of mind to fight the system of the Elect and keep up with the quickly changing post-war world, Slothrop brings to a close the family tradition of inertia, literally lacking the "physical grace to keep it working" (GR 880). Even Bodine, consequently, begins "in shame, to let Slothrop go [...] *Rocketman, Rocketman. You poor fucker*" (GR 880-81). After this, Slothrop dissolves into fragments, and it remains questionable whether the one part that achieves weight enough to come to rest under the gravity-related "apple tree by the road" (GR 882-83) will find his way back to those he used to care about most deeply: "It may be too late to get home" (GR 883).

The physical vocabulary and metaphors before, in, and after Slothrop's last scene suggest a parallel between the conclusions derived from the elevator experiment and Slothrop's situation: a person is weighed down by gravity and, in space, by their inertia when the elevator accelerates. When Slothrop is contrasted to the group that finds itself defying representatives of the system of the Elect and the gravity-like effects in the accelerating elevator, the implication is that his emotional inertia equals gravity and is as harmful or at least as ambiguous as the control of the Elect. So the physical equivalence principle—that the effects of inertia in accelerating surroundings equal those of gravity—finds an analogy in ethics: the effects of sloth can equal those of the Elect's domination.

The Two Sides of Gravity and Sloth

The equivalence principle that *Gravity's Rainbow* introduces with the case of Slothrop shows that sloth, absence of action, and having no impact on the surroundings can equal the effects of the Elect's force that weighs down the Preterite. Yet, when the inability to muster enough gravity to "come down on one side or another" (GR 802) means that Slothrop is a Neuter, it follows that some gravity is needed to lead a meaningful life. Gravity is therefore not presented as entirely negative, but also as a necessary constituent of life, and it thus has part in the principle of a balance of opposites that is characteristic of Pynchon's work. After considering the positive aspects of gravity that *Gravity's Rainbow* pits against its role as metaphor for the force of the Elect, I will look more closely at sloth as a positive stance in Pynchon's thinking. As the above has shown, *Gravity's Rainbow* makes use of different understandings of gravity, and notions of gravity as force, constant relation, and curvature in space-time coexist in the novel. I therefore continue to use the term "force" where appropriate to the discussion.

In the novel, Lyle Bland's experience of escaping gravity is closely related to a positive evaluation of this universal force. Before embarking on his Messianic experiments, Bland visits a room full of broken pinball machines that accommodate balls from the planetoid Katspiel. A planetoid's orbit depends on two main aspects: the planetoid's velocity and the gravitational force exercised by the sun it circles. Katspiel's is a "veryvery elliptical orbit—which is to say it passed by Earth only once, a long time ago, [...] and nobody knows where Katspiel is now or when, or if, it'll be back. It's that familiar division between return and one-shot visitation" (GR 691). Only if gravity is stronger than the energy due to velocity does the planetoid return. N. Katherine Hayles reads the passage as having wider significance: not only the fate of the pinballs depends on gravity but so does the universe. The universe is expanding and will either keep expanding or, if its total mass and the related gravitational forces are big enough, it will return to its original state and be reborn in another Big Bang. For Pynchon's novel Hayles therefore identifies a double role of the force of gravity that on the one hand does not let things escape from its grasp and on the other hand might enable cosmic return: "If Return is possible, it will be because gravity is pulling the universe together again" (196).

Gravity's Rainbow brings up the notion of an expanding universe and the associated questions when Gottfried is about to launch with the Rocket and remembers an apple whose speckled skin presents "a look into curved reddening space" (GR 895). The notion of curved space refers to the theory

of relativity, and the term 'reddening' relates Gottfried's flight to questions about the future of the universe. The so-called cosmological redshift is seen due to the expansion of the universe, since the further an object is moved away from the observer, the more does the light increase in wavelength and the 'redder' it becomes. Thus, "reddening space" (GR 895) is space that expands, while a blueshift would denote a contracting universe and the promise of its rebirth. Gottfried's changing notions of colour during his flight thus have wider significance for the hope of cosmological Return: suddenly, he "*can't remember what red meant, the pigeon he chased was slateblue*" (GR 901). Gravity will ultimately end Gottfried's ascent, but the dominance of gravity that prevents his escape also gives rise to hope that the universe might contract and be born again.⁴ The physical imagery thus supports the novel's illustration of a necessary balance between extremes: paranoia is as bad as anti-paranoia, complete control as unpleasant as absolute freedom and absence of meaning, and enslaving gravity as undesirable as endless expansive flight.

If gravity is not only presented as an enslaving force, so sloth, the ethical equivalent of gravity, similarly entails positive potential, as Pynchon's nonfictional writing in particular shows. In the newspaper article "Nearer, My Couch, to Thee" Pynchon discusses sloth and ethics and their relation to writing and to technology. He traces sloth back to its Puritan meaning that also informs *Gravity's Rainbow*: "Sloth—defiant sorrow in the face of God's good intentions—was a deadly sin" ("Nearer"). According to Pynchon, a secularised version of sloth refers to "[o]ccasions for choosing good [that] present themselves in public and private for us every day, and we pass them by" ("Nearer"), while a positive notion emerges when sloth begins to be considered a sin against productivity and the economy. To illustrate this modern notion of resistance, Pynchon uses the example of Herman Melville's "Bartleby the Scrivener: A Story of Wall-Street" (1853) whose Bartleby replies to all demands: "I would prefer not to." Pynchon then asks the question: "who is more guilty of Sloth, a person who collaborates with the root of all evil, accepting things-as-they-are in return for a paycheck and a hassle-free life, or one who does nothing, finally, but persist in sorrow?" ("Nearer"). Although Pynchon does not say so explicitly, the implication is that Bartleby's refusal to comply with the demands of the economy constitutes a laudable position of resistance.

Leise draws on Pynchon's newspaper article to argue that Slothrop's dispersal is due to "salvific sloth" (139). He provides an overview of the Puritan tradition and the role of Pynchon's ancestor William Pynchon in

seventeenth-century religious and political debates and establishes the notion of sloth in *Gravity's Rainbow* as “the modern sin of sloth that [...] is the moral malaise of inactivity in the face of injustice and iniquity” (137). While Leise holds the character Franz Pökler to embody this modern sin of sloth, he contrasts it to Slothrop's inactivity and argues that Slothrop gains “fuller insight into the nature of a salvific Sloth” (139) when he becomes a glozing Neuter and thereby transcends the distinction between Elect and Preterite. While Slothropian sloth does entail resistance to productivity, Leise does not take into consideration Slothrop's growing emotional passivity and carelessness that casts him in the ethical terms of the original Puritan understanding rather than in the terms of modern sloth that Leise derives primarily from Pynchon's newspaper article. Herman and Weisenburger are more attentive to the differences between Pynchon's fictional and nonfictional writing when they read Slothrop's inactivity far less positively as an expression of “freedom's minimalist position, short of killing himself” (212). Slothrop's refusal to cooperate is political when it rejects domination from the outside, but Herman and Weisenburger emphasise that his position is not in any way idealistic or transcendent. They specify that for Pynchon in “Nearer, My Couch, to Thee” “modern acedia demonstrates a lack even of a minimal disobedience. [...] The true acedia Pynchon defines entails the absence even of Bartleby's bare-bones mode” (208), and that while Slothrop shows some kind of defiance, he remains dangerously far removed from any notion of salvation when his “freedom entails the conditions of a perpetual banishment [...], forswearing practically all that human beings identify with ‘the good’” (211).

The physico-ethical dimension of Slothrop's dispersal that emphasises the equivalence of the effects of gravity and inertia in accelerating surroundings agrees with Herman and Weisenburger's darker reading of Slothrop's disappearance, and a closer look at Slothrop's inertia reveals a crucial difference to the example of Bartleby that Pynchon uses in his newspaper article: Bartleby's reiteration “I would prefer not to” marks a decision, however tentative the formulation, whereas Slothrop does not even decide not to act. Other than Bartleby, Slothrop does not prefer not to act but laments his inability to do so. And Slothrop's inertia costs him his innocence when he is handed a bomb with a lit fuse and does nothing except think: “Gee, sometimes I wish I wasn't so indecisive” (GR 817). He “is rescued from his indecision” (GR 818) but instead of then helping his rescuer who is abused and tortured in his stead, Slothrop “slips away, [...] dragging reluctantly, off of his grease-chevroned head, the shining wig of innocence...” (GR 818). If

Slothrop's unwanted inertia constitutes minimal resistance it also demands a high moral price.

Slothrop's indecisiveness is contrasted against Mexico and Gottfried's resolutions to defy gravity and control even though their attempts are doomed to fail. Mexico asks a question similar to the one Pynchon presents in "Nearer, My Couch, to Thee" but comes to a different conclusion when he realises the equivalence principle, namely the fact that doing nothing equals being part of Their system: "which is worse: living on as Their pet, or death? [...] he really does have to decide [...] He has to choose between his life and his death. Letting it sit for a while is no compromise, but a decision to live, on Their terms..." (GR 846). Mexico experiences a similar emotional carelessness as Slothrop, but a friend manages "to deliver him from his unmoving" (GR 746) and Mexico joins Seaman Bodine in a culinary prank that upsets maybe not Their system but at least the stomachs of the Elect. Slothrop's indecisiveness is also starkly contrasted to Gottfried whom Blicero has dominated in sado-masochistic practices all along, and who finally realises that he has to take a decision himself and at least momentarily defies gravity when traveling in the Rocket. Both Mexico and Gottfried's defiant actions are doomed to ultimately lose against gravity and Their control, but they at least keep alive dreams of freedom and maintain the innocence that Slothrop forfeits due to his inertia. The final scene of *Gravity's Rainbow* presents a similarly unwinnable defiance of gravity: there is no question that the rocket posed over the cinema will ultimately fall on "us", but it does not do so in the fiction—the novel ends with the rocket remaining suspended in "its last unmeasurable gap above the roof of this old theatre" (GR 902).

Gravity and sloth and their 'opposites' of free flight and playing the system form part of a balance of opposites in *Gravity's Rainbow* when the novel presents neither aspect alone as desirable. The interconnection of physical and ethical aspects clarifies the novel's focus on sloth, which differs from Pynchon's nonfictional writing when showing that a person who does not even decide not to act is as guilty as one accepting things-as-they-are for the sake of their own advantage—in *Gravity's Rainbow* the effects of sloth are largely equivalent to those of gravity.

Narrative Model: Frame of Reference

When *Gravity's Rainbow* points to the fact that gravity is a fictitious force and the related concept of Their control has to be rethought, it never loses sight of the fact that the effects of gravity cannot be ignored. Pynchon's novel thus does not present a world where "reality has become as relative as time

and space” (Olster 100), as more than one critic has claimed, but *Gravity's Rainbow's* vision as well as its narrative structure is better understood in the more detailed terms of relativity theory that the text introduces in relation to gravity. The novel's narrative structure, as well as its metaphorical use of relativity theory with the elevator experiment at its centre, does not support the pop version of Einstein's theory that 'everything is relative,' but it exhibits a far closer fidelity to Einstein's theory: rather than present reality as relative, *Gravity's Rainbow* illustrates the process that exposes universal forces to be fictitious.

The theory of relativity does not state that everything is relative but that the speed of light in vacuum is absolute, while all times and positions in space are relative. When measuring motion and rest it is therefore important to take into consideration the point of observation relative to which the measurement is taken; in other words, the frame of reference has to be taken into account. In physics, such frames of reference are distinguished into inertial frames and non-inertial frames, where an inertial frame is in a state of constant, rectilinear motion with respect to another frame and a non-inertial frame is in a state of acceleration in respect to another, inertial frame. The theory of relativity shows that the laws of motion in non-inertial frames differ from those in inertial frames, and that additional forces have to be introduced to account for motion if it is observed from within a non-inertial reference frame. These additional forces are fictitious forces, such as gravity.

The elevator experiment illustrates how a change in the frame of reference can reveal a force to be fictitious, and a slightly longer explanation of the thought experiment will help clarify the physico-ethical and structural use of it in *Gravity's Rainbow*. The elevator experiment begins by supposing that a person—let's call them “Rocky”—wakes up in what looks like the inside of an elevator, feeling the $1g$ or 9.81 m/s^2 of gravitation on the earth's surface act on him and keeping him on the ground. Rocky might, of course, be in a stationary elevator on earth. However, he might also have woken up in a “space-elevator” that, like the one the wine-shooting group defying the police finds itself in, “rockets upward” (882, first emphasis mine, second emphasis in original). Due to the equivalence principle, Rocky similarly experiences $1g$ when the elevator-rocket accelerates with 9.81 m/s^2 : as long as the acceleration lasts, Rocky is pressed down to the floor as an effect of his inertia in accelerating surroundings. From his position inside the Rocket, Rocky is not able to distinguish the source of the phenomenon that weighs him down: experiencing the gravitational “force” normally felt on earth, he is likely to

explain the fact that he is standing on the floor with gravity. As Einstein puts it in his *Relativity: The Special and General Theory* from 1920:

Relying on his knowledge of the gravitational field [...], the man in the chest will thus come to the conclusion that he and the chest are in a gravitational field which is constant with regard to time. [...] Ought we to smile at the man and say that he errs in his conclusions? I do not believe we ought to if we wish to remain consistent; we must rather admit that his mode of grasping the situation violates neither reason nor known mechanical laws. (Einstein 79-80)

Based on his experience of being weighed down and on experiments conducted in the elevator—letting apples fall to the ground and the like—Rocky could come to agree with Newton that “gravity does really exist” (Newton, *Mathematical Principles* II 392). Indeed, from inside the elevator and its non-inertial (accelerating) frame of reference, it is not possible to explain Rocky’s being weighed down other than by positing a force. In Einstein’s words: “A gravitational field exists for the man in the chest” (82). If the situation is viewed from an inertial frame of reference however, the force that Rocky feels can be discovered to be fictitious. A stationary observer outside the Rocket sees that there is no force pulling Rocky down, but that the effect of gravity is due to Rocky’s inertia. From the outside, it is therefore not necessary to introduce a new, ‘mysterious’ force that acts on Rocky, and an observer can conclude that the force of gravity that Rocky holds responsible for weighing him down is an illusion, that it is a fictitious force. Thus, a change in the frame of reference reveals whether a force experienced is really a force or rather a fictitious force. To adopt the clear words of Harald Fritsch’s popular physics book: “Gravitation is a phenomenon that depends on the reference system. In one system it exists, in the other it does not” (94).

The fact that Einstein’s thought experiment reveals the fictitious nature of the force of gravity explains why the episode in *Gravity's Rainbow* that ends with the group defying gravity at the elevator ceiling begins with an elevator operator who does not allow associations being made between elevators and Rockets. The scene takes place in Raketen-Stadt: “elevators are long-haul affairs, with lounges inside: padded seats and benches, snack bars, newsstands where you can browse through a whole issue of *Life*⁵ between stops” (GR 872). Mindy and the other elevator operators are instructed to deflect from elevator passengers’ questions about the Rocket: “he was going to ask about the Rocket and everyone knows it, but the subject is under a curious taboo, and polite Mindy has brought in now a chance for actual

violence, the violence of repression” (GR 872). The literal reading of “Life” that suggests itself here leads to the notion that the elevator is separated from the outside; a closed system in which a whole life can be spent. When the passengers are prevented from considering their journey in relation to a Rocket, they are discouraged from entertaining ideas that might lead them outside their frame of reference and to the consequent realisation that the repressive forces bearing down on them might be fictitious.

Where the Elect have an interest in preventing thought experiments and changes in perspectives to uphold belief in Newtonian laws and the basis of Their power in causality, the strategy of changing reference systems in order to determine the state of reality and fictitiousness is, of course, central to *Gravity's Rainbow* itself: the reader is not provided with a stable frame of reference but forced to frequently change perspective, and passages read as ‘real’ turn out to be characters’ hallucinations or dreams. As Brian McHale has shown, “the minds of *Gravity's Rainbow* give us access only to provisional ‘realities’ which are always liable to be contradicted and cancelled out” (“Modernist Reading” 91). The effect of the impossibility to determine the truth- and reality-status of an episode, so McHale argues, “is radically to destabilize novelistic ontology” (“Modernist Reading” 106), since what has been taken as novelistic reality might be eradicated with the next sentence. However, the detailed examination of gravity in *Gravity's Rainbow* provides us with an important caveat: gravity can be and is overcome in Pynchon’s novel, but the illustration of this central phenomenon also suggests that Pynchon does not embrace complete ontological uncertainty or relativism. He is careful not to put into question the very real gravitational effects, regardless of whether they are due to a force, constant relation, or curvature in space-time: Gottfried’s flight in the Rocket is a momentary escape from gravity only, and when Lyle Bland defies gravity, he has to leave his body behind and confine travel to the mind—a process largely comparable to literary flights of fancy and scientific thought experiments. *Gravity's Rainbow* itself closes with the suspension of a rocket over the roof of the cinema without implying that it can stop the fall. Pynchon’s novel does not propose the possibility of opting out of gravity then, but highlights the value of using fiction to step out into different frames of reference and discover the speciousness of what seems inevitable and ‘real.’ In this qualification, *Gravity's Rainbow* is reminiscent of Einstein’s cautioning his readers against misconceptions:

we might easily suppose that the existence of a gravitational field is always only an *apparent* one. We might also think that, regardless

of the kind of gravitational field which may be present, we could always choose another reference-body such that *no* gravitational field exists with reference to it. This is by no means true for all gravitational fields, but only for those of quite special form. It is, for instance, impossible to choose a body of reference such that, as judged from it, the gravitational field of the earth (in its entirety) vanishes. (Einstein 82)

As a further caution in *Gravity's Rainbow*, the metaphorical use of gravity suggests that the proliferation of perspectives is not to lead to inertia, but that the exact nature of reality, its perspectives, causes, and reasons, have to take a backseat: what ultimately matters is commitment to some kind of action that maintains compassion and the “physical grace to keep it working” (GR 880). In this way, the ethical dimension of gravity even takes precedence over the ontological.

Gravity in the various understandings introduced—as a (fictitious) force and a frame of reference—signals not only that the physical component of the title is interrelated with fictitious concepts as much as the more poetical rainbow is with science, but that the precise metaphorical role of gravity plays a crucial role in illustrating that and how *Gravity's Rainbow* is “a profoundly *moral fiction*” (Weisenburger 45). With its physico-ethical engagements the novel takes up and reshapes the tradition of physicotheology that begins with Newton’s formulation of the law of universal gravitation. When *Gravity's Rainbow* explores the contemporary state of physics in relation to ethical concerns, the physico-ethical dimension shows the necessity for detailed readings of Pynchon’s use of the theory of relativity: next to the well-established postmodernist proliferation of perspectives and worlds, *Gravity's Rainbow* also cautions against a free-for-all relativity and emphasises the limits of what can be exposed as fictitious. Comparable to Einstein’s conclusion from his thought experiment, Pynchon’s novel shows that it is impossible to choose a body of reference such that, as judged from it, the reality of the ethical demand vanishes. In other words, *Gravity's Rainbow's* interrelation of physical and ethical concerns establishes that seemingly universal forces can be exposed as fictitious but that there are matters that no change in reference frames can deny, most of all, the gravity of ethical concerns.

Conclusion: Luddite Sorrow and Ethical Writing

Alessia Riccardi takes up the non-physical meaning of the term ‘gravity’ when she compares Pynchon’s attentiveness to reality and its

ethical demands with Italo Calvino's *Invisible Cities* and claims that Pynchon's *Mason & Dixon*, but not Calvino's concern with language and literary form, constitutes an "ethically responsible engagement with social realities" (1063), not least "by virtue of the 'gravity' of Pynchon's very style" (1074). Riccardi here refers to the novel's grounding in history and its stylistic variability, instability, and plurality, but given the significance of the physico-ethical dimension in *Gravity's Rainbow*, it is worthwhile looking more closely at Pynchon's style and work in relation to the combination of scientific and ethical matters that the term 'gravity' and the related concept of sloth imply and that is a concern in Pynchon's nonfictional writing too.

In "Nearer, My Couch, To Thee," Pynchon draws conclusions from the discussion of sloth for his own profession when he ends with the suggestion that "[p]erhaps the future of Sloth will lie in sinning against what now seems increasingly to define us—technology"—and, we can safely add, science. Writers, already "considered the mavens of Sloth," are likely to be associated with opposition to technology too when seeing them "[p]ersisting in Luddite sorrow" ("Nearer"). Pynchon more closely examines the problematical connection of writers and technophobe Luddites in his 1984 newspaper article "Is It O.K. to be a Luddite?", and the implications in "Nearer, My Couch, to Thee" are that "persisting in Luddite sorrow" is a position guilty of the sloth of passing by "[o]ccasions for choosing good" and that writers are not to ignore the positive potential of slothful "mental traveling" to help realise "technology's good intentions" ("Nearer"). Unsurprisingly, then, for writers the sin of sloth is not suffering from writer's block or procrastination but indulging in Luddite sorrow, which is a sin of negligence, omitting possibilities to choose to advance the positive potential inherent in technology and science. Pynchon's nonfictional writing here strengthens the connection of technological and scientific issues with ethical concerns that he establishes in *Gravity's Rainbow*; his nonfictional "physico-ethical" view considers resistance to the developments of accelerating technological development to be an ethical sin of sloth—a sin that the writer of *Gravity's Rainbow* with its prominent interrelation of scientific, literary, and ethical elements can hardly be accused of himself: the physico-ethical dimension of the novel leaves no doubt that *Gravity's Rainbow* has ethical gravity and physical grace enough to keep it working.

End notes

1. See for example Alan J. Friedman's "Science and Technology" 82, N. Katherine Hayles's *The Cosmic Web* 170, Joseph W. Slade's *Thomas Pynchon* 185.

2. “Une chose exprime une autre (dans mon langage) lorsqu’il y a un rapport constant et réglé entre ce qui se peut dire de l’une et de l’autre.”
3. Einstein’s reconsideration of the *force* of gravity points back to the notion of force having become questioned in the nineteenth century. In their written correspondence James Clerk Maxwell and Michael Faraday discuss “the great mystery [...] how like bodies attract (by gravi[ta]tion)” (*The Life of James Clerk Maxwell* 203). Maxwell argued for “get[ting] over that difficulty [...] by simply admitting it [i.e. gravity]” (203), while Faraday warned against using the term ‘force’ and criticised people “who receive that description of gravity as a physical truth, and believe that it expresses all, and no more than all, that concerns the nature and locality of the power” (205).
4. When Pynchon and Hayles wrote about these cosmological matters, it was still scientifically held possible that gravity would counteract the expansion of the universe. In the late 1990s scientists discovered that the expansion rate of the universe most likely is accelerating, meaning that gravity is not powerful enough to pull things back together again and that the universe will keep expanding at an ever-increasing speed (see Riess 1297).
5. A particularly appropriate issue of the American general interest magazine *Life* is the one from 18 November 1957 where the photographic essay “The Seer of Space” is dedicated to Wernher von Braun’s rocket work.

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