



# Brecht's *Life of Galileo*: Staging a theory of the encounter of practices

Alejo Stark

University of Michigan; alejo@umich.edu

## Abstract

Brecht's *Life of Galileo* provides elements for elaborating what I call "a theory of the encounter of practices". The concept of the *encounter* pushes back against teleological theories that predestine modern science to operate as an instrument of domination. I argue that *Life of Galileo* stages the *missed* encounters in modernity between science, politics, and art at the same time as it foregrounds the emancipatory power of science. I trace the encounter of practices from the play's opening scenes – highlighting what I call Galileo's "double life". Then, I turn to the most important scene of the play, Scene 10, in which political and artistic practices repurpose Galileo's novel inventions for their emancipatory desires. In the virtual potentialities of this encounter, that is, despite the missed encounter between Galileo and "the people", Brecht's *Life of Galileo* continues to be fruitful for theorizing the emancipatory power of science.

## Keywords

Bertolt Brecht, Galileo Galilei, *Life of Galileo*, modern science, theory of the encounter of practices

## How to cite this article

Stark, Alejo. "Brecht's *Life of Galileo*: Staging a theory of the encounter of practices". *Galilæana* XXI, 1 (2024): 145-165; doi: 10.57617/gal-40

## Copyright notice

This work is licensed under a Creative Commons Attribution 4.0 International License (CC-BY 4.0).

## Article data

Date submitted: November 2023

Date accepted: January 2024

### *The modern sciences between domination and emancipation*

Let me begin with a famous disjunction that helps to express a broad range of beliefs in our contemporary moment as it concerns the effects of modern science. It is a famous disjunction concerning Galileo, a scientific hero or villain.

On one side of the coin, we have Galileo Galilei's "recantation" of his teachings. Galileo's cowardly recantation to the Inquisition was enough evidence, for some, to demonstrate how modern science is predestined to uphold Power.<sup>1</sup> Perhaps only second to Francis Bacon, Galileo bears the brunt for the "original sin" of modern scientific practice. Galileo the villain (or the coward): the Florentine who originated the Fall of modern science as he bit into the fruit of the tree of knowledge.

On the other side of the coin, Galileo's inventions and discoveries are the proximate cause that put the world *out of joint*, as Shakespeare's *Hamlet* might put it.<sup>2</sup> Galileo's heroism put the world out of joint, in part, by pointing the *occhiale* (later called "telescope") towards Jupiter and finding out that it had moons orbiting it, demonstrating – through analogy – that the Earth was not only *not* the center of the Ptolemaic-Aristotelian *kosmos* but that it orbited the Sun. It was an indirect attempt to support the "Copernican revolution". If Jupiter's moons orbit around the planet, then it is also conceivable that the Earth could orbit around the Sun. But Galileo also pointed the telescope – an instrument he did not invent but "merely" perfected – towards the Earth's moon, demonstrating the striking resemblances between this satellite and the planet it orbits. The moon's mountains, valleys, and craters were not unlike those seen by human eyes on the surface of the Earth. But all of this was unthinkable in the Catholic Ptolemaic-Aristotelian cosmology. First of all, how could the Earth move? Did not the senses seem to demonstrate otherwise? Certainly, one would fall sideways if Earth were hurling around the Sun! And secondly, how can the heavenly bodies contain structural features that humans also encounter on this lowly Earth? So it might already be intuited that Galileo's heroics did not just depend on simply extolling others to "look up" to the skies through his telescope. Still, it presupposed the production of a complex conceptual (and rhetorical) body that operated in such a way

<sup>1</sup> In what follows I use a common distinction in early modern philosophy between small "p" power and big "P" Power. Often attributed to Spinoza who distinguishes between *potentia* (power, *potencia*, *puissance*, *Kraft*), which is used in the sense of "power of acting", or activity, and *potestas* (Power, *poder*, *pouvoir*, *Macht*) which is used in the sense of being "under a Power" or having "in one's Power". Because the English language makes no such distinction between *potentia* and *potestas* I have resorted to using capitalization to distinguish the two concepts.

<sup>2</sup> *Hamlet's* quote is "The time is out of joint". But as Jacques Derrida remarks in *Specters of Marx* on the various French translation's of Shakespeare's play "time" can be *le temps* itself, that is, *le monde* ("the world") as well as *l'histoire* ("history") (*Specters of Marx*, 21). *The world is out of joint*.

that it shifted the grounds for what counts as evidence.<sup>3</sup> Galileo's conceptual inventions and the telescope threw the Earth – and the worldly Power that kept it in place – out of joint. If all of this holds, Copernican heliocentrism is not just an interesting mathematical alternative to Ptolemaic geocentrism but also undermines the very seat of the divine and social ensemble. The Gods were above the Earth, which guaranteed the perfect circular epicyclical motions of the stars on the celestial sphere. The social order was erected upon a cosmic order. The divine right of kings and the sovereignty of the Pope were thrown off their hinges once the Earth was decentered from the universe and began to move. (Recall that at the time, the supreme pontiff was preoccupied with expanding the Church's dominium in the New World and containing the Reformation within the Old World). Galileo closed the transcendent gap between the Earth and the heavens, throwing the political-theological *kosmos* off balance. Galileo: the hero who undermined Power.

So much for the origin tales. In contrast to these myths, it is perhaps Bertolt's Brecht play *Life of Galileo* – arguably his best and most accomplished play, a play which consumed almost half of his life – that most forcefully stages this disjunction between the villainous and the heroic Galileo *without ever deciding or resolving it*.

In *Brecht and Method*, Frederic Jameson argues that this “mechanism” defines Brecht's *dialectical* method. Galileo is a contradictory hero-villain, or “hero-coward”, as he puts it. But is it not the case that the dialectic formulated by Jameson – through St. Augustinian Identity/Difference and Hegelian Contradiction – necessarily *resolves* itself through overcoming such Contradiction (i.e., through a “double negation”)?<sup>4</sup> In that sense, it might be more rigorous to say that *Life of Galileo's* “contradiction” is perhaps closer to Brechtian *difference*. What follows can be read as an attempt to respond to Frederic Jameson's challenge in *Brecht and Method*: “I will therefore leave it to the Brecht friends among the

<sup>3</sup> Feyerabend's infamous take on the demarcation problem made much of Galileo in *Against Method* – anticipating the so called “strong programme” of the sociology of science which denies science any capacity for “objectivity” – by taking the consequences of the Italian modern scientist's “rhetorical” strategies to their absolutely relativist limit by comparing modern scientific practice to astrology and even the Mafia. Swerving from Feyerabend's relativist and reductionist account, Isabelle Stengers nonetheless maintains that “the invention of power to confer on things the power of conferring on the experimenter the power to speak in their name” (*The Invention of Modern Science*, 88). Koyré is famously known for breaking with the “abstract empiricis[t]” account of Galileo and posits instead the importance of a “Platonic mathematicism”. See Koyré, *Galilean Studies*, 37.

<sup>4</sup> Jameson, *Brecht and Method*, 123-124: “If, as St Augustine says (not an unscandalous saying in its own way), a thing can mean either itself or its opposite, then we have here the signifying mechanism of allegory, which can play on Identity and Difference indifferently, with the expectation that these will move on to Opposition, and finally to Contradiction. This mechanism explains why we do not have to decide whether Galileo (or Bukharin, for that matter) was justified: all we have to do is to note the issue itself, and debate it...”

Deleuzians (there must be some!) to show that what the playwright (and perhaps even Hegel himself) called *contradiction* was in many instances only a larger tent or umbrella for rich and subtle differentiations of all kinds”.<sup>5</sup> What follows will neither resolve nor decide this disjunction between dialectics and difference. But it will emphasize that in spite of Galileo’s recantation, modern science is not *predestined* to produce effects of domination.

For Brecht, and in contrast to the teleological *reductio ad dominationem* (reduction to domination) of scientific practices that obliterates any “subtle differences”, scientific practices are not inherently dominating. But neither are they inherently emancipatory. Brecht’s play stages this great “contradiction” – or unresolvable difference – that is constitutive of modern scientific practice. It also stages an encounter of practices as a way of reimagining how modern practices might become otherwise. Before turning to Brecht’s play, let me briefly clarify what I mean by a theory of the encounter of practices.

### *Encounter, not teleology*

It is perhaps Louis Althusser, in his dialogue with the Mexican philosopher Fernanda Navarro, who most audaciously defined the contours of a “philosophy of the encounter”.<sup>6</sup> Much discussion exists about how to best account for this move in Althusser’s philosophical practice.<sup>7</sup> For my purposes here, it suffices to say that the concept of *encounter* displaces *teleology*. The tendency that most powerfully expresses this in the history of philosophy is that of “aleatory materialism”, which, according to Althusser, can be traced in a rather heterogeneous list of proper names: Epicurus, Machiavelli, Hobbes, Spinoza, Rousseau, Marx, and Heidegger. Althusser often falls back on the cosmogony of the ancient atomists to illustrate the concept of the encounter, the *clinamen*, or the swerve of atoms through which the universe is produced. There is a “rain” of atoms whose paths are all parallel to each other. It is through a *clinamen*, or swerve, through which an atom strays from its parallel path and into another atom, thus producing an encounter, a new world.

Everything so far indicates that every practice and the social ensemble are themselves the *product* of an encounter. A practice is the product of an encounter that is not fleeting but rather, one that finds consistency in a specific mode of thinking-doing-making. Operationally, a practice is produced through the composition of such various elements. But it is the relation, the in-between practices, that make them what they are: colonial-capitalism, or the social ensemble, which is itself the product of an encounter Marx called “primitive accumulation”. Such a concept of the encounter displaces teleological theories of practice

<sup>5</sup> Jameson, *Brecht and Method*, 79. Emphasis mine.

<sup>6</sup> Althusser, *Philosophy of the Encounter*.

<sup>7</sup> See the edited volume *Encountering Althusser: Politics and Materialism in Contemporary Radical Thought*.

– that is, conceptualizations of practices that predestine them to some end which can already be found in the beginning, for instance, by predestining a practice to be essentially dominating (or emancipatory).

More importantly, it is through an encounter that yet another social ensemble might emerge – new relations between practices as well as the operations through which new practices can be produced. Bertolt Brecht’s *Life of Galileo* itself produces such an encounter of practices, swerving from the *reductio ad dominationem* of scientific practices and recuperating them as a power that can also produce emancipatory effects. In this sense, the play sets the scene for considering what I call the *encounter of practices* in a much more precise way than a purely “factual” historical account would allow us to do.

More specifically, *Life of Galileo* dramatizes the encounter – or rather, the *missed* encounter – between political and artistic practices and modern scientific practice. It also dramatizes an encounter in which modern science, through artistic and political practices, can be considered to produce emancipatory effects.<sup>8</sup> In this sense, Brecht is a true “poet” and not a “historian” in the sense distinguished by Aristotle’s *Poetics*. So even as Brecht’s “epic theatre” resists the Aristotelian dramatic theatre (insofar as it produces “a drama of a scientific age” by devaluing not just the cathartic moment but also any identification with the hero) – it is still quite close to it.<sup>9</sup> Even as the Brechtian epic theatre produces effects in the brain more than in the nervous system, it gets closer to the “poet” than the “historian” in Aristotle’s sense.

### *The poet and the historian*

In chapter 9 of his *Poetics*, Aristotle famously states that “the essential difference” between “the poet” and “the historian” is that “one tells us what happened and the other the sort of thing that would happen.”<sup>10</sup> And it is also this difference that brings poetic practice closer to philosophical practice. The writer, when producing effects as a historian, is concerned with *actuality*. In contrast, when producing effects as a poet-philosopher, the writer is concerned with what “would happen”, that is, with *possibility*.

<sup>8</sup> Following the distinction between power and Power in the footnote above, a given practice is not inherently emancipatory nor inherently dominating. This ambiguous character of practice cannot be clarified through logical or conceptual precision. Practices are ontologically ambiguous. The effects produced by a practice are analogous to the effectivity of the *phármakon*, the remedy poison that Jacques Derrida posits, through a deconstruction of Plato’s dialogue *Phaedrus*, in which writing becomes, at the same time, both the support to memory and of oblivion. The essence of writing, as a practice, are both a medicine and a poison to memory – it cannot be judged to be *essentially* emancipatory nor dominating.

<sup>9</sup> See Brecht on theatre: *The development of An Aesthetic*, 161.

<sup>10</sup> Aristotle, *Poetics*, 548-549.

But *possibility*, according to Henri Bergson and Gilles Deleuze – and in stark contrast with Aristotle – is coherent only when considering a *closed* system.<sup>11</sup> Aristotelian teleology, for example, presupposes such a closed system.<sup>12</sup> The characteristic mark of teleology is that the *ends* (the what-it-is-for of something) are already contained in the beginning – in the origin. Aristotle's well-known example is that of the acorn. The acorn is the *possibility* of – or *potentially* – an oak tree. Teleology presupposes, therefore, that becoming is the product of the *realization* of what is already there in the beginning. In contrast, an open system – such as what is presupposed in a Darwinian evolutionary theory of life or the physical cosmic evolution of the universe (from the Big Bang to the formation of stars and so on) – both scientific theories of the encounter – must take into consideration open systems, their operations, and their relations. In open systems, *possibility* is displaced for *virtuality*.

Virtuality (which is not any less real than actuality yet is qualitatively distinct from it) involves production, whereas possibility presupposes the ends in advance. So, for example, when Marx considers the “tendencies” of capitalist development, these should be thought of as virtual potentialities (in the sense of power or *potentia*) rather than *teleological possibilities*. The social ensemble colonial-capitalism is, in this sense, an *open* system.<sup>13</sup>

Following this account of virtuality, I will argue that Brecht's *Life of Galileo* dramatizes the inventive forces that – not in spite of historiography but nonetheless distinct from it – animate the real conditions of encounters between scientific practice and other practices. Far from demonstrating the “essential” character of science as domination – which

<sup>11</sup> See Bergson's *Creative Evolution*. Deleuze explicitly considers the relation between Bergson's open system and the virtual in *Bergsonism*, 43. For Deleuze's concept of “the new” and the shift from “possibility” to “virtuality” see Daniel W. Smith's “The New” in *Essays on Deleuze*, 252.

<sup>12</sup> There is nothing *essentially* erroneous about closed systems. This is not a critique of closed-systems as such. Much of modern science – such as thermodynamics' pistons – depends on them. The error lies in confusing the social ensemble with a closed system.

<sup>13</sup> This is not an uncontested account of Marx's concept of tendency nor of the Aristotelian-Hege-  
lian teleological story in which *potentiality* or *possibility* necessarily lead to *actuality*. In his account of Alain Badiou's paradoxical concept of the “evental site”, Bruno Bosteels provides a helpful mapping of the rejection of what he calls the “paradigm of potentiality” in contemporary theory (*Badiou and Politics*, 233). He traces the teleological “paradigm of potentiality” in Marx's letters to Ruge as well as Lenin and Mao as well as the rejection of such a paradigm in Agamben and Derrida (“potentiality without actuality, or spectrality without presence”), Žižek and Deleuze (“real virtuality, or the actualization of virtuality and the virtualization of the actual”) as well as Badiou (“actual impossibility, or the possibility of the impossible”). In my own account of Marx I have taken him closer to Deleuze's concept of virtuality. But for me, virtuality is merely a name for the Spinozan concept of practice as *potentia*, as actual, which is not “realizable” through “consciousness”, but rather, increased/decreased through a composition, or an *encounter* of practices.

would judge Galileo as responsible for the Fall of modern science – the play’s script itself is condemned to being written and re-written again and again – a becoming-philosophic of drama and a becoming-poetic of philosophy. Brecht re-wrote the play at least three times in two decades as multiple battle lines were drawn and re-drawn. The fog of war does not allow for a clear and distinct idea of the role played by scientific practices in emancipation. In this sense, the play itself is not a closed system; it remains open as it is re-written and re-invented under the effects produced, for example, both by political and scientific practices (war, the Atomic Bomb, Stalinism, the Un-American Activities Committee, ...).

The play was first written in German in three weeks of November 1938 and rewritten in English with some significant changes by Brecht and Charles Laughton in 1944. After the war, Brecht retranslated and rewrote it into German for the third version (1953-1956) to be staged in the *Berliner Ensemble* of East Berlin – amidst the remains and ruins of the war. It is a play written and re-written, translated and re-translated, because – not unlike Marx’s *Capital* – Brecht’s Galileo breathes in and out with the rhythms of the poet’s life as well as with the tendencies of the social ensemble.<sup>14</sup> Brecht’s achievement is that he does this without somehow “abusing” the actual “facts” of the historian.

As the theatre of war changes, so does the play. As the poet stages the “new age” of modern science, he faces the catastrophes at the dawn of the “atomic age”.<sup>15</sup> For Jameson, this points to the allegorical virtuality of any text. In the case of *Life of Galileo*, as a historical play, it is both about Galileo, the “new age” of modern science”, and also *about something else*. It is also about Oppenheimer, but also about Bukharin.<sup>16</sup> About the power to emancipate and the Power to dominate of scientific – and political – revolutions. Even as Brecht himself might become more and more skeptical about the virtual potentialities of science in the “atomic age”, these are always immanent to the text itself – “proto-allegorically” as Jameson puts it. Catastrophes that are perhaps not so foreign to the reader who today might face yet another scenario, yet again, of a “civilizational crisis” or “the end of the world”. In this sense, *Life of Galileo* is not so much (or not only) a representation of historical facts – of an actuality devoid of virtuality – but rather, it is a dramatization of the forces, of the encounters and *missed* encounters, between practices.<sup>17</sup> *Life of Galileo* is not

<sup>14</sup> The first volume of Marx’s *Capital* – perhaps even what establishes its scientific character – is its permeability to the open system of social practices (the social ensemble). This is most clearly expressed in the 1872-1875 French edition of *Capital: Vol. I* which was revised in the wake of the “defeat” of the Paris Commune and Marx’s turn towards the “margins” of capitalism.

<sup>15</sup> Brecht and Willett. *Brecht Collected Plays 5: Life of Galileo; Mother Courage and Her Children*, 234-271.

<sup>16</sup> Jameson, *Brecht and Method*, 122-123.

<sup>17</sup> It is well known that Brecht resorted to scientists as well as philosophers and historians of science – such as Hans Reichenbach – in the development of the scientific and historical elements of the play (*ibid.*, xi). See also Eamon, “Brecht and the Historical Galileo”, 19-23.

concerned solely with stating the facts of Galileo and his recantation, but rather, with its virtual potentialities (powers) and its inventions.

So how does *Life of Galileo* stage this central figure of the “scientific revolution”? It could be said that in consideration of “revolutions” – scientific, political, artistic, and so on – there exists a conservative and/or defeatist model which considers revolutions as always already bearing the seed of their demise. Even before they get going, it would appear that revolutionary events are already pre-determined to defeat and fail. In contrast to this view, yet another model exists that prioritizes the problem of “betrayal”. This model concerns itself with that moment in which a figure (a proper name) is deemed to be the cause of the closure of a rupture or event in a given practice or a given social ensemble. The model of betrayal asks disjunctive questions: did Stalin betray the Bolshevik revolution? Or had things already gone awry with Lenin?<sup>18</sup> Kronstadt? Did the multitude betray itself, or was it betrayed by those above? Did Breton betray *La Révolution surréaliste*, or...? Do contemporary scientists betray the great scientific revolutions? (Einstein's, Newton's, Copernicus'...but also Darwin's, Freud's and Babbage's and so on...). Did Galileo betray the Copernican revolution in his recantation, or did he cunningly bypass the authorities to finish the *Discorsi*? This model sets up the scene of an original Fall, perhaps not unlike that of original sin, through which a pure event becomes corrupted. Both models presuppose that revolutionary processes are *closed* rather than *open* systems (whose revolutionary becomings survive the actuality of the event).

In this sense, when considering the power of revolution, it is necessary to begin again. That is, to inherit the power of revolutionary becomings even in, or in spite of, their actual “defeat”. This is how I will read *Life of Galileo*'s staging of the “contradictions” (in the sense elaborated above) faced by modern science.

Revolutions produce fractures, cracks (*grietas* as the Zapatistas call them) from which the new might pass – through which invention erupts once again.<sup>19</sup> New cracks emerge. In this sense, betrayals and deviations – swerves – might also create new worlds. Or did not Christianity derive “a greater good” from Judas' betrayal? Was Christianity not born out of what Leibniz calls an “admirable economy” that sought to capitalize on Judas' sin – ensuring that it “is paid back with interest in the universe”?<sup>20</sup> A different example: the Lucretian swerve (*clinamen*) of an atom encounters and composes itself with another atom (as in the myths of the ancient atomists). Or, a quantum fluctuation gives rise to the Big Bang (as in the contemporary paradigm of physical cosmology). In both the case of the sensible science of Lucretius' *De Rerum Natura* and contemporary physics, it is out of a swerve or a fluctuation

<sup>18</sup> Deleuze and Guattari, *Anti Oedipus*, 375.

<sup>19</sup> Sixth Commission of the EZLN, *Critical Thought in the Face of Capitalist Hydra*. This is a recurring theme throughout the book and the Zapatista communiqués. See Subcomandante Galeano's “The Wall and Its Cracks” (“El Muro y la Grieta”).

<sup>20</sup> Leibniz, *Discourse on Metaphysics in Philosophical Essays*, 61.

– in short, *difference* – that “the New” emerges.<sup>21</sup> Jameson is correct in affirming that if there is a pedagogical aspect of Brechtian theatre: “what is taught, what is shown”, is “*ultimately always the New itself*”.<sup>22</sup> In this sense, Brecht is to Galileo’s physics what Lucretius was to the physics of the ancient atomists (Democritus and Epicurus). It is also in this sense that *Life of Galileo* dramatizes Galileo’s “life” and stages the power of the encounter (or rather, the *missed* encounter) between modern scientific practice and other practices.

### *A double life: Galileo in Brecht’s Life of Galileo*

None of this makes much sense without re-staging, at least in part, some relevant scenes of the script. In what follows – unless otherwise noted – I will focus on the English translation of the last Berlin edition of the play (1953-1956), which is longer than the much reduced and repackaged American version. (Even the title is shortened in the American version – simply *Galileo* rather than *Life of Galileo*). Despite this, in all versions of the play, Brecht stages what I call a “*double life*”. The opening scene expresses this much.

The script describes the scene as being set in “a modest house” that is understood to be “Galileo’s wretched study in Padua”.<sup>23</sup> It is there that the “teacher of mathematics at Padua” has “set out to prove Copernicus’s new cosmogony”. And he is animated by a “vast desire” for a “new time” – a new epoch.<sup>24</sup> Galileo is found teaching what today might be called “tabletop physics” to a young boy named Andrea – the housekeeper’s son. On the stage, a spectator can spot Andrea playing with a wooden model of the Ptolemaic system: the immobile Earth sits at the center, enclosed by nested metal rings representing the orbits of planets (“stars”) and the sun. As the boy moves the rings around the Earth, he says: “... we’re so shut in”. Galileo responds: “Yes, I felt that first time I saw one of those”. He continues:

Walls and spheres and immobility! For two thousand years people have believed that the sun and all the stars of heaven rotate around mankind. Pope, cardinals, princes, professors, captains, merchants, fishwives and schoolkids thought they were sitting motionless inside this crystal sphere. But now we are breaking out of it, Andrea, at full speed.<sup>25</sup>

<sup>21</sup> Before Stephen Greenblatt’s fabulous story of Lucretian modernity (*The Swerve*), it was Michel Serres’ *La naissance de la physique dans le texte de Lucrece* (translated as *The Birth of Physics*) that linked Lucretius and modern physics. Serres writes: “Henceforth the *clinamen* is indeed the smallest deviation and the optimal slope... Where then does one place the Galilean revolution? If it has balls roll down an inclined plane, it is doubtless because it constructs a singular case of the global model conceived by the atomists of antiquity” (*The Birth of Physics*, 33).

<sup>22</sup> Jameson, *Brecht and Method*, 125.

<sup>23</sup> Brecht, *Collected Plays 5: Life of Galileo*, 5.

<sup>24</sup> *Ibid.*, 6-7.

<sup>25</sup> *Ibid.*, 6.

Galileo's characterization of the "new time": the breaking out of the cage-like crystal spheres and its dominant social order – a closed system. "Our cities are cramped", Galileo continues, "and so are men's minds. Superstition and the plague. But now the word is 'that's how things are, but they won't stay like that.' Because everything is in motion, my friend". The Earth, the world, and the times – de-centered and in motion – are *out of joint*.

These ideas of modern science are so cathected ("a vast *desire*... to know"), Galileo states, because of "the ships".<sup>26</sup> Colonial expansion and the investments (libidinal and otherwise) of the nascent Venetian bourgeoisie caged "new" peoples and territories while, at the same time, pierced through the closed crystal spheres of the old cosmogony. A struggle of multiple tendencies or deviations – each with its singular virtual worlds to come. Or what Adorno and Horkheimer might have thought of as the contradictory dialectics of Enlightenment. In any case, differing from the "dialectic of Enlightenment", the aetiology in Brecht's play is reversed: modern science is not the *cause* of colonial-capitalist domination, as Adorno and Horkheimer might put it, but rather, it is an *effect* of the colonial-capitalist social ensemble.<sup>27</sup> It was *because of* "the ships". This *relative autonomy of scientific practice* (*vis a vis* the social ensemble of practices) is dramatized through the entrance of Ludovico Marsili, briefly described as "a rich young man".<sup>28</sup>

Ludovico's family has sent him to get private science lessons from Galileo. They own estates in the Italian campagna, which – the spectator is later told – are sustained by peasants' labor. But Galileo resists taking on another student. He desires and needs to produce new experiments and continue his research. But in light of his financial situation (or rather, as Andrea's mother stares him down from the other room), he is forced to take Ludovico on as a student. Galileo needs to buy milk – keep his belly full, pay rent, and so on – but also get his wine. Galileo's scientific practice is partially determined by economic practice (need and desire).

Brecht's notes on the character of Galileo produce not only a scientist who needs to "eat" but also a modern Epicurean: "He insists on his physical pleasures because of his

<sup>26</sup> *Ibid.*, 6-7.

<sup>27</sup> While I cannot elaborate on this in detail here, the opening chapter of *Dialectic of Enlightenment* strongly suggests that science is essentially dominating and in the service of colonial-capitalism: "Although not a mathematician, Bacon well understood the scientific temper which was to come after him. Knowledge, which is power, knows no limits, either in its enslavement of creation or in its deference to worldly masters. Just as it serves all the purposes of the bourgeois economy both in factories and on the battlefield, it is at the disposal of entrepreneurs regardless of their origins. Kings control technology no more directly than do merchants: it is as democratic as the economic system with which it evolved. Technology is the essence of this knowledge. It aims to produce neither concepts nor images, nor the joy of understanding, but method, exploitation of the labor of others, capital". (Adorno and Horkheimer, *Dialectic of Enlightenment*, 2).

<sup>28</sup> Brecht, *Collected Plays 5: Life of Galileo*, 11.

materialist convictions. He wouldn't, for instance, drink at his work; the point is that he *works* in a sensual way".<sup>29</sup> Brecht insists, "My Galileo is a powerful physicist with a tummy on him, a face like Socrates, a vociferous, full-blooded man with a sense of humor". Because the poet emphasizes, "History without humor is a ghastly thing". The Brechtian gesture (*Gestus*) embodies the spirit of the new physicist: "Favorite attitude: stomach thrust forward, both hands on the buttocks, head back, using one meaty hand all the time to gesticulate with, but with precision; ...".<sup>30</sup> To keep his belly full and drink his wine, Galileo tends towards Ludovico's offer: "fifteen scudi a month". However, scientific practice is not reduced to its determination by economic practice.

After Ludovico leaves the stage, the university Procurator comes in. He informs Galileo that he must reject his "application for a rise in salary to 1000 scudi". And then says: "As you know, courses in mathematics do not attract new students. Mathematics, so to speak, is an unproductive art". Galileo responds, perhaps not unlike a contemporary university professor whose research grant has just been rejected and who teaches too many classes and sits on too many committees: "My dear fellow, I can't manage on 500 scudi". When the procurator tells Galileo he must get new pupils to give private lessons to, the physicist responds: "I teach and I teach, and when am I supposed to learn? ... When am I to get on my with my research?" The procurator reminds Galileo that even though the Venetian republic "pays less than certain princes it does guarantee freedom of research", and that "[w]hen you're selling knowledge you can't ask more than the buyer is likely to make it from it". To which Galileo responds: "I see. Freedom of trade, freedom of research".<sup>31</sup>

The research is therefore interrupted to deal with matters concerning Galileo's household. A "second life" creeps in. (It divides, that is, it multiplies). The nascent merchant bourgeoisie is interested in science insofar as it can produce a profit for it. That is, insofar as Galileo turned mathematics towards technologies that could produce what bourgeois political economist David Ricardo called a "comparative advantage" for the Venetian merchants. In return, the republic will fund his research.

Far from being autonomous, scientific practice is subjected to an external Power, to a Power alien to it: the economic practice of the nascent bourgeoisie. Galileo's double life: scientific practice *and* economic practice. But this conjunction also involves a causal direction: economic practice *determines* scientific practice. The latter is *relatively autonomous* as it is alien to it and not in a relation of *free association*. Galileo leads a double life as a worker, selling the products of labor to capital, and as an astronomer, studying the heavens – two

<sup>29</sup> These are undated notes written by Brecht concerning the "character of Galileo" which seem to be directed at the American version of the play (*ibid.*, 193).

<sup>30</sup> *Ibid.*, 193. These are notes written by Brecht in March 1941.

<sup>31</sup> *Ibid.*, 15.

aspects of what is otherwise conflated as the same practice. One aspect is concerned with how and what the practice produces, and the other is concerned with its relation to other practices (the effect by and on economic practice, in this case). So even though Galileo reminds the Procurator that the republic handed “Giordano Bruno over to Rome”, what is determining is not so much the external Power of religious practice, but rather, the true universal equivalent – the money commodity – and its capacity to produce and reproduce both conscious needs and unconscious desires.

This double life evokes Marx's critique of Bauer's concept of emancipation: “[a] state can be a free state without man himself being a free man”. Even in the “free” Venetian republic, Galileo's scientific practice was subjected to Power alien to it. Marx writes in his critique of Bauer: “[w]here the political state has attained its full degree of development man leads a *double life*, a life in heaven and a life on earth, not only in his mind, in his consciousness, but in reality”.<sup>32</sup> This parallels the dual life of the commodity and the dual life of labor under capitalism. Use value and exchange value are paralleled by concrete labor and abstract labor. Two aspects of the same thing, not as dichotomies, but as conjoined flows: use-value bleeds into exchange-value, and concrete labor bleeds into abstract labor. At stake is the problem of domination as abstraction.

In his account of Marx's characterization of domination as abstraction, the political philosopher Alberto Toscano seems to trace a line that follows the abstractions of transcendence: from religious transcendence to the transcendence of the political state, passing through the transcendence of money. This is why, Toscano emphasizes, Marx's critique of Bauer is a *critique of the critique of religion*. It is not enough to critique the abstraction of religious transcendence while leaving the abstractions of political-economic practice intact. Furthermore, it is also vital not to confuse the *weapon of criticism* with *criticism by weapons* because transcendence is not merely in “consciousness” but in “reality”.<sup>33</sup> But Toscano quickly veers into the populated territory of what I call the *reductio ad dominatorem* of scientific practice and identifies “abstraction” today – perhaps not unlike Adorno, Horkheimer, and others before him – with “the certainties of science”.<sup>34</sup> Today, there is a certain displacement in critical theory. *The critique of religion has now become the critique of science*. What is needed is, perhaps, a *critique of the critique*. Brecht and a theory of the encounter of practices – might be able to help in this regard.

All of this suggests that Galileo's *double life* is not unlike that of a worker who sells their labor-power in exchange for a means of consumption. Galileo's “concrete labor” is that of

<sup>32</sup> Marx, “On the Jewish Question”, 210. Emphasis added.

<sup>33</sup> Marx writes: “The weapon of criticism cannot, of course, replace criticism by weapons, material force must be overthrown by material force; but theory also becomes a material force as soon as it has gripped the masses” (“A Contribution to the Critique of Hegel's *Philosophy of Right*. Introduction”, 251)

<sup>34</sup> Toscano, *Fanaticism*, 202.

the production of knowledge (i.e., scientific practice and its pedagogical and technological variations). And that's not reducible to producing technologies for war and trade (political and economic practice). Without the distinction between *power* and *Power*, scientific practice's effects are reduced to those of *Power*, that is, to a practice of domination (or abstraction, in Toscano's formulation). These two tendencies, or lives, are embodied and staged in Brecht's Galileo. The second scene of *Life of Galileo* further dramatizes this *double script* concerning the physicist's "invention".

It turns out that Galileo had gotten news from his student Ludovico that some contraption was being manufactured in the Netherlands that put together high-quality (that is, meticulously polished) convergent and divergent lenses on opposite ends of a tube to magnify far-away objects. The Florentine made a few changes, repackaged the contraption, and sold it to the Doge of Venice shortly after. The scene opens up with Galileo presenting his "invention" to the Doge, several senators, and other authorities of the Venetian republic:

Your excellency; august Signoria! In my capacity as mathematics teacher at your university in Padua and director of your great arsenal here in Venice I have always seen it as my job not merely to fulfill my exalted task as a teacher but also to provide useful inventions that would be exceptional advantage to the Venetian Republic. Today it is with deep joy and all due deference that I find myself able to demonstrate and hand over to you a completely new instrument, *namely my spyglass or telescope*, fabricated in your world-famous Great Arsenal on the loftiest Christian and scientific principles, the product of seventeen years of patient research by your humble servant.<sup>35</sup>

The spectator meets Galileo's stately address with incredulous laughter. The previous scene had shown how Galileo had not invented the spyglass-telescope, but merely "discovered" it – *encountered* it – through Ludovico, the son of elites seeking private science lessons. A signature moment of Brecht's historical humor.

As the Venetian authorities applaud "their" scientist, the double script or double life becomes discernible as Galileo moves towards his friend Sagredo and "softly" tells him: "Waste of time". The mathematician "softly" responds to Galileo: "You'll be able to pay the butcher, old boy". The double script continues throughout the scene as Galileo simultaneously smiles at the authorities while confiding to Sagredo that the telescope is not just meant for giving Venetian merchants a comparative advantage in anticipating ships coming to their port nor for giving Venetian military men the capacity to anticipate warships on the horizon. As Marx states, the use-values of a commodity are "the work of

<sup>35</sup> *Ibid.*, 18. Emphasis added.

history" (in other words, *virtual*).<sup>36</sup> The exchange value of this commodity – that is, its use-value for others – is as a *spyglass*, not as a *telescope*. Hence, the "or" in the phrase "my spyglass or telescope" should be read as an *exclusive disjunction* rather than as an *equivalence*.<sup>37</sup> In the latter case, the consideration of the telescope is taken under some notion of possibility (a telos which predestines all to its "economic" use) and in the former as virtual potentiality.

Galileo says "softly" to Sagredo: "I'm not sure how long I'll be able to stick this circus. These people think they're getting a lucrative play thing, but it's a lot more than that. Last night I turned it on the moon".<sup>38</sup> Scientific practice here is taken not under the aspect of what it *produces* (onto-epistemologically: knowledge about the "stars") nor under the aspect of its *process*, or how it does so (with a telescope, ink and paper, and so on), but rather, *relationally*. Or under the effect of a practice external to it, which determines it (economic practice). In the subsequent scenes, Galileo would also turn his "invention" on four bright "objects" in the vicinity of Jupiter.<sup>39</sup>

This double script, this double life, can also be encountered in the actual traces left by Galileo in a single-leaf manuscript that the astronomer divided in two by tracing a clear line of demarcation.<sup>40</sup> This manuscript is sometimes called "the Michigan leaf" because it is kept by the University of Michigan's special collections library, and it is dated to the months before the publication of *Sidereus Nuncius*.<sup>41</sup>

On the top half of the sheet, the reader finds a part of Galileo's draft letter written in the August 1609 to the Doge of Venice explaining how his invention – a spyglass ("l'Oc-

<sup>36</sup> Marx, *Capital: Vol. I*, 125. Full quote which opens *Capital*: "Every useful thing... maybe looked at from the two points of quality and quantity. Every useful thing is a whole composed of many properties; it can therefore be useful in various ways. The discovery of these ways and hence the manifold uses of things is the work of history". While it is often said that Marx's conception of economy involves only conscious interest concerning *needs*, Marx also clearly states in this opening paragraph that: "The commodity is, first of all, an external object, a thing which through its qualities satisfies human needs of whatever kind. The nature of these needs, whether they arise, for example, from the stomach, or the imagination, makes no difference". As such, *needs* are already a multiplicity. Not just conscious needs ("from the stomach") but also needs from "the imagination", that is, unconscious desire.

<sup>37</sup> So much hinges on this – think for example, of the implications of considering Spinoza's "*Deus sive natura*" as expressing a *disjunction* in contrast to expressing an *equivalence*, that is, "God, or Nature" in contrast to "God = Nature".

<sup>38</sup> *Ibid.*, 19.

<sup>39</sup> Scene 3, *ibid.*, 25.

<sup>40</sup> A digital rendition of the manuscript can be seen here: [https://quod.lib.umich.edu/s/sclib/x-b224299/32469\\_0001](https://quod.lib.umich.edu/s/sclib/x-b224299/32469_0001). University of Michigan Library Digital Collections. Accessed: February 22, 2022.

<sup>41</sup> Bredekamp, *Galileo's Sidereus Nuncius*.

*chiale*) – will provide advantages to the republic’s military and economic interests.<sup>42</sup> This draft letter matches, in spirit and in letter, Galileo’s stately opening dialogue to the Doge in the beginning of Scene 2 quoted above. On the bottom half of the page, the reader finds the astronomer’s own observational notes of several bright objects moving near Jupiter during the weeks of January 1610 which he saw through his invention – a telescope. Galileo turned the “invention” upwards and discovered that the traces of the movement of the four objects across the night sky must be Jupiter’s moons.<sup>43</sup> Months after, Galileo published *Sidereus Nuncius* (*The Starry Message* or *The Starry Messenger*), which is devoted, in large part, to a study of Jupiter’s four moons and their trajectories around their host planet.<sup>44</sup> The stars, or moons, were no longer erratically “wandering” around a straight line across Jupiter but were *orbiting* the planet. The universe had no unique, universal center of rotation. *Sidereus Nuncius* argued against those who opposed the Copernican system because it could not explain why the Earth would be the only planet with a single moon orbiting it. If Jupiter had not just one but four moons orbiting it, then the Earth was like any other body orbiting the sun.<sup>45</sup> It is as if the two lives, two tendencies embodied by Galileo’s practice – the determination of modern scientific practice by political-economic practice, that is, science’s *relative* autonomy – can be directly in the traces left by the astronomer in this single sheet of paper. Abstract and concrete labor, Power and power, expressed in the same sheet of paper and separated by a line of demarcation which multiplies life in two.

When I got to consult this manuscript, the very helpful librarian at the *Michigan Special Collections* told me that this was a mere contingency. Galileo used the same sheet – jotting down what would become the first scientific notes of telescopic phenomena in the history of modern astronomy – because “paper was expensive”, and he had the need to take research notes on the same sheets of paper he used to draft his letters to his patron (the Doge of Venice) that is, to those he wrote for money. As such, not much is to be made of this contingency other than the sheer necessity of its economic determination.<sup>46</sup> Since then, the

<sup>42</sup> Most translations render this as “spyglass”. Only later was the term “telescope” used. The invention started functioning as a telescope – not just as a spyglass – well before it was named as such.

<sup>43</sup> For an overview of Galileo’s discoveries in those years prior to the publication of *Sidereus Nuncius* see Hamacher, “Introduction”, 17-19.

<sup>44</sup> Compare the “Michigan leaf” notes to what was then published in *Sidereus Nuncius* (Van Helden, *Sidereus Nuncius* or *The Sidereal Messenger*, 66-70).

<sup>45</sup> See Van Helden, *Sidereus Nuncius*, 86. Galileo writes: “We have moreover an excellent and splendid argument for taking away the scruples of those who, while tolerating with equanimity the revolution of the planets around the Sun in the Copernican system, are so disturbed by the attendance of one Moon around the Earth while the two together complete the annual orb around the Sun that they conclude that this constitution of the universe must be overthrown as impossible”.

<sup>46</sup> For extensive commentary on these fateful days of Galileo’s and the writing of *Sidereus Nuncius* see Bredekamp, *Galileo’s Sidereus Nuncius*, 13-18.

historian Nick Wilding has discovered the famous manuscript to be a forgery.<sup>47</sup> And yet, the forged “Michigan leaf” nonetheless perfectly illustrates Galileo’s double life: scientific practice and its relation to the economic (and political practices) of the artisan and courtier.<sup>48</sup>

Beyond this bifurcation of life, the question is whether the *starry message* is disseminated beyond those who could read the Latin of *Sidereus Nuncius*. Brecht dramatizes this encounter in Scene 10.<sup>49</sup>

### *Science and the People?*

An entire decade separates Scene 10 from Galileo’s discovery of Jupiter’s moons in Scene 3. During that decade, Brecht’s opening script – often staged by being written on a banner – reads: “Galileo’s doctrine spreads among the common people. *Ballad-singers and pamphleteers everywhere take up the new ideas*. In the carnival of 1632 many Italian cities choose astronomy as the theme of their guild’s carnival processions”.<sup>50</sup> The shorter American version poses the encounter by setting up the “Carnival” scene with the following verse: “On April Fools’ Day, thirty two, / Of Science there was much ado. / People had learned from Galilei: / *They used his teaching in their way*”.<sup>51</sup>

<sup>47</sup> Feldman, “Historian Discovers a Prized Galileo Manuscript Was Forged”.

<sup>48</sup> See Mario Biagioli’s *Galileo Courtier: The Practice of Science in the Culture of Absolutism*.

<sup>49</sup> This jump from Scene 3 to Scene 10 over-emphasizes the determination of scientific practice by political-economic practice while sidelining the (perhaps more common) determinations by political-religious practice. For example, in Scene 4 Galileo attempts to convince the scholars of the Court of Florence that the Medici Stars (the name he gave to moons of Jupiter in *Sidereus Nuncius*) exist and that they trouble the old cosmology. Arguing against the Aristotelian-Ptolemaic philosopher and mathematician of the Court – who refused to look through the telescope – Galileo discourteously states: “What has made Italy prick up its ears is not the movements of a few distant stars but the news that hitherto unquestioned dogmas have begun to totter-and we all know that there too many of those” (Brecht, *Collected Plays 5: Life of Galileo*, 39). Galileo continues his research in spite of the plague (Scene 5) and gets confirmation of his discovery (Scene 6) by the famed Vatican astronomer Christopher Clavius who states: “Now it’s up to the theologians to see how they can straighten out the movements of the heaven once more” (*ibid.*, 51). It turns out that they cannot. And so in Scene 7, set after the plague, then-Cardinal Barberini (who will eventually become Pope, Scene 9, and order Galileo’s house arrest in Scene 11 and 12) invites Galileo to a masked carnival celebration (except that the astronomer is the only one without a mask). The Inquisition puts Copernicus’ teachings on the Index of Printed Books and Bellarmine states: “the Church’s view that it is impossible for us to know, but legitimate for us to explore” (*ibid.*, 57). Modern scientific practice is therefore caught up between, on the one hand, political-economic practice (the nascent merchant bourgeoisie and the Courts), and on the other hand, Ptolemaic-Aristotelian philosophical and scientific practice allied with religious practice.

<sup>50</sup> Brecht, *Collected Plays 5: Life of Galileo*, 76. Emphasis mine.

<sup>51</sup> Brecht, Laughton, and Bentley, 98. Emphasis mine.

The “people” have taken up the scientific ideas of the new times. At stake now is the effect produced by scientific practice on other practices. More specifically, the effect of modern scientific practice on political and artistic practices – and their emancipatory effects.

In this scene – the most important one in the play – the people’s use of scientific ideas is dramatized in a carnival procession headed by a “half-starved couple of fairground people with a baby and a five-year-old-girl”.<sup>52</sup> The couple enters the market, starts drumming, and ironically announces the title of their song, “Ye horrible doctrine and opinions of Messer Galileo Galilei, physicist to the court, or A foretaste of ye Future”. They sing,

When the Almighty made the universe  
 He made the earth and then he made the sun.  
 Then round the earth he bade the sun to turn –  
 That’s in the Bible, Genesis, Chapter One.  
 And from that time all creatures here below  
 Were in obedient circles meant to go.

So the circles were all woven:  
 Around the greater went the smaller  
 Around the pace-setter the crawler  
 On earth as it is in heaven.  
 Around the pope the cardinals  
 Around the cardinals the bishops  
 Around the bishops the secretaries  
 Around the secretaries the aldermen  
 Around the aldermen the craftsmen  
 Around the craftsmen the servants  
 Around the servants the dogs, the chickens and the beggars.<sup>53</sup>

The cosmological order (*kosmos*) is hierarchically structured around a single center – from the sovereign rulers to the animals and beggars. So what happened to this “Great Order of Things”? The ballad-singer continues,

Up stood the learned Galilei  
 (Chucked away the Bible, whipped out his telescope, took a quick look at the universe.)  
 And told the sun ‘Stop there.

<sup>52</sup> Brecht, *Collected Plays 5: Life of Galileo*, 76.

<sup>53</sup> *Ibid.*, 76-77.

From now the whole creatio dei  
 Will turn as I think fair:  
 The boss starts turning from today  
 His servants stand and stare.'

Now that's no joke, my friends, it is no matter small.  
 Each day our servants' insolence increases  
 But one thing's true, pleasures are few. I ask you all:  
 Who wouldn't like to say and do just as he pleases?<sup>54</sup>

Galileo's ideas have put the "Great Order" out of joint. Now "[t]he serf stays sitting on his arse...The apprentice lies in bed". This is a scary future, indeed. Now that the cosmological (political-economic and theological) order is out of joint, neither "housewives", "masons", nor "tenants" seem to fulfill their predestined roles. The ballad singers ironically plead with Galileo to stop: "People must keep their place, some down and some on top".<sup>55</sup> The "people" use "*his teaching in their way*".

In a brief essay on *Life of Galileo* written by the early modern historian of science William Eamon – whose main concern is to decide whether the astronomer had a "choice" between being a "hero" or a "coward" – this Carnival scene is described as being "slightly contrived from a historical point of view". Nonetheless, writes Eamon, "it captures the essential point that in the time of Galileo the Church was engaged in a two-front war". On the one hand: "against high culture, which resisted conforming to Counter-Reformation patterns", and on the other, "*against the people, who often perverted doctrine in aggressively original ways*".<sup>56</sup> This is the crucial point: the people used Galileo's teaching, perhaps *in spite of him* – as subsequent scenes imply – for their own emancipatory desires. That is the desire of the "servants" (housewives, masons, tenants, and so on) to affirm their power in carnival beyond the subjection of Power. They take up new ideas as a critical weapon against abstraction.

This relation – what happens in this encounter – raises a problem concerning the *transmissibility* of ideas between practices. It concerns the real conditions of transmissibility of "the starry message" (the *Sidereus Nuncius*) beyond scientific practice. Perhaps in spite of scientists themselves and the many *missed encounters* with modern scientific practices, the sciences continue to harbor the potential of emancipation in their encounters with other practices.

Scientific practice, in spite of itself, produces an emancipatory effect in conjunction with artistic-political practices. This is the enduring lesson of Brecht's *Life of Galileo*. In

<sup>54</sup> *Ibid.*, 77.

<sup>55</sup> *Ibid.*, 78.

<sup>56</sup> Eamon, "Brecht and the Historical Galileo", 20-21. Emphasis added.

contrast to teleological accounts, modern science is not pre-destined to repeat the same ends. And if scientific practices are to emancipate themselves from Power, they ought to ally themselves with political and artistic practices from below. As Jameson's allegorical account of Brecht's method shows, "Galileo" and the "people" could be stand-ins for contemporary scientific communities and political-artistic struggles from below.

## References

- Althusser, Louis. *Philosophy of the Encounter Later Writings 1978-87*. Translated by G.M. Goshgarian. New York: Verso, 2006.
- Aristotle. *Poetics in A New Aristotle Reader*. Edited by J. L. Ackrill. Princeton: Princeton University Press, 1988.
- Bergson, Henri. *Creative Evolution*. Trans. Arthur Mitchell. New York: Random House, 1944.
- Biagioli, Mario. *Galileo Courtier: The Practice of Science in the Culture of Absolutism*. Chicago: University of Chicago Press, 1993.
- Bosteels, Bruno. *Badiou and Politics*. Durham: Duke University Press, 2011.
- Brecht, Bertolt. *Brecht on theatre: The development of An Aesthetic*. Trans. and Ed. by John Willett. New York: Hill and Wang, 1992.
- Brecht, Bertolt. *Brecht Collected Plays 5: Life of Galileo; Mother Courage and Her Children*. Translated by John Willett. London: Bloomsbury Methuen Drama, 2006.
- Brecht, Bertolt. *Galileo*. Edited by Eric Bentley. New York: Grove Press, 1966.
- Brückle, Irene, Hahn, Oliver and Needham, Paul. Vols. I/II *Galileo's Sidereus nuncius: A comparison of the proof copy (New York) with other paradigmatic copies (Vol. I). Needham: Galileo makes a book: the first edition of Sidereus nuncius, Venice 1610 (Vol. II)*. Berlin: Akademie Verlag, 2011. <https://doi.org/10.1524/9783050062402>
- Deleuze, Gilles. *Bergsonism*. Trans. Hugh Tomlinson and Barbara Habberjam. New York: Zone Books, 1991.
- Deleuze, Gilles and Félix Guattari. *Anti Oedipus Capitalism and Schizophrenia*. Trans. Robert Hurley, Mark Seem, Helen R. Lane. Minneapolis: University of Minnesota Press, 2000.
- Deleuze, Gilles. *Spinoza: Practical Philosophy*. Trans. Robert Hurley. San Francisco: City Lights Books, 1988.
- Derrida, Jacques. *Specters of Marx: The state of the debt, the work of mourning, and the new international*. Trans. Peggy Kamuf. New York: Routledge, 1994.
- Derrida, Jacques. "Plato's Pharmacy" in *Dissemination*. Trans. Barbara Johnson. Chicago: University of Chicago Press, 1981.
- Eamon, William. "Brecht and the Historical Galileo". *Gestus: Journal of Brechtian Studies* 3 (1989): 19-23.
- Feldman, Ella. "Historian Discovers a Prized Galileo Manuscript Was Forged", *Smithsonian Magazine*, 22 August 2022, <https://www.smithsonianmag.com/smart-news/historian-discovers-a-prized-galileo-manuscript-was-forged-180980615/>.
- Feyerabend, Paul. *Against Method*. London: Verso, 1993.
- Galileo, Galilei. *Sidereus Nuncius or The Sidereal Messenger*. Trans. Albert Van Helden. Chicago: University of Chicago Press, 2015.
- Horkheimer, Max and Theodor W. Adorno. *Dialectic of Enlightenment*. Trans. Edmund Jephcott. Stanford: Stanford University Press, 2002.
- Jameson, Frederic. *Brecht and Method*. New York: Verso, 1998.
- Koyré, Alexandre. *Galileo Studies*. Atlantic Highlands: Humanities Press, 1978.
- Leibniz, Gottfried, Wilhelm. *Philosophical Essays*. Trans. Roger Ariew and Daniel Garber. Indianapolis: Hackett, 1989.

- Machamer, Peter. "Introduction". In *The Cambridge Companion to Galileo*, 1-26. Cambridge: Cambridge University Press, 2006.
- Marx, Karl. *Capital: Vol I*. Trans. Ben Fowkes. New York: Penguin, 1990.
- Marx, Karl. "On the Jewish Question". In *Early Writings*, 211-242. New York: Penguin, 1992.
- Marx, Karl. "A Contribution to the Critique of Hegel's *Philosophy of Right*. Introduction". In *Early Writings*, 243-258. New York: Penguin, 1992.
- Serres, Michel. *The Birth of Physics*. Trans. David Webb and William Ross. London: Rowman & Littlefield, 2018.
- Sixth Commission of the EZLN. *Critical Thought in the Face of Capitalist Hydra I*. Durham: Paper Boat Press, 2016.
- Smith, Daniel W. "The New". In *Essays on Deleuze*, 235-255. Edinburgh: Edinburgh University Press, 2012.
- Spinoza, Baruch. *The Collected Works*. Trans. and ed. by Edwin Curley. Princeton: Princeton University Press, 1988.
- Stengers, Isabelle. *The Invention of Modern Science*. Trans. Daniel W. Smith. Minneapolis: University of Minnesota Press, 2000.
- Toscano, Alberto. *Fanaticism: On the uses of an idea*. New York: Verso, 2017.