

ITIS Galileo: Marco Paolini and the History of Science

Marco Paolini represents the most notable interpreter of the so-called *teatro di narrazione*,¹ a theatrical style akin to storytelling, with a strong political and ethical awareness. Paolini became known first for a one-man act, entitled *Vajont*, which earned him the notoriety and the respect of the Italian public. It was broadcast live in 1997 on Italian national television, and reawakened the conscience of the whole country about one of the saddest and most forgotten stories of the *dopoguerra*.

Within the context of the *teatro di narrazione*, Paolini's first experiences were Teatro Settimo, of Settimo Torinese, where the actor experimented with the storytelling modality in order to create a direct relationship with the public. Dario Fo is considered the forefather of this genre, which, starting in the 1980s has been explored and, within certain limits, formalized by Paolini himself, Laura Curino, Marco Baliani and others. Simone Soriani defined it a quasi-genre (Soriani), but after almost a decade since that definition, it is obvious that the *teatro di narrazione* is a genre per se. The main feature of the *teatro di narrazione* is that the actor establishes a direct relationship with the audience, speaking about himself/herself in the first person. This is an important development from Dario Fo's monological theatre; he performed solo but did not bring autobiography within the performances. Contemporary *teatro di narrazione* seeks to establish a relationship with the public starting from an autobiographical level, as a shared experience. *Teatro di narrazione* (narrative theatre) and *teatro civile* (civic theater) often come together within the monologues created and interpreted by the actors who work in this discipline. Civic theatre is a subcategory of narrative theatre in which the stories are told from the point of view of the citizen, and often display indignant overtones while retelling stories that have to do with Italian recent history. Paolini's *Vajont* brought the story and narrative theatre techniques to the great televised public. *Vajont* is the monologue that of the story of the tragedy caused by a landslide in the hydroelectric dam of the river Vajont, in the mountains between Veneto and Trentino. When the tragedy occurred, the landslide killed about four thousand people and completely submerged the nearby city of Longarone. On

October 9th 1997, Paolini's monologue, performed from the site of the dam was broadcast on Italian television and mesmerized an audience of more than three million people, giving him immediate notoriety.² Other important pieces followed the *Racconto del Vajont*. Among them *Il Milione, quaderno veneziano*, dedicated to Venice,³ and two more shows entitled *Bestiario veneto* and *Bestiario italiano*, dedicated to poetry in the Venetian vernacular and in other vernaculars spoken around Italy.⁴

During an interview on prime time TV, interviewer Fabio Fazio asked Marco Paolini if he ever thought of putting up a purely comical show; Paolini answered: "continuamente" "e però?" "È... è il destino... cioè... è la storia del mio paese che mi costringe a fare il tragico" (*Che Tempo*).⁵ Describing Paolini's dramaturgy purely as tragic would not do it justice, as his theater is also lyrical, intense, political and often funny. There is, however, something about it that sets it apart from the rest of Italian theater, and that is mainly its "civic" quality. This author's narrative power hinges on his uncanny ability as a storyteller, which allows him to entertain even when the fictional element is reduced to a minimum. Paolini often pointed out that his *Racconto del Vajont* comprises two hours of explanations and only fifteen minutes of pure theater. It is his terse, impassionate storytelling that stirs consciences and makes long-forgotten facts come alive; his "political" theater is intended as "theater for the *polis*," that is, for the city.⁶

Why Galileo then? The occasion was the year 2009, which marked the Quattro-centennial anniversary of the telescope. *ITIS Galileo* follows Paolini's dramaturgical project to study and tell some key episodes in the history of science. He had already performed, beside *Vajont, I-Tigi* (about the Ustica tragedy), *Parlamento Chimico* (about the impending danger of Marghera, the industrial pole outside of Italy) *Ausmerzen* (about eugenic practices and ethnic cleansing in Nazi Germany), and *Bhopal*. On the part of Paolini, *ITIS Galileo* comes at the high point of his dramaturgical project of civic interrogation of science. Many of these performances are structured as questions on tragedies that characterized recent Italian history, or world history in the case of *Ausmerzen* and *Bhopal*.⁷

In a year of not-so-sumptuous celebrations for the first telescopic observations, Paolini took it upon himself to remember

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Galileo, and concurrently expand his scientific interests with a more philosophical approach. As he put it, “Il libro di Keplero fu pubblicato nel 1609, lo stesso anno del cannocchiale. Solo che noi non lo festeggiamo perché siamo italiani...” (*ITIS Galileo*).

This article analyzes the way Marco Paolini described the life and times of Galileo, how he problematized the stark dichotomy between free scientific enquiry and religion featured in Brecht’s *Life of Galileo* by introducing elements of the more contemporary debate about the sociology and philosophy of science.

Science’s representation in theatre has a long and honored tradition. One need only to mention George Bernard Shaw’s *The Doctor’s Dilemma*, but also Toms Stoppard’s *Arcadia*, not to mention Dürrenmatt’s *The Physicists* and Brecht’s *Galileo*. The looming presence of Brecht’s successful *Galileo* and the more recent debate in the philosophy of science become the lenses through which Paolini analyses and describes the intellectual life of Europe during the counter-reformation. Among other topics, Paolini discussed astronomy and astrology; classical philosophy and the new science; the inner workings of the inquisition and the complex biography of Galileo, and most notably Galileo’s persecution by the Holy Office. The complete name of the show is *ITIS Galileo*. *ITIS* is the name of the Italian technical high schools (Istituto Tecnico Industriale Statale), which are often dedicated to Galileo. Such schools are not famous for the classical erudition of their students:

di questo parlo stasera, sistemi, massimi, ma... Questo spettacolo per capirci s’intitola *ITIS Galileo*... come dire: io la prendo bassa, e quelli del classico, portino pazienza... Lei che scuola ha fatto Roberto! Ahi, ho trovato quello ignorante. Filosofia? Mai fatta. La scrittura è la mia, tu leggi quello che... se sbagli, sono parole mie...

Paolini portrays Galileo as a champion of independent thought against the obscurantism of power. *ITIS Galileo* is divided into two sections. The first is a theoretical discussion about the history of science preceding the time of Galileo. This discussion is mostly based on the so-called Received View, but also acknowledges a sociological approach to epistemology. The second is more biographical and

anecdotal.

Instead of the classical dichotomy of science and faith, Paolini relies on a more elaborate triad of science, faith and superstition. When referring to Brecht's *Life of Galileo*, Paolini explained:

Non mi sono confrontato col suo Galileo, che pure mi fu fondamentale, per i toni troppo in bianco e nero. A me hanno colpito le cose con cui non si sono fatti i conti fino in fondo, che si ripresentano nel tempo. Vedi l'elemento magico, l'astrologia applicata ai destini, come se le stelle fossero fisse. (di Gianmarco)

To explain how modern science works, Paolini begins with the old science, particularly with astrology. Galileo and many other protagonists of the new science earned their living making horoscopes, which illustrates how many protagonists of the early modern scientific revolution were mired and conversant in traditional thought. According to Paolini, this is part of the story that is yet to be told:

Stipendio da fame. E come campa? Oroscofi! Quello facevano gli astronomi: oroscopi! È per quello che studi. Il Galilei, nuovo padre della scienza, ci metterà fino a 50 anni per smettere di campare di oroscopi. (*ITIS Galileo*)

The subject matter—the history of science, and the history of the Inquisition—becomes thus understandable and entertaining for the public. Paolini attempts not to simplify it to the point of losing its deeper meaning:

Questi pensavano che la terra stesse fissa, e intorno ci sono i pianeti fissi, e ci fa ridere questa visione del mondo, ma non posso andare avanti se pensiamo così. Io credo che per comprenderla bisogna [sic] comprendere la grandezza di Tolomeo. Perché non riconosci a me l'abilità di leggere le stelle. C'è tutta la dignità dell'astrologia, ma lui dice che lo sa che ci sono cialtroni e ciarlatani, che ci gabellano cose che non sono vere, e se Tolomeo poteva prevedere Vanna Marchi...." (*ITIS Galileo*)

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In order to describe Galileo's contribution to the history of science, Paolini begins from Aristotle. His take on the Stagirite is an attempt to make him understandable and even endearing to the public:

E poi... arrivano i Greci.. e i Greci... Quanto bontempo hanno i greci? Madonna santa, quanto bontempo...⁸ là, fissi, a dare un nome alle cose... a organizzarle, a ragionare prendendosi il tempo che serve su idee diverse. Filosofia, e altro. La summa di tutto questo, non certo per originalità, ma certo per vastità, a un certo punto è il filosofo Aristotele. E non perché sia migliore degli altri, ma perché Aristotele ha il buon senso probabilmente di mettere le cose tenendo insieme non soltanto ciò che egli pensa, ma ciò che pare a tutti di aver pensato.” (*ITIS Galileo*)

His initial argument is that is that Greek thought, particularly Aristotle's physics, was easy to understand and apply. Paolini explains the early modern acceptance of the “wrong” science had to do with the fact that Aristotelian physics was grounded in common sense, and useful in a limited, European-centric fashion.

The attractiveness of Aristotle's arguments is an opinion shared by many commentators in the field: “Aristotelian practical reason seems more attractive than the standard modern picture, in which reason is famously the slave of passions” (Garver 57). However, not all scholars agree that simplicity was on the side of Aristotle or Ptolemy. Thomas Kuhn, whom we shall analyze a little later, writes:

Simplicity, however, favoured Copernicus, but only if evaluated in a quite special way... In terms of the computational labour required to predict the position of a planet at a particular time, then [the two systems] proved to be substantially equivalent... On the other hand... as every schoolchild knows, Copernicus required only one circle per planet: Ptolemy two. (Kuhn, “Objectivity” 437-438)

Notwithstanding the sophistication of the Aristotelian corpus, Paolini finds in the *Physics* a simplicity that he assimilates to animism: “Per Aristotele, perché una pietra cade? Perché vuol tornare al suo posto.

Cara... è la stessa cosa che pensa un bambino, è la stessa cosa che pensa una tribù animista” (*ITIS Galileo*).

Here Paolini refers to that part of Aristotle’s *Physics* that defines movement: “Nature is a source or cause of being moved and being at rest, in that to which it belongs primarily, in virtue of itself and not in virtue of a concomitant attitude” (Aristotle 21-23). Hence, a thing falls to the ground because it wants to go back where it belongs, in virtue of itself. In Aristotle, the nature of a thing is intimately connected with form, and form in Aristotle is an active constituent of things; “similarly, too, ‘down’ is not any chance direction but where what has weight and what is made of earth are carried—the implication being that these places do not differ merely in relative position, but also as possessing distinct potencies” (Shapere 31-32). If the nature of an object is to belong to the ground, then it will be attracted to the ground. Paolini’s reduction of Aristotle’s physics to an aspiration of the thing to go back “home” is a simplification, but not an incorrect one.

In *ITIS Galileo*, then, the first dichotomy is simplicity versus complexity. Aristotelian theories are simple and respond to common sense, whereas the new science can be counterintuitive and more complex. Paolini makes the point that not only is Aristotle attractive and charming, because his physics is easy to understand: “In Aristotele c’è una specie di condensato di cose piene di senso” (*ITIS Galileo*) but Christianity found such an affinity with him that Thomas Aquinas ended up “baptizing” both Aristotle and Ptolemy (*ITIS Galileo*).

The discussion on Aristotle helps Paolini build the theoretical framework to discuss Ptolemy and then Copernicus, Kepler and Tycho Brahe. Ptolemy built his cosmology on Aristotle and is an inspirational departure point for Paolini, who at the beginning of *ITIS Galileo*, calls on people from the audience to read from Ptolemy’s *Tetrabyblos*: “Leggiamo una pagina di Tolomeo che ci riguarda perché non è l’oroscopo di una persona ma l’oroscopo di popolazioni. Una pagina del *Tetrabiblos* intitolata ‘popoli destri e popoli sinistri.’”⁹ The division of the world in four parts prompts the description of left and right people with races determined by the climate.¹⁰

From the beginning of the show, Paolini draws connections between the old and new sciences. He implies that in order to understand Galileo’s times and his contribution to history, one has to be aware of the

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importance of the science that preceded him. It is the interconnection of old and new science that Paolini tries to bring to the foreground:

Stasera qui siamo tutti a scherzare sull'idea che questi pensavano, con Aristotele, che la terra stesse fissa, e intorno ci stanno i pianeti che girano, sette cerchi sette pianeti, per sette pianeti per sette fratelli... tutto gira... e c'è da ridere di questa visione del mondo, ma non posso andare avanti se pensiamo così. Perché quella visione del mondo aveva una sua ragione d'essere, era affascinante. E io credo che per comprenderla bisogna comprendere la grandezza di Tolomeo. (*ITIS Galileo*)

Paolini does not mention his sources, but it is obvious that he is aware of the latest debates in the history of science. In particular, he is knowledgeable of Kuhn's seminal *Structure of Scientific Revolutions*, which revived the debate on the development of scientific thought. Although Kuhn is never mentioned directly, this sentence that Paolini utters at the beginning of the show is revealing: "Io credo che possiamo capirci su questo: il cannocchiale non ti mostra niente che tu non stia cercando" (*ITIS Galileo*). This very sentence shows that Paolini is aware of Kuhn's distinction between normal and extraordinary science, and that Galileo looked into the telescope with the book of Copernicus in his head. It also shows Paolini's awareness of Kuhn's criticism of the "received view," that is, the idea that scientific revolutions are prompted by the falsification of theories in the presence of recalcitrant experiments.

The received view seems natural, because it is the way everyone learned the evolution of science. However, such a view is only apparently simple and natural; it is in fact based on logical positivism,¹¹ a philosophical school that has characterized scientific meta-thinking for the past two centuries. Logical positivism is based on what Frederick Suppe called correspondence rule, or the idea that a theoretical assumption about a fact corresponds to the observation about the same fact. As Suppe put it (64), the theory (T) about x is the same as (\equiv) the observation (O) about x. Or:

$$Tx \equiv Ox$$

If we stop and consider this statement, we will notice that many of the books that discuss Galileo's problems with the Inquisition are based on this simple dichotomy: observation and subsequent theory ($T_x \equiv O_x$) versus dogma without observation.¹²

According to the received view, an observed fact that does not agree with a certain theory, can singlehandedly disprove it. This means that even a single observation might be able to force a scientist or a community of scientists to discard a scientific theory. In other words, theory replacements are prompted by anomalous observations, or recalcitrant experiments that do not adapt to the theory. See for example what Paolini says about the observations of Galileo:

la luna ha le rughe: doveva essere etere, materia incorruttibile. Lo punta sul sole e il sole ha le macchie. E allora? Non doveva essere tutto ciò che c'è la sopra, secondo Aristotele, etereo e perfetto, contrapposto alla corruzione della terra, mobile e fatto di materia impenetrabile? (*ITIS Galileo*)

According to this view, a so-called recalcitrant experiment will kill a theory, as facts always trump theories. Kuhn's interpretation goes in the opposite direction. He states that because of Galileo's telescopic observations of the moon, that old science was dismissed as simplistic. In fact, when Galileo became a scientist, his colleagues were already undergoing an epistemological crisis, which was plain to see in the tormented lives of Bruno and Campanella, and in the persecution and final execution of Giordano Bruno. The crisis had already produced Copernicus' *De Revolutionibus Orbium Coelestium* (1543); when Osiander published it, he shielded Copernicus and himself from being accused of heresy by claiming that the book was simply a tool to aid calculations. Because of this instrumentalist statement *De Revolutionibus* did not encounter the wrath of the Inquisition until Galileo began using it as the backbone of his theory. At the time many of Galileo's colleagues were trying to work through the crisis of the Ptolemaic world view; as Alasdair McEntire (61) put it, Galileo was simply more effective, and more daring: "Galileo resolves the crisis by a threefold strategy. He rejects instrumentalism, he reconciles astronomy and mechanics, and he redefines the place of experiment in natural science."

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Thomas Kuhn was not the first epistemologist to see a progressive and cumulative vision of the scientific development as problematic. Steven Toulmin and, more notably, Paul Feyerabend also criticized the received view as naïve and ideological. Once modern epistemologists accepted that “there can be no valid derivation of a law of nature given a finite number of facts” (McIntyre 2), a number of alternatives to the received view became central to the epistemological debate.

Kuhn’s vision of the history of science is based on the concept of paradigm, and a scientific revolution happens when a new theory, disciplinary matrix, or paradigm, replaces an old one. It does not have to be a violent act, although in the case of Galileo, the acceptance of the new paradigm left a few victims along the way. Galileo was one victim who managed to survive, while others, such as Giordano Bruno, did not. Kuhn himself cites the example of the Aristotelians and Galileo about the pendulum:

To the Aristotelian, who believed that a heavy body is moved by its own nature from a higher position to a state of natural rest at a lower one, the swinging body was simply falling with difficulty... Galileo, on the other hand, looking at the swinging body, saw a pendulum, a body that almost succeeded in repeating the same motion over and over again ad infinitum. (Kuhn, *Structure* 92)¹³

In *The Structure of Scientific Revolutions*, the link between proof and refutation of a given theory and set of data is heavily challenged, though not completely destroyed. While in the received view a set of empirical data can prove or disprove a theory, Kuhn’s views empirical data as the backbone of normal science, as normal scientists try to fit it into the framework of the theory. Scientific theories can fail in front of a certain amount (it is impossible to determine an exact number) of recalcitrant data, but a single crucial experiment does not challenge nor support the stability of a theory.

Paolini is well aware of the epistemological debate that took place from the 1970s onward and uses it as an operational tool in the show. At the very beginning, he comments:

Penso che ci possiamo capire su questo: il cannocchiale ti mostra quello che stai cercando. Se guardi delle cose con un cannocchiale,

non le vedi. Se guardi avendo in testa il libro di Copernico trovi nel cielo le risposte alle teorie che tu già sai nel libro. Per Galileo Galilei, copernicano convinto, l'osservazione col cannocchiale conferma che l'universo non è quello dei libri di Aristotele, di Tolomeo. (*ITIS Galileo*)

In describing a Galileo who looks at the world with the book of Copernicus in mind, Paolini refers to a specific phase of the scientific revolution when an extraordinary scientist (in the Kuhnian sense) experiences a Gestalt shift and views the world with different eyes.

Another aspect that Paolini takes on in his complex intertwining of biography and theory is the problem of demarcation between science and the so-called pseudo-sciences. Any textbook account of the development of science that is based on the Received View provides a clear vision of the link between facts and theory. A theory is proven by facts and experiments; one that fails to do so is considered non-scientific. For example, astronomy is scientific, astrology is not. Paolini is fascinated by the fact that Galileo, one of the greatest astronomers of all times, supported himself by writing horoscopes.

In the Kuhnian view there seems to be no conclusive way to tell a scientific theory from a non-scientific one or from a piece of ideology. Neither proof and error, nor confutation or crucial experiments help draw the demarcation. As Imre Lakatos puts it,

In Kuhn's conception, anomalies, inconsistencies, always abound in science, but in "normal" periods the dominant paradigm secures a pattern of growth, which is eventually overthrown by a 'crisis.' There is no particular rational cause for the appearance of a Kuhnian crisis... Thus, in Kuhn's view, scientific revolution is irrational; a matter of mob psychology. (Lakatos 178)

The irrationality of the scientific process is at odds with the intense appeal to rationality of science itself. What Paolini, a reader of Kuhn as much as of Galileo, introduces in this show is the irrational and biographical/sociological elements of science. These elements go hand-in-hand with the irrationality of the Inquisitors who tried to stop the development of the new science. Paolini successfully debunks the myth of a hyper-rational Galileo versus an obscurantist and irrational Inquisition, and inserts a different set of concepts to explain the dialogue (or missed opportunity

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for a dialogue)¹⁴ between Galileo and the Church.

The first concept that Paolini provides for his audience comprises the idea that until the Copernican revolution, scholars were not against science. They instead were engaged in a different type of science that was based on (mostly Aristotelian) philosophy. Whereas Galileo, argues Paolini, rebelled against the culture of the book and the *ipse dixit*.

Although this argument reminds one of the received view's dichotomy between book and observation, it is remarkable how in *ITIS Galileo* complex concepts in the philosophy of science assume their own levity without losing their deeper meaning. The conflict between the Copernican and the Aristotelian is portrayed as the battle between two equally strong adversaries.

In post-Tridentine Europe, the triumph of the new scientific method was accompanied by great interest in the occult. The astronomers of the time were also astrologers, and many scientists were also magicians and alchemists. Galileo was hardly the only scientist writing horoscopes for work or personal interest: as "not only did astrology provide Kepler with a livelihood, he also pursued it as a serious interest, although he was sceptical of the particular analyses of previous astrologers" (Thagard 66-75). The clearest example of the coexistence of magic and science was Giordano Bruno:

Bruno era mago. La magia e la scienza erano mescolate insieme. L'uomo che ha inventato la scienza faceva oroscopi, Galileo. Come fai a pensar che fosse contro la magia, quando la magia permeava il pensiero... religione, magia, filosofia... intendo filosofia naturale, cioè la scienza, cioè quel modo di pensare all'universo. Queste cose erano mescolate. (*ITIS Galileo*)

Paolini's insistence on astrology teases out another complex theoretical point: the demarcation between science and the so-called pseudosciences. Modern epistemology has much debated about the issue of demarcation. The famous speech by Karl Popper known as "Conjectures and refutations" sets up the problem thusly:

I knew, of course, the most widely accepted answer to my problem: that science is distinguished from pseudoscience – or from "metaphysics" – by its empirical method, which is essentially

inductive, proceeding from observation or experiment. But this did not satisfy me. On the contrary, I often formulated my problem as one of distinguishing between a genuinely empirical method and a non-empirical or even pseudo-empirical method – that is to say, a method which, although it appeals to observation and experiment, nevertheless does not come up to scientific standards. The latter method may be exemplified by astrology with its stupendous mass of empirical evidence based on observation – on horoscopes and on biographies. (Popper 214)

Popper thought that “falsifiability” crucially distinguishes between science and pseudoscience—a theory can be considered scientific when it identifies a crucial phenomenon that, if observed, would unequivocally falsify said theory. For astrology, there is no identifiable phenomenon that would falsify the theoretical tenets of astrology. It can therefore be concluded that astrology is not a science. This criterion is elegant and therefore attractive, because it sounds like a silver bullet: name a falsifying phenomenon, often brought about by a falsifying experiment; the verified presence of such phenomenon will be proof that the theory is false. Conversely, its absence is proof that the theory holds. Such criterion treads very close to the received view, which assumes a strong connection between theory and facts. Popper’s “falsifiability” implies the existence of a theory, of a counter example and the possibility to observe it. This amounts to admitting that observable phenomena, even though they cannot prove a theory, can nevertheless disprove it.

However, according to Kuhn, no single crucial experiment could falsify an entire theory. There is no silver bullet—no single, falsifying experiment that would obliterate a theory. However, Kuhn admits that there can be a number of recalcitrant experiments that might convince a healthy scientific community into changing a theory.¹⁵

The demarcation between science and pseudoscience in Thomas Kuhn (and *a fortiori* in Feyerabend) can only be sociological. In fact, the accent on the sociology and psychology of research, as opposed to the logic of discovery, emerges clearly in Kuhn’s reflections. In a sense, the accent of such research theories is a tribute to all the past sciences that have fallen out of favor and become outdated.

In *ITIS Galileo*, Paolini is acutely aware of the question of

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demarcation and obsolescence of the sciences. Therefore, regarding Galileo's observations and method, Paolini is fair in portraying Aristotelian physics as a science, not as a superstition. He makes a connection between Galileo and famous renaissance magician, philosopher and renegade Giordano Bruno. His execution, on February 17, 1600, happened three decades before Galileo's abjuration. News of Bruno's death resonated all over Europe and struck fear in the hearts of many European scientists. Most of them were quietly working on the new scientific theories and almost never openly discussed the theoretical tenets of their work. Paolini mentions the much delayed publication of Copernicus' *De revolutionibus*, published in 1543, the year of his death.¹⁶ Dedicated to Pope Paul III, the book presents itself as a series of pure mathematical hypotheses, useful for calculations, having nothing to do with the real structure of the universe.¹⁷

L'uomo che ha scritto il libro più rivoluzionario della storia dell'umanità non era un Che Guevara, era un uomo estremamente prudente. Ma quelli che pubblicano il suo libro, perché lui sta morendo, sono ancora più prudenti di lui, e mettono una prefazione dicendo: sono solo ipotesi matematiche, chiaro? (*ITIS Galileo*)

In the meantime, the scientific community was undergoing its period of extraordinary science. It was important to keep quiet about research, because "scientific research consists in choosing a problem, in proposing and verifying its solutions, and in presenting some results. In its crucial moment science, to be successful, must be autonomous" (Radnitzky 9). Most scientists communicated with one another, but were extremely careful in preserving the necessary autonomy to conduct research.

Galileo was bold enough to openly embrace Copernicanism as the paradigm supporting many of his theories.¹⁸ One commonality between Bruno and Galileo was that they both aspired to make Copernicanism accepted in the Christian world. According to Ludovico Geymonat:

As the years passed, he [Galileo] became more and more convinced that one thing above all was necessary: to spread belief

in Copernicanism more and more widely... in the greatest possible number of persons. (59)

Given that Giordano Bruno lost his life to that very aspiration, many of Galileo's colleagues wondered why he insisted on going public about his theories. The more public he went, the more they all risked losing their autonomy of research at the hand of the Inquisition.

Secondo voi, l'odore di bruciato da Campo de' Fiori a Roma arrivava fino a Padova? L'odeur de Bruno brûlé il est arrivé à Prague et à Paris. Fu uno scandalo, l'esecuzione di Bruno nel febbraio del 1600. Ma non per quello che pensiamo noi... Un collega scrive a Keplero: Perché Bruno si è fatto bruciare... ha messo nei guai tutti noi. Non poteva dirgli di sì? E poi continuare a fare quello che voleva? Sottinteso: come facciamo tutti. L'arte di dissimulare era considerata una virtù necessaria. (*ITIS Galileo*)

Having set up the theoretical background of the story, now Paolini delves into the intricate historical, personal and scientific history of Galileo's publications, from the *Sidereus Nuncius* (1610) onwards. He aims to dispel the myth of a Galileo persecuted by Bellarmino and beloved by everyone else. In fact, Galileo was disliked not only for his theories and discoveries, but also for his status. As a scientist, he became rich and famous relatively late in life, but returned to his Alma Mater, the University of Pisa, as a professor with too many privileges and a stipend higher than anyone else's. These factors created envy and petty revenge aspirations within university circles.

In the second part of the show, the narrative becomes more biographical, with a short digression on Tycho Brahe and on some of the exchanges between Galileo and Kepler. The second part also deals with one of the most difficult of Galileo's treatises, the *Dialogue of the two major world systems*, in which Galileo discusses the comparative merits of the Copernican and the Aristotelian worldviews. The dialogue, the most difficult of Galileo's treatises, is written in the manner of ancient rhetorical diatribes; Paolini finds a way to make it interesting, even gripping for his public:

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secondo me, la spiegazione del perché non lo capisco io è che il *Dialogo sopra i due massimi sistemi* è una commedia, non come quelle di Shakespeare, ma al modo della commedia dell'arte. I protagonisti sono tre: uno è il paron de casa, gli altri due sono due filosofi che se le danno come due servi della commedia dell'arte, randellate e bastonate a suon di argomenti. (*ITIS Galileo*)

To explain how the *Dialogue* lends itself so well to a comedic reduction, Paolini, donning a mask of the Commedia dell'Arte, recites Galileo's counter thought experiment of the "great vessel." Such experiment has a history of its own, which needs to be highlighted to appreciate how Paolini renders it on stage.

The Aristotelians objected that if the earth moved, it would leave behind everything that is not attached to the earth itself: "Sinnò tutto ciò che non fusse attaccato alla terra istessa, se la terra se move, dove anderebbero le cose... le nuvole? Tutte dalla stessa parte andrebbero..." comments Paolini (*ITIS Galileo*). This is a classic thought experiment, that is, an experiment that is not performed with instrument, but with the mind. James Robert Brown (1955) explains:

We set things up in the imagination, we let it run, we see what happens, and we draw a conclusion. It's also quite similar to a real experiment, except that it's done in the imagination rather than in the real world. And like real experiments, thought experiments are fallible.

The original thought experiment was created by the Aristotelians, about the earth moving and everything being left behind, including birds, smoke, and clouds. The response to such an objection, in the form of a counter thought experiment, came initially from Giordano Bruno, in his *La cena de le ceneri* (1584).

Paolini adapts the counter thought experiment to the modes of the commedia dell'arte, and recites it with a mask on. With the mask on his whole demeanor becomes stiffer, as he adopts the moves of a consumed Arlecchino. He renders the counter thought experiment in the Venetian dialect, thereby turning a piece of philosophical theory into a theatrical scene that is remarkable for its clarity and impact.

In this piece, Galileo envisions two scenarios: a large ship (*gran naviglio*) at anchor, and the same large ship in motion, no matter at which speed, as long as it is constant. Galileo's counter thought experiment disproves the Aristotelian theory of the solar system, by proving that while the ship moves, things are unaffected by that movement. As a result of this experiment, it is impossible to determine whether the earth is moving or immobile, because this experiment is compatible with both. In other words, Galileo's counter thought experiment proves that the concept of a moving earth is not impossible.

Rinserratevi nella maggiore stanza che sia sotto coverta di alcun gran navilio, e quivi fate d'aver mosche, farfalle e simili animaletti volanti; siavi anco un gran vaso d'acqua, e dentrovi de' pescetti; sospendasi anco in alto qualche secchiello che a goccia a goccia vadia versando dell'acqua in un altro vaso di angusta bocca, che sia posto a basso: e stando ferma la nave, osservate diligentemente come quegli animaletti volanti con pari velocità vadano verso tutte le parti della stanza; i pesci si vedranno andar notando indifferentemente per tutti i versi; le stille cadenti entreranno tutte nel vaso sottoposto... Osservate che avrete diligentemente tutte queste cose, benché niun dubbio ci sia che mentre il vassello sta fermo non debbano succedere così, fate muover la nave con quanta si voglia velocità, ché (purché il moto sia uniforme e non fluttuante in qua e in là) voi non riconoscerete una minima mutazione in tutti li nominati effetti, né da alcuno di quelli potrete comprender se la nave cammina oppure sta ferma... (Galileo *Dialogo* 271)

In order to render this experiment on stage, Paolini announces that he will recite this part of the *Dialogue* in the venetian dialect; he turns Galileo's initial "rinserratevi" into a peremptory: "sereve su, sereve dreto" repeated five times and followed by a list of the objects necessary for the experiment.

List recitation is an art. Renewed scholarly interest arose recently¹⁹ for the epistemic value of lists because of their taxonomical and heuristic value. Paolini has been reciting lists since the beginning of his recorded career: from the catalogue of the *merendine*, the afternoon snacks of his childhood to the bibliography of books he

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read on the train in *Vajont*; from the annotated inventory of cars in the garage San Marco in Venice to the long list of fish of the lagoon and open sea, read in the Chioggia dialect in *Par Vardar*.

The starkness of a recited list lends itself to a deeper understanding of the matter at hand. This has been known since ancient times: the school of Aristotle worked on a taxonomy of natural phenomena with the intent of discovering the essence of things. The work and time that goes into the creation of a taxonomy has the purpose of creating some sort of finding—a heuristics.²⁰

Paolini slightly improves on Galileo's list by turning the dripping water into dripping wine, by changing incense into firewood, and by adding a ball with which the friends under deck can play. The experiment ends with the suggestion to fry the fish for supper and toast with the wine to the health of Galileo and Copernicus

The last scene of *ITIS Galileo* is in stark contrast with the comedic rendering of the counter thought experiment, as Paolini walks his audience through the year 1533, when Galileo was summoned by the Sant'Uffizio. The somber tone of this section of Paolini's narration connects the major events of that year for Galileo—from the initial summoning to the abjuration, which Galileo pronounced on June 22, 1633.

The Holy Office thought that the publication of the *Dialogue* was an “open transgression of said prohibitions” (*aperte transgressio praedicti praecepti*) (Naes 174) of teaching in any way whatsoever his ideas, and brought about Galileo's condemnation, of 1633, on the part of the Holy Office.

Che il Sole sia centro del mondo e immobile di moto locale, è proposizione assurda e falsa in filosofia, e formalmente eretica, per essere espressamente contraria alla Sacra Scrittura;

Che la Terra non sia centro del mondo né immobile, ma che si muova eziandio di moto diurno, è parimente proposizione assurda e falsa nella filosofia, e considerata in teologia ad minus erronea in Fide...

E acciocché questo tuo grave e pernicioso errore e transgressione non resti del tutto impunito, e sii più cauto nell'avvenire e esempio all'altri che si astenghino da simili

delitti. Ordiniamo che per publico editto sia proibito il libro de' Dialoghi di Galileo Galilei.

Ti condanniamo al carcere formale in questo S.o Off.o ad arbitrio nostro; e per penitenze salutari t'imponiamo che per tre anni a venire dichii una volta la settimana li sette Salmi penitenziali: riservando a noi facoltà di moderare, mutare o levar in tutto o parte, le sodette pene e penitenze.

E così diciamo, pronunziamo, sentenziamo, dichiariamo, ordiniamo e riservamo in questo e in ogni altro miglior modo e forma che di ragione potemo e dovemo.²¹ (Galilei, *Opere* n.p.)

Galileo's self-defense, as Paolini points out, was irrelevant; a summon by the Holy Office implied the presumption of guilt. This notwithstanding, Galileo chose to defend himself, which may have aggravated his position. The Holy Office condemned him, and he was forced to pronounce a solemn abjuration of his beliefs. The *Dialogue* was prohibited, and the abjuration was read all over the Christian world.²² Galileo was famous, and Pope Urban VIII made sure that news of Galileo's condemnation circulated widely.

As Paolini said in an earlier version of the show, reciting the text of Galileo's abjuration is the high point of an actor's career; without further comments, Paolini recites Galileo's condemnation, abjuration, and renders the public humiliation of having the *Dialogue* burnt in front of his eyes.²³ The imprisonment and silencing on the part of the inquisitors of a blind and old scientist is one of the most dramatic moments in the history of science.

However, the message in Paolini's version of Galileo's story is resilience, resistance and original scientific research carried out even after such dramatic facts. That is why *ITIS Galileo* does not end with the abjuration, but discusses Galileo's last book, his *Discourses and Mathematical Demonstrations Relating to Two New Sciences*, smuggled out of Italy and published in Leiden in 1638.

In *ITIS Galileo* the anticlimactic last scenes run contrary to the joyous recitation of the counter thought experiment. However, Paolini draws some theoretically complex conclusions. If in the beginning of the show he had identified both Galileo and Kepler as "figli di Copernico" (children of Copernicus) now he takes a few contemporary

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ideas regarding Galileo and traces another genealogy, from Galileo's *Two New Sciences*, to Newton's laws of motion,²⁴ to Einstein's special relativity theory (Hawking 398), to the atomic bomb, of which he has a simulacrum on stage.

The idea of continuity between Galileo and the atomic bomb was already present in Brecht: "Now keep the flame of science, the flame of science right / use it for mankind, and use it right/ lest it makes a rain of fire to fall. Down upon us to consume us all" (Brecht 86).²⁵ This scientific genealogy comes up at the very end of *ITIS Galileo*. It is a brilliant way to continue the theoretical thread by connecting it to a scientific genealogy. Paolini could have further expounded on it, but he may not have wanted the audience to be distracted from the main message of the show, which is resistance to obtuse power and obscurantism.

Both Nietzsche and Foucault have spoken of genealogical work as a way of deconstructing the truth. In "Nietzsche, Genealogy and History," Foucault describes the formation of a genealogy as relentless work: "Genealogy is grey, meticulous, and patiently documentary. It operates in a field of entangled and confused parchments, on documents that have been scratched over and recopied many times" (145). He also shows how genealogies help deconstruct the current morals and focus on those elements that are "without history" (Foucault, *Language* 139) For this reason, genealogies tend to become radical by their very nature.

In the case of Paolini, the genealogy that he proposes is based on the same dusty archival work, on the same relentless erudition, but it is also radical, in it denounces the long history of oppressive power exercised over Giordano Bruno, Tommaso Campanella, Galileo Galilei and other protagonists of one of the *deepest* revolutions in history.²⁶

In the context of a pièce that lasts less than three hours and tells the history of science from Aristotle to Galileo, with short forays into Egyptian Astronomy as well Special Relativity Theory, Paolini's show on Galileo is remarkably accurate. He weaves in and out of the received view according to his needs, but he works within the parameters of the recent debate on scientific revolutions. He refuses to make the show a matter of us and them, or of Galilei and Bellarmino. He builds his story working with his audience, which is less and less

conversant in history and philosophy, but is steeped in the received view. He still manages to build the titanic figure of a man, his telescope and of knowledge.

Most importantly, Paolini underlines how Galileo, Giordano Bruno, Campanella, Kepler, Copernicus, and the community that championed the scientific revolution straddled the demarcation between science and pseudo science, and was perfectly comfortable with the incommensurability of the two world views: “È facile ridere di un mondo che pensava che la terra fosse al centro dell’universo... Il problema è che le teorie quando la smettono di esistere fanno ridere, ma finché ci sei dentro, ti dimentichi che son teorie” (*ITIS Galileo*).

Ultimately, *ITIS Galileo* is not just about Galileo, it is about the relationship between truth and power and the idea that truth is immutable only when it is legislated and imposed by power. If power does not control the truth, then the truth becomes elusive: “La verità la puoi cercare e non la puoi possedere e devi in ogni caso esser pronto ad accettare che non lo sia più” (*ITIS Galileo*). This fluidity of the concept of truth is what Galileo aspired to and, in this most un-autobiographical of shows, is also what Paolini is looking for: a truth that will be open for discussion.

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ENDNOTES

¹ Although he rejects the definition of “*teatro di narrazione*,” Paolini traces the roots of his own theater to three main models: religious rhetoric, classical rhetoric and play, as in children’s play. See the interview with Marco Paolini, March 19, 2005, on *Che Tempo Che Fa* where he discusses his dramaturgy (*Che Tempo*).

² The videotape of the *Racconto del Vajont* was published by Einaudi in 1999. The *Racconto del Vajont* is also available in English translation (Paolini *Tale*).

³ See Cristina Perissinotto (“Polo”), and also Marco Paolini’s website under “Rassegna stampa” (Marco Paolini).

⁴ About *Bestiario veneto* see also Cristina Perissinotto (“Ciamarse dentro”). After the two *Bestiari* Paolini produced, among others, the following shows: *I-TIGI* (on the tragedy of Ustica); *Song n. 32* (on the exploitation of water and its transformation from common good to commodity) and *Parlamento chimico. Storie di plastica* about Marghera. More recently, he has produced other shows concentrating on his own

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personal history: *Miserabili, Album, Cinque Monologhi per Report* (produced only for Rai Tre) and *Il sergente*, adapted from Mario Rigoni Stern's *Il sergente della neve*.

⁵ Although this was an incisive answer, and earned him applause from the studio audience, it was not a completely accurate one. During a lecture he gave in Chicago in 2000 Paolini said that his show about Venice, entitled *Il Milione*, was his attempt to do something comic, radically different from the tragic *Racconto del Vajont* which he had brought to the stage a few years beforehand.

⁶ “Per me è teatro, per carità, se poi ci vuoi metterci un aggettivo vicino, chiamatelo politico, che vuol dire della *polis*, della città. Io racconto, soprattutto, questo è il mio mestiere, e poi, dire che faccio teatro è come mettergli i paletti” (*Che Tempo*).

⁷ The relationship between theatre and science has been fully explored in the history of theatre. See Campos, Lachapelle, and Rozik.

⁸ Reference to *otium* in Latin and *scholé* in Greek.

⁹ He reads in Italian from the *Tetrabyblos*, book 2, Chapter 2:

Again, the natives of those countries which lie towards the east excel in courage, acting boldly and openly under all circumstances; for in all their characteristics they are principally conformed to the Sun's nature, which is oriental, diurnal, masculine and dexter—and it is plainly apparent that the right-handed parts of all animals are much stronger than others—hence results the greater courage of the inhabitants of the East. And as the Moon, on her first appearance after conjunction, is always seen in the west, the Western parts are therefore lunar, and consequently feminine and sinister; whence it follows that the inhabitants of the west are milder, more effeminate and reserved. (Ptolemy 42)

¹⁰ The notion of different climates that might influence different people is also reflected in Macrobius' theory of the world, partly derived by Ptolemy, in which there is the postulation of an *Antipodean* race, of which we can know nothing.

¹¹ For a history of the received view, see Suppe.

¹² See for example Hofstadter, in particular the first three chapters: “Galileo Galilei and Maffeo Barberini,” “The Telescope, or Seeing,” and “The Trial, or, Not Seeing.”

¹³ For a history of this concept in Thomas Kuhn see Bird (97-148).

¹⁴ Catholic scholars regret the “missed dialogue” between Galileo and the Vatican. See Viganò.

¹⁵ The discovery begins with the conscience of an anomaly, that is to say the impression that nature, one way or the other, contradicts the expected results within the paradigm that governs normal science. Follows an exploration, more or less prolonged, of the domain of the anomaly. And the episode is not closed until the theory of the paradigm is readjusted so that the abnormal phenomenon becomes the expected phenomenon. (Kuhn, *Structure* 72)

¹⁶ The frontispiece of the first edition, Nuremberg 1543, says: *Nicolai Copernici Torinensis De Revolutionibus Orbium Coelestium, Libri VI*.

¹⁷ The introduction, published anonymously, is attributed to Andrea Osiander (1498-1552), a German theologian and scientist who published the first edition of Kepler's *De Revolutionibus*.

¹⁸ Bruno tended to broaden the Copernican theory in a purely philosophical or

metaphysical direction, in which precise scientific consequences were lacking. He made the heliocentric system a philosophy of nature that was rich in new ideas and poor in rigorous thinking. [...] Galileo gave to Bruno's program a completely different direction. For him, the Copernican conception possessed the unique property of being a point of convergence for all new scientific research – mathematical astronomical, and mechanical. (Geymonat 59)

¹⁹ TEOFILO: Con la terra dunque si muovono tutte le cose che si trovano in terra. Se dunque dal loco extra la terra qualche cosa fusse gittata in terra, per il moto di quella perderebbe la rettitudine. Come appare nella nave *AB*, la qual, passando per il fiume, se alcuno che se ritrova nella sponda di quello *C* venga a gittar per dritto un sasso, verrà fallito il suo tratto per quanto comporta la velocità del corso. Ma posto alcuno sopra l'arbore di detta nave, che corra quanto si voglia veloce, non fallirà punto il suo tratto di sorte che per dritto dal punto *E*, che è nella cima de l'arbore o nella gabbia, al punto *D* che è nella radice de l'arbore, o altra parte del ventre e corpo di detta nave, la pietra o altra cosa grave gittata non vegna. Cossi, se dal punto *D* al punto *E* alcuno che è dentro la nave, gitta per dritto una pietra, quella per la medesima linea ritornerà a basso, muovasi quantosivoglia la nave, pur che non faccia degl'inchini. (Bruno 64)

²⁰ See Eco.

²¹ For an accurate textual analysis of Galileo's condemnation and abjuration, see Finocchiaro (7-20).

²² Pagano has the letters of the various nunci and inquisitors of Italian and European cities that confirm the sentence of condemnation and Galileo's abjuration having been publicly read and circulated.

²³ Antonio Badelli reports in the *Avvisi di Roma* of 25th of June 1633 that "They burned his books which deal with the movement of the earth before his eyes" (D'Addio 64).

²⁴ "So great a contribution to physics was *Two New Sciences* that scholars have long maintained that the book anticipated Isaac Newton's laws of motion" (Hawking 397).

²⁵ Brecht wrote the first version of *The Life of Galileo* between 1938 and 1939, that is before the atomic bomb. However, he wrote the second version between 1945 and 1947, after Hiroshima.

²⁶ Further elaborations on Kuhn's initial theory brought to the concept of *deep* revolution in science:

This was a revolution of a much more fundamental sort because it involved a change in what counted as a good theory, in the procedures of justification themselves... And what made it revolutionary... was the gradual transformation of the very idea of what constitute valid evidence of a claim about the natural world, as well as in people's beliefs about how that world is ordered at the most fundamental level. It can thus be called a *deep* revolution... The Aristotelians and the Galileans totally disagreed as to how agreement itself should be brought about, as did the Cartesians and the Newtonians. The Galileans made use of idealization, of measurements, of mathematics, in ways that Aristotelians believed were illegitimate. (McMullin 60-61)

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