

Preface

In the spring of 1915, Tullio Levi-Civita, at that time in Padua, sent a letter to Albert Einstein in which nothing less than a key step of the first version¹ of the general relativity was contested. An intense correspondence began between the two, but each new letter of the great German physicist's concluded with a firm defence of his assertions. The duel lasted several weeks, until, in the last letter, a grateful Einstein acknowledged his mistake. Further on, with the humility typical of the greats, Einstein wrote to him: "It must be nice to ride on the horse of true mathematics through these fields, while someone like me has to be satisfied with proceeding on foot."²

Together with Gregorio Ricci Curbastro, at the end of the 19th century, the young Tullio radically improved the discipline invented by his master Ricci – the absolute differential calculus – without which general relativity would not have found a mathematical formulation. As a pure mathematician, however, he was an advocate of the great value of abstraction in physical applications. He dealt with the geometry of the general relativity: his masterpiece, the parallel transport theory, had been developed, hoping to be "useful" to the great theory of Einstein, as we can read in the introduction to his famous 1917 paper. He took on many other topics, from the stability of the orbits of the planets, the three body problem, to the mathematics of intercontinental telegraph cables. His students adored him, and so did his Italian, European, Russian, American and South American colleagues.

Tullio was a passionate popularizer and a cosmopolitan pacifist. Even Paul Valéry, one of the pillars of French poetry and philosophical thought of the 20th century, in 1934, sent him a letter full of gratitude and admiration, captivated by the beauty of writing and communicative power of the Paduan mathematician.

Tullio did not underestimate the violently anti-Semitic climate that was spreading from Germany to the rest of Europe in the 1930s. But he was animated by a sort of enlightened confidence, an option for voluntary naïvety, in the final prevalence of tolerance. On the contrary, tolerance increasingly disappeared from the moral panorama of the fascist regime: in 1938, as a result of the "racial laws," Tullio was expelled from the university and from all the Italian academies, since he was of Jewish origin.

He passed away in 1941, in the indifference of a nation intoxicated by dictatorship and overshadowed by war. In contrast, esteemed institutions like the Royal Societies of London and Edinburgh mourned his loss and commemorated his contributions with

¹ A. Einstein and M. Grossmann, Entwurf einer verallgemeinerten Relativitätstheorie und einer Theorie der Gravitation. *Zeitschrift für Mathematik und Physik* **62** (1913), 225–261.

² A. Hentschel, *The collected papers of Albert Einstein, Vol. 8, The Berlin years: Correspondence, 1914–1918*. (English translation supplement) Princeton University Press, 1998.

moving obituaries, even amid the ongoing aerial onslaught conducted by Germany and Italy.

Of every good book, especially a history book, one should not ask for whom it was written. The cultural audience is self-selecting. It is a matter of freedom. Reading the book you have in your hands, the idea emphatically resurfaced in my mind (now that I am writing this, it seems obvious to me) that the history of science books represents an indispensable aid for the women and the men who work in science.

Living as a “craftsman” in mathematical physics³ at the University of Padua, where Tullio Levi-Civita spent the long beginning of his scientific creativity, I often rummage in, but also avidly read, the works of a distinguished group of authors, sometimes with quite heterogeneous characters, which I fondly term *humanist scientists*.⁴ This has always been “comforting” to me; perhaps the more appropriate word should be “corroborating.” Through their explanations, sources of doubt and critique, I believe I have shaped my cultural education. I owe a debt of gratitude to this collective wisdom.

The author of this volume, Rossana Tazzioli, places herself in the wake of this albeit heterogeneous group of authors, even well before the publication of the present volume. Like her other works, this book is strongly written for scientists; it has a precious value in unraveling the paths of the construction of scientific thought, intertwining historical and mathematical perspectives. Furthermore, there is another important reason for placing Rossana among the humanist scientists: it is the rigor in the use of sources; in her book, private facts described in Levi-Civita’s correspondence are intertwined with his scientific contribution.

This book represents a point of arrival in Tullio Levi-Civita’s whole history, nevertheless – and this is a further beauty – it discloses important pages of the history of science, still to be investigated. Rossana underlines this well.

I want to draw attention to the not completely unraveled cultural connection between Levi-Civita and the Fermi and Persico couple, who at the beginning were students of Levi-Civita and who subsequently had autonomous brilliant scientific careers.

A future exploration should delve into Levi-Civita’s stance on quantum mechanics. While he supported its original formulation, known as the *old quantum theory*, his attitude toward its subsequent developments remains controversial.

³I like to remember, with a certain emotion, that I was a student of Aldo Bressan (1926–2007) who was in turn a student of Giuseppe Grioli (1912–2015): his master was Antonio Signorini (1888–1963), a great pupil in continuum mechanics of Tullio Levi-Civita’s.

⁴I have in mind, the character who, at least in Italy, was a forefather of a rich list of humanist scientists: Federico Enriques; and after him, Ludovico Geymonat, Abraham Pais, Clifford Truesdell, Enrico Bellone. All of them arrived at the history of science through and after a cultural journey in genuine science. I regret that I have certainly forgotten many of them here.

Additionally, the abrupt abandonment of the unified theories of gravitation and electromagnetism, inspired by Einstein's early ideas and in which Levi-Civita collaborated, deserves thorough investigation. A common opinion today is that the interest of the scientific community shifted swiftly to the nascent modern quantum mechanics, based on the Schrödinger picture. It was in fact a sort of oblivion of a cultural precious core, which was forgotten, along with some of its bright mathematical tools, such as Ricci's coefficients of rotation, which were widely used by Levi-Civita and only recently exploited in theoretical physics.

But other salient mathematical aspects and applications of absolute differential calculus were similarly marginalized, undermined by the so-called vectorialists, tacitly supported by the fascist regime. It was a partial cultural removal. Although on another vast and epochal scale, scientific oblivion was narrated by Lucio Russo,⁵ the relevance of his book in the present context is the powerful message of attention and protection towards every scientific thought, which we should always exercise.

The book by Rossana Tazzioli that you are holding enters deeply into the "golden age" of Italian mathematics, spanning the 19th and 20th centuries. It offers a comprehensive account of one of the crucial characters of that era, telling the tale of the science of Tullio Levi-Civita.

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⁵L. Russo, *The forgotten revolution*. Springer, 2004.