

Preface

My interest in Mary Somerville began in 2011, when I was invited to give a talk on women mathematicians in history at a meeting on “Mathematics and Culture” held in Venice. This represented a challenging task to me, as I co-founded in 2009 a Gender Interuniversity Observatory (GIO) based in the four state universities in Rome, “Sapienza”, “Tor Vergata”, “Roma TRE”, and the “Università del Foro Italico”, and among the goals of the observatory, there has been from the very beginning much research on excellent women in culture, so making a significant list of outstanding ladies in mathematics seemed to me quite appealing.

My choice involved Hypathia, Émilie de Breteuil, Maria Gaetana Agnesi, Sonya Kovalevsky, Sophie Germain, Mary Somerville, and Emmy Noether. Among these scientists, the only one I had never heard of before was Mary Somerville, maybe because there is no Somerville’s theorem, or because for a long time after her death she had been somehow left aside, even by her fellow citizens; but when I actually read the *memoir* of her life, *Personal Recollections* (PR), which her daughter Martha Charters Somerville edited in 1873, one year after her death, I discovered that in the 19th century she had been a celebrity as a scientist. Indeed, she wrote four outstanding books: *On the Mechanism of the Heavens* (MH), after Laplace’s *Mécanique Céleste* (LPS), *On the Connexion of the Physical Sciences* (CPS), Physical Geography (PG), and *On Molecular and Microscopic Science* (MMS), which means that she was an expert in all the sciences, even if mathematics was her first love.

To my eyes, the main feature of her long and fruitful life was that she was self-taught: no exclusive schools, no top institutions like Oxford and Cambridge, but just hours and hours of stubborn study on her own, enlightened by many conversations and correspondence with the most important scientists of her time. In fact, they all came to admire her when it became known that she was the only woman who had yet succeeded in understanding the work of Laplace, the great French mathematician whom she met in Paris during one of her stays, and who was astonished to learn that she had indeed mastered all the mathematics he used in his treatise.

But long before this immense success, when she was ten years old, Mary Somerville was barely able to read and spent most of her time alone, wandering the shores near her Scottish village in Fifeshire, the quaint seaport of Burntisland. She transformed her happy hours among the sandy creeks into her own private school: lessons were taken up observing nature and all the living creatures she encountered.

No comparison whatsoever with Sonya Kovalevsky, who after a fictitious marriage with a young paleontologist, left Russia for Germany, attended Karl Weierstrass's lectures in Berlin, presented three papers at the University of Göttingen as her doctoral dissertations in 1874, and became the first woman in Europe to hold a doctorate in mathematics (SE).

But as an algebraist, it's natural for me to make a comparison with Emmy Noether, daughter of Max Noether, professor of mathematics at the University of Erlangen, a celebrity thanks to his theory of algebraic functions. "Der Noether", as Hilbert referred to her, using the masculine article as a recognition of her power as a creative thinker who had broken the gender barrier, obtained her degree in mathematics in 1907, and after some pleasant years in the beautiful Institute of Mathematics in Göttingen, had to emigrate to the United States because of the racial laws. There she obtained a position in Bryn Mawr College in Pennsylvania, near the Institute of Advanced Study in Princeton. There she reorganized modern algebra and united the theory of group representations with the theory of modules and ideals. By great misfortune, she died at the age of 53 as a consequence of unsuccessful surgery (SE).

These two ladies were extraordinary mathematicians and obtained their results after proper schooling and university studies, while Mary Somerville used her desk and all the books she collected by herself in various and unusual ways to open her mind to science. It is therefore impossible not to be captivated by her case, and the need for proper review seems hard to ignore.

The admiration I felt induced me to go to England and visit the British Library, where I knew I could find original copies of her books. I spent many hours going through those pages in the beautiful "rare books" section, and I loved opening the perfectly kept leather bindings: the delicate scent of old paper reminded me that those volumes concealed the thoughts of a woman scientist of the 19th century.

One morning while concentrating on *Physical geography*, I came across a description of the Amazonian rainforest. She gave such a fascinating report of the species of plants hidden in the shadows below the trees that one could almost hear the sound of raindrops dripping on the flowers, I didn't have the same magical impression even when I saw the rainforest for myself; her words were more evocative than my own eyes.

Reflecting on her from the gender point of view, Mary Somerville represents a tremendous source of inspiration, as she really had the capacity to create "a room of her own" in the world of science. She was married twice, in arrangements made by her family with two different cousins. These two men were completely different one from the other. The first, Simon Greig, didn't understand her thirst for knowledge at all, and in three years of unhappy marriage, did nothing to support her studies. But

at least he had the decency to die young, leaving his wife with some money, two children, and the freedom to use her time on books.

The second husband, William Somerville, was the man of destiny, the person who, through his deep love, fostered her ascent in the society of the 19th century, not an easy task in such a male-dominated realm. It is difficult to imagine that Mary Somerville would have succeeded in the way she did without William Somerville's support; but when she became famous and he began to suffer from an infectious disease, it was to a great extent Mary who provided for the family, and bravely stood by him until his death in 1860.

Mary Somerville spent the years of her life until middle age in Scotland and England, occasionally travelling in Europe, until she was forced to move to a warmer climate because of her husband's bad health. She settled in Italy and remained alone after his death, never returning to her native country, studying and writing about science until the very last day of her life at the age of ninety-one.

An experience which started with a family health problem slowly became a state of mind: she took inspiration from the colours of the beautiful places in which she spent long periods, such as Venice, Florence, Siena, Perugia, Turin, Genoa, La Spezia, Rome, and Naples, not only for her painting, another of her talents, but also for new curiosities and investigations which embraced even frontier fields, such as microscopic science.

I sincerely believe that the importance of her years in Italy has not yet been completely recognized; one third of a woman's life is something which cannot be neglected. However, this underrating is comprehensible, for the esteem in which her contemporaries held her went beyond any border. But if one has the patience to ask questions about the nature of her scientific reasoning and the relation of gender to modules of perception, the Italian years are illuminating.

Maybe this is the main reason why she dedicated herself to microscopic science in the last part of her life, while in her early and middle years she had instead focused on nature as revealed through a telescope: she had clearly come to feel that even small details were fundamental, and she succeeded in using the poetic side of her powerful rhetoric to convince her readers that the Universe was not only macro but also micro-magnificent.

In the end, it turned out to be a natural journey, as she had begun with great things and concluded with tiny ones, covering a vast area of knowledge on the way: after the stars, she returned to earth, to consider its own features and its inhabitants, using a telescope to begin with and a microscope later. She herself was a powerful driving force for research that ran for more than 90 years. It is surely for these reasons that she was so careful and skillful in describing scientific matters to her readers, never boring or pedantic, but determined to give them pleasure.

In Italy Mary Somerville maintained her involvement in the scientific world to such an extent that she became part of the Italian cultural scene, receiving a wide range of honours: she was elected a member of the Academy of Natural Science in Florence, the College of Risurgenti in Rome, the Imperial and Royal Academy of Science, Literature, and Art in Arezzo, the Italian Society of Natural History, and

the Accademia Pontaniana at Naples. Such a level of recognition was extraordinary for a woman who only came to the country when she was 58 years old.

And as painting was a parallel to science writing throughout her life, it is natural to point out that during her time in Italy she devoted much time to capturing the beautiful landscapes on canvas, far more than she ever did in England or Scotland.

Her ability in showing the extent to which words can be used to extend the frontiers of imagination has been a feature of other female mathematicians. Sonya Kovalevsky, mentioned a moment ago, also wrote a *memoir* entitled *A Russian Childhood*, some plays in collaboration with Anne Charlotte Leffler, the sister of the Swedish mathematician Gosta Mittag-Leffler, and a partly autobiographical novel, *Nihilist Girl* (SE). About this side of her personality, Kovalevsky said something quite important that applies perfectly to Mary Somerville:

“It is impossible to be a mathematician without being a poet in the soul [...]. The poet has only to perceive that which others do not perceive, to look deeper than others look, and the mathematician must be able to do the same thing.”

As a proof of this, the final powerful evocation in Somerville’s *memoir* is a majestic account of an eruption of Vesuvius in Naples; the beautifully described activity of the volcano provides a final pyrotechnical conclusion to a long life, enriched not only by her family and relatives, but also by an incredible gallery of encounters with people of all sorts, encounters that were as valuable for her as all the culture she had stowed up in her mind and in her soul.

As a scientist, I believe that, even though she had to struggle to achieve her goals, in a certain way she was lucky. During the Victorian era, science was not yet conceived of as a profession, and it was not so highly specialized: most of her contemporaries devoted themselves to science in addition to other intellectual activities. The term “scientist” referred to expertise rather than to originality, so she was indeed considered a scientist. The world of amateur researchers in the Victorian period accepted an interdependence of science, poetry, and religion which allowed the belief that these three worlds were intertwined: from this point of view one could see how someone like Mary Somerville would be so successful in presenting science as a form of high level meditation, with no closed doors.

Members of the middle class who were trying to change society through the promotion of science found great encouragement in her books: for this reason she was wise enough to publish the *Preliminary Dissertations* of her books as independent publications.

Moreover in the days when Mary Somerville was still pursuing her self-taught education and beginning to earn a reputation, there was fairly widespread support for the education of middle-class women: the problem was that the education then available happened to be limited. The assumption that women were intellectually inferior to men was deeply rooted in society and the main aim in their upbringing was to prepare them for a domestic role of some kind. So science was encouraged in a circumscribed way, but in reality, it was more readily available then than later in the 21st century.

The fact that science was more private than institutional represented another fortunate circumstance for Mary Somerville, as she could progress in her work

without neglecting her womanhood: from her post at her desk, she could keep an eye on her family and enjoy her friends. If there had been more full-time paid science positions in the institutions, she would have been induced to work in an academic setting, rather than a domestic one of this kind.

I have had the opportunity in recent years to give several talks on Mary Somerville. I always noticed that the audience listened with special interest to her story, and that women mathematicians felt even more involved than general scientists. In the lovely town of Cortona in Tuscany, in September 2015, an important event took place, namely the 17th General Meeting of European Women in Mathematics. More than eighty ladies from all over Europe gathered to listen to their female colleagues' recent results.

One evening I was scheduled for a public lecture on "Lights and shadows for women in mathematics through the ages", and once again I felt very strongly that Mary's endeavours were warmly understood. I guess this was because mathematicians know very well how difficult it is to work in this field, even after a first-class training, so the story of a self-taught woman mathematician two centuries ago, who surfed across all branches of science was a good one to present.

I am fully aware that several historians have been as captivated as I was by the life of Mary Somerville. In particular Kathryn A. Neeley at the University of Virginia has produced *Mary Somerville. Science, Illumination, and the Female Mind* (NK) and Allan Chapman at Oxford University has written *Mary Somerville and the World of Science* (CA), while Dorothy McMillan at the English Department of the University of Glasgow has edited and introduced Mary Somerville's autobiography in a more complete way using manuscripts owned by Somerville College, Oxford (MD).

I believe that McMillan's work is particularly precious, as it offers an unexpurgated edition of her writings. This contrasts with Somerville's daughter who, in her edition, wanted to give a more perfect image of her mother. This was quite understandable, but in doing so she made a choice of papers which softened the overall picture; like anyone, Mary Somerville also had certain weak points and dark sides to her polyhedric personality. These are easy to detect, simply by reading her recollections. These *Personal Recollections* are more important than her scientific books and any other book in determining how she should be remembered, bringing out her many-sided personality.

In writing about Mary Somerville, one has to be careful not to distort her. I think that basically she was much simpler than she has been depicted by many authors: she was first and foremost a pragmatic mathematician and a charming woman in perfect combination.

A new interest in Mary Somerville is perfectly justified by the decision by the Royal Bank of Scotland to use Mary Somerville's image on the ten-pound plastic banknote in circulation from 2017. She will therefore be the first woman other than the Queen to appear on Royal Bank of Scotland banknotes. Her name was voted from among 4100 people via Facebook, and the students of Somerville's College in Cambridge campaigned for this choice: a long-awaited recognition, 144 years after her death in 1872.

I wrote this book as a mathematician and as an Italian. It is just a simple contribution, inspired by my admiration for an amazing and pioneering scientist. I don't pretend to answer to the question "Who was Mary Somerville?." She played too many roles and had too many areas of expertise to be so thoroughly analyzed. But I do claim to like her as a human being, as I believe that she had an extraordinary scientific intellect, with the soul of both a mathematician and a poet. This book is thus a playful attempt to understand how Mary Fairfax from Burntisland became the famous Mrs. Somerville, paying special attention to the more than 30 years she spent in Italy, not forgetting certain fortuitous events of the kind that are always present in any life, in any endeavour, in any ambitious human adventure.

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