Mathematics, Faith and Politics during the Italian Risorgimento
Snapshot Two – Mutual Goals and Collaboration

Introduction

In the previous snapshot from early nineteenth century Naples we examined controversies between the Fergola's synthetic school of the geometry and that of analytics who focused on the mathematization of science. While the debate was framed in terms of the *right* way to do geometry, in actuality these disagreements were a direct result of changes occurring in Neapolitan society during the French occupation and subsequent Restoration period, in which the Bourbon monarchy was returned to power. Our second snapshot looks at mid-nineteenth century Italy and the collaborative efforts of Italian mathematicians from different religious and political persuasions to establish an Italian school of mathematics, which would rival those of France, Germany and England.

Snapshot Two: Mutual Goals and Collaboration

The early to mid-nineteenth century in Italy is often referred to as the Risorgimento, a national rebirth of Italy with broad cultural, social, and economic revival. Politically its themes were independence from foreign rulers, unification of the Italian peninsula and liberty for its citizens. It was also a time of a rebirth of Italian mathematics. While many reforms enacted by the French were put on hold with the Congress of Vienna's establishment of Restoration governments, movements within the scientific community, including annual scientific congresses, a proliferation of general disciplinary journals and a gathering of statistical information, all helped develop a sense of an Italian scientific community. The scientific congresses were especially significant as they provided one of the first opportunities for scientists from across the different Italian regions to meet each other, to exchange ideas, and to debate both scientific and political ideas. Many future heroes of the Risorgimento attended these conferences. Several of these heroes were mathematicians who became future leaders in the new Italy. Three who played a particularly significant role were Francesco Brioschi (1824-1897), Enrico Betti (1823-1892) and Luigi Cremona (1830-1903). Each was involved in the 1848 military insurrection, a failed attempt at ousting the Austrians from Italy but a harbinger of the 1860 campaign that would achieve the unification of almost all Italy (excepting Venezia and the Papal States). Each was also a prolific mathematician who also played a significant role in the scientific unification of Italy. While the names of Brioschi, Cremona and Betti are often the ones associated with mathematics in Italy at this time, their lives intersected with and were influenced by other less well-known but significant mathematicians such as Barnabas Tortolini.

At the beginning of the 19th century work by Italian mathematicians was little known abroad. This was despite some significant achievements, such as Paolo Ruffini's work proving that fifth degree equations could not be solved algebraically. Such revolutionary results often did not receive the merit or attention they deserved by other European mathematicians – Lagrange had dismissed Ruffini's proof and it was only later that Cauchy recognized its significance. Italy was also a difficult place to do

mathematical research. The state of Italian mathematics in many ways paralleled the political fragmentation of the peninsula. The Congress of Vienna reaffirmed the political division of Italy into separate states, all which were under foreign rule but most primarily controlled by Austria. Advances in the process of political and civic renewal which had been made under the French were now halted. Though institutions for presenting and discussing mathematical research did exist in Italy the political and geographical fragmentation of the peninsula caused most of these institutions to have a local rather than national flavor. In the decades following the Congress of Vienna there was a growing sense of the need for scientific unification of the Italian state. Steps to bring about this unity included promotion of the work of Italian mathematics both in Italy and abroad, interaction and collaboration of Italian mathematicians with the international mathematical community, a reorganization of the Italian education system and the development of national research centers. There was also an awareness of the need for an Italian journal devoted solely to mathematics.

The following paragraphs tell the stories of some of the Italian mathematicians who worked towards these goals, at times setting aside their personal goals and ambitions to achieve what they came to believe was best for Italian mathematics. The common goal of reestablishing Italy as a world-class mathematical community underlined the collaboration between mathematicians with very different political and religious perspectives.

Gabrio Piola (1791-1850), Angelo Secchi (1818-1878), Barnabas Tortolini (1808-1874) and Prince Baldassare Boncompagni (1821-1894), along with Paolo Ruffini (1765-1822) and Nicola Fergola (1753-1824) who lived at the turn of the century, were all devout Catholic mathematicians and scientists. In their writings they tried to show that Catholicism was not hostile to the progress of modern science but rather was interested in the search for scientific truth. (Mazzotti, 2000, p. 276) Their interpretations of how that search was to be done and what that truth entailed varied. But generally it was a belief in the primacy of religion and a conception of mathematics and science that opposed Laplacian determinism. (Bottazzini, 1994, p. 85)

Brioschi, Betti, Angelo Genocchi (1817-1889) and Luigi Cremona were mathematicians who had served in the wars of Italian independence and believed strongly that mathematics and patriotism were intertwined. (Borgato, 2009) Many of their mathematical endeavors were guided by a desire to help Italy take its place amongst the leading countries in Europe in its mathematical prowess and to develop the educational infrastructure to enable Italy to develop as a unified nation. Brioschi, Betti and Cremona served in the new Italian government as senators or in the Ministry of Education. They developed research centers at universities, worked on developing new textbooks as part of an educational reform, started schools to prepare the engineers that were needed to build the infrastructure of the new state, and were leaders in the Italian School of Mathematics that was to emerge as a mathematical powerhouse in the later nineteenth century. Some were anti-clerics. They believed in ending the temporal power of the pope, which would come with the unification of the whole Italian peninsula.

These were two seemingly disparate groups of scientists with different agendas. Yet they shared a love of mathematics and science, an interest in its advancement, and a desire for Italian mathematicians to take their place in the European scientific community. Their lives and work overlapped. Some of them met personally at scientific congresses; some were each other's pupils. They edited each other's papers, worked on projects together and learned from each other. Together they worked for the goals they shared in common. They showed a willingness to lay aside their own preconceptions and listen to the viewpoints of others. While there were definite differences regarding religion and politics, there was not the need to choose sides, which would be forced upon them after unification.

Piola – A man open to learning

Gabrio Piola was a Milanese nobleman who had significant influence on Italian mathematics during the earlier decades of the nineteenth century. (Barbin, 2013, pp. 60-61) He was famous for his work in continuum mechanics and for his research in the history of mathematics. He was renowned not only for his mathematical work but for his poetry, moral stature and civic engagement as well as his faith expressed in works of Christian apologetics. He was a devout Catholic who sought to promote complete agreement between science and religion. (Bottazzini, 2002, p. 77)

Piola studied mathematics at Pavia University under Vincenzo Brunacci, a devout follower of LaGrange. In 1824 Piola won a prize for a long article he wrote on the mechanics of Lagrange. He was offered a chair in applied mathematics at Pavia University, but refused it for family reasons. He did, however, devote much of his time to teaching mathematics. He gave regular lessons at his home and stirred the scientific culture of Milan by hosting regular meetings at his house to discuss the latest developments in mathematics. Francesco Brioschi was a regular attendee at these meetings and became a private pupil of Piola. Placido Tardy was another of Piola's pupils. These men and others who attended Piola's school went on to attain professorships and fame, but Piola, a humble man, was never concerned about being overshadowed by the success of his pupils.

For many Italian mathematicians and physicists, Lagrange represented modernity. Lagrange was still regarded as an Italian mathematician and this was a period of rising nationalistic feelings. Though a strong supporter of Lagrange's mechanics and his algebraic approach to mathematics (in Snapshot One we learned about Fergola's opposition to this approach), Piola was influenced by his conversations with Cauchy when he came to Pavia in 1830. Piola was perceptive enough to realize the significance of Cauchy's results which were based on a more rigorous approach. Though Piola continued to embrace Lagrangian mechanics, his journal, *Opuscoli matematici e fisici di diversi autori* (Brochures of mathematics and physics from different authors), became a main conduit for the spread of Cauchy's mathematics ideas and techniques in Italy. (Martini, 2006, p. 33) Piola thus brought Italy into closer contact with new mathematical developments abroad.

Piola's confidence in God's sovereignty enabled him to search for mathematical truth and to weigh the merits of different mathematical developments and methods not basing his assessment solely on patriotism or religion. For example, after finishing his doctorate in 1816, Piola wanted to learn more, so he applied to the pope for permission to read works of science and philosophy condemned by the Church and included on the Index of Forbidden Books. He was granted permission to read the books but not to share their content. (Filoni, 2006, pp. 102)

Piola wrote extensively on Christian apologetics as applied to the sciences. Piola was concerned with Laplace's mechanistic view of the universe, which denied divine intervention in creation and which applied probabilistic calculations in the sphere of ethics. Laplace's theories had become popular in Italy and Christian mathematicians such as Paolo Ruffini (1765-1822) and Piola tried to respond to them. In 1827 Piola published an article entitled *Sulla certezza* (On Certainty) in the *Memorie di religione, di morale e di letteratura dell'Accademia di Modena* (Memoirs of religion, morality and literature of the Academy of Modena) in which he addressed the application of probabilistic calculations to the sphere of morality. Piola opposed the rigid determinism that constrained the freedom of man, discounted emotions and feelings, and which strongly opposed the existence of God. In his writings Piola tried to restore a form of balance between reason and faith that the Enlightenment and Rationalism had virtually eliminated, the Napoleonic rule in Italy had further compromised and which continued to be compromised in the Restoration era as national governments tended to maintain an attitude of religion's subordination to the needs of the state. (Filoni, 2006, pp. 107-110)

Piola saw being a scientist and a Christian as being in full agreement with each other. God created the world through a very high knowledge and a man who observed the world with a scientific eye was enabled to reach part of this knowledge. Between doing science and practicing faith, therefore, there was no contradiction. To admit the existence of a creator and eternal entity was not an obstacle to scientific knowledge of the world; knowing the world scientifically could, on the other hand, be a further invitation to faith. These were the key ideas in articles he wrote, first for a magazine in Turin and later as a separate work, *Le Lettere di Evasio ad Uranio intorno alle scienze matematiche* (The Letters of Evasio to Uranio around the mathematical sciences). (Filoni, 2006, pp. 113-114)

In these letters Piola played the role of the mathematician Evasio who, though young, had already acquired fame and experience in science. In the letters he addressed an imaginary disciple Uranio (Greek word for sky, indicating 'heavenly' – this name revealed Uranio's scientific interests and his aspirations to a higher knowledge). Uranio wanted to learn the sciences and in particular mathematics. Evasio warned him of a series of dangers that might come across his path and strove to show him a straight path. These four letters addressed an idea of the Enlightenment and Rationalism movements – that human pride, swollen by the progress man had made, had come to the point where man wanted to extend the domain of science to every other province of human knowledge. The first two letters addressed the idea that math and science were not sources of atheism. A scientist blinded by pride could draw from science unjust conclusions, not seeing in the

world a place for God. He also addressed claims, like those of Laplace, that the human behavior was predictable and could be described in scientific terms; Evasio argued that this is impossible. The second two letters addressed the idea that mathematics and science were cold and unable to speak the language of faith. Evasio responded that while science itself was not needed for faith in that even an uneducated person could possess faith, yet with science one could better understand the creation and also the work of the Creator who thought in mathematical terms. The ideas in these letters showed that Piola was well acquainted with the debates between faith and science that had taken place in Europe from the Scientific Revolution onward.

In his research on the history of mathematics Piola was attentive to the humanity of the mathematicians, talking about their personalities as well as their achievements. He discussed how they approached their work, their successes and failures, and what could be learned from their methods and their errors as one looked to the future. He wrote eulogies and obituaries as well as works of praise. His masterpiece was his *Eulogy on Cavalieri*, which he presented at the 1844 meeting of the Congress of Italian Scientists in Milan. [i] This eulogy was an extensive scientific biography of the monk Cavalieri, in which Piola portrayed the scientist as one who tried to reconcile faith and reason. Piola used poetry and emotion to make his points and in doing so addressed the cold, mechanistic view of mankind prevalent among some scientists. He used examples from law, science and everyday life. The power of example showed the absurdity of probabilistic methods applied to morality as this approach cannot meet the needs of man nor ease his suffering.

Politically, Piola saw himself as an Italian and had anti-Austrian sentiments. Austria at this time controlled Lombardy where Piola lived and worked. Piola shared the frustration of many Italians who had hoped for an independent kingdom of Italy, free from a foreign power that controlled everything and everyone. This control extended even to appointments to prestigious scientific academies. Piola himself, when welcomed into the Italian Society of Sciences in 1828, had to wait several years for the government to approve the appointment. Austrians also feared that the Italian Scientific Congresses were too nationalistic in nature. Piola, in his work on the 1844 Scientific Congress in Milan, complained that spies and informers were there and that all participants had to be careful and measure the words they uttered in public. Thus, even the seemingly innocuous world of men of science was closely monitored. (Filoni, 2006, p. 158)

Relatives of Piola were active in the unification of Italy. One of his relatives was Gabrio Casati, who headed the provisional government in Milan following the 1848 revolts. (Casati would later become famous for the law named after him that restructured the educational system in unified Italy.) A distant relative, Count Federico Confalonieri, had participated in the 1821 revolutions in Italy and was captured and sentenced to death. Family intervention got the sentence changed to life imprisonment and Confalonieri was later able to immigrate to America. One of Piola's own sons became one of the first Senators of the Kingdom of Italy.

Piola himself was not a revolutionary. He had seen the bloody effects of the French Revolution and the suppression of religious orders that the atheistic Napoleonic regime had brought to Italy. During the 1848 revolt in Milan, Piola avoided the violence but published two articles in which he sought the removal of special interests in view of a greater common good. The principle he laid down was that the "highest good" collectively would result from the addition of the "highest good" individually; it was therefore necessary for someone to make some sacrifices. Piola, with sensitivity worthy of a great diplomat - without specifically naming this or that political party - appealed to moderate Catholics and urged their opponents, the Republicans, to take a step back in the name of the common good.

His desire to learn all he could about science, his awareness of philosophical arguments about science and faith, and his willingness to entertain new ideas about developments in mathematics, all characterize Piola as a man open to learning and ideas. While not a direct supporter of the military actions of those fighting for a unified Italy, he did sympathize with the desire for an Italy free of foreign influence. He believed strongly in the agreement between science and faith and used his literary and analytical skills to refute ideas that promoted a mechanistic universe. Piola engaged with other mathematicians with different perspectives and religious beliefs; he participated in national scientific gatherings and contributed articles to the *Annali*, a national mathematical journal, one of whose editors was his former pupil Brioschi. One doesn't sense in Piola the fear and bigotry that Fergola and Flauti [ii] exemplified to those with whom they disagreed, especially in their later years.

Tortolini – Importance of a journal

While Italy struggled to obtain political unity, the scientific community was taking steps to bring about scientific unity in Italy. In addition to the scientific congresses, another aspect of this scientific unification was the realization that a specialized journal devoted solely to mathematics and the sciences was needed to disseminate the work of Italian mathematicians both in Italy and internationally. In the first half of the nineteenth century the journals available for Italian mathematicians to publish in were primarily those of local academies and had a broad audience. Their content ranged from literature and poetry to the various sciences. (Martini, 2003, pp. 175-176)

Some Italian mathematicians published their work in foreign journals. France had Liouville's *Journal de mathematiques pures et appliquees*, Germany had *Crelle's Journal* and England had the *Cambridge Mathematical Journal*. One of these Italian mathematicians who published in foreign journals was Barnabas Tortolini.

Barnabas Tortolini was born in Rome in 1808. He studied literature and philosophy and then went on to study mathematics. He took the technical course for engineers at the University of Rome before studying theology at the *Pontificio Seminario Romano*. In 1832 he became a priest. His academic career began in 1835 when he was appointed professor of mathematical physics at the *Collegio Urbano di Propaganda Fide* (devoted to worldwide Catholic missionary activity). In 1837 he became professor of

differential and integral calculus at the University of Rome, a position he would hold for over 30 years. In 1846 he took on the additional responsibility of becoming professor of mathematical physics at the *Pontificio Seminario Romano*. During his lifetime Tortolini published more than 100 mathematical memoirs in Italian, French and German journals. Prominent European mathematicians such as Cauchy, Catalan and Liouville mentioned his work in their writings. Tortolini was honored with membership in the most distinguished Italian societies. He was also renowned for his teaching. At a time when the Italian public school system was being criticized for the state of its scientific education, Tortolini stood out as exemplary. Vincenzo Diorio, in his paper on Tortolini's life and works, spoke of Tortolini's devotion to teaching to demonstrate, "how the state of scientific public education was anything but deplorable among us." (Martini, 2003, p. 179) Tortolini lived a life incorporating many different aspects of Italian life. He was a person of stature within the Catholic community, a noted academic and teacher, and a productive mathematician. He is best known, however, for his founding of the *Annali di scienze matematiche matematiche e fisiche* (Annals of Physical Science and Mathematics), the first Italian international scientific journal.

Tortolini's previous work with foreign journals prepared him well as editor of the *Annali*. He recognized the importance of the internationalization of mathematical results and he had made international contacts that would enable him to promote abroad the work of Italian mathematicians. His familiarity with foreign journals made him aware of the standards for international journals. All this helped him to recognize the need for a specialized journal published in Italy and devoted to mathematics and the physical sciences, where the work of Italians mathematicians could become known throughout Italy and abroad. As an international journal it would also provide another venue for European mathematicians to publish their works and for Italians to learn the latest mathematical developments in Europe. The first issue of the *Annali* was in 1850. While its earliest publications included a high portion of articles devoted to the sciences, gradually the journal took on a more mathematical flavor.

The *Annali* was started at a time when Italy saw the emergence of a new generation of talented mathematicians who could both contribute to and benefit from such a specialized journal. Some of its contributors included Giuseepe Battaglini (1826-1894), Giusto Bellavitis (1803-1880), Brioschi, Felice Casorati (1835-1890), Domenico Chelini (1802-1878), Cremona, Francesco Faa di Bruno (1825-1888), Riccardo Felici (1819-1902), Genocchi, Carlo Matteucci (1811-1868), Ottaviano Mossotti (1791-1863), Giovanni Novi (1827-1866), Piola and Placido Tardy (1816-1914). These were mathematicians from different political and religious persuasions but all interested in the promotion of Italian mathematics. The most prolific contributor was Brioschi, though Tortolini, Betti, and Genocchi also regularly contributed many articles.

Much of our knowledge about Tortolini's role as an editor comes from his correspondence with Betti who was a regular contributor to the journal. Tortolini exhibited an appreciation of the work of his contributors. He worked directly with his contributors, clarifying notation and content, wanting to make their work as clear as possible. Through his contacts with foreign editors and journals, he kept abreast of the

latest mathematical developments abroad and would pass these on to his contributors. (Martini, 2003, pp. 181-182) He also sought to promote the work of his authors. For example, when Betti submitted a high level memoir on the resolution of algebraic equations, Tortolini not only wrote to him and praised him for it but also sent reprints of Betti's memoir to other European mathematicians such as Bellavitis, Sylvester, De Morgan, Kummer, Borchardt, Dirichlet, Poinsot, Serret, Bertrand, Lame, Sturm, Hermite, Liouville, Cauchy and Gauss.

Toward the end of the 1850s things changed politically in Italy. Unification of all but a small portion of Italy (including the Papal States) was on the horizon. Betti, Brioschi and Genocchi were active politically and they wanted to parallel what was happening politically with a renewing and uniting of Italian mathematics. They felt that this could best happen by having an editorial board that would include mathematicians from various regions of the country (Tortolini, the sole editor of the *Annali*, was from Rome) and would be *solely* devoted to mathematics. They proposed reorganizing the *Annali*, changing its name to the *Annali di matematica pura ed applicata* and having a joint editorial board consisting of Brioschi (from the Kingdom of Lombardy), Genocchi (from Kingdom of Sardinia), Betti (from the Duchy of Tuscany) and Tortolini (from the Papal States). This would give the journal a national character. The journal would still be published in Rome. They envisioned the journal being on the order of *Crelle's Journal* in Germany.

To bring about this change, Brioschi first wrote not to Tortolini, the journal's editor, but rather to Genocchi and to Betti. When he had obtained their approval he wrote to Tortolini with his idea, also letting him know of Betti and Genocchi's support for a reorganization of the *Annali*. Tortolini wrote back to him and waited for a reply. Meanwhile, Tortolini wrote to Betti regarding the next issue of the *Annali* and in this letter you sense the quandary he faced. He knew the *Annali* needed some improvements in terms of scope and quality of articles as well as editing, and was prepared to make these. Yet at the same time he could see the advantages to Brioschi's proposal for a joint editorial board and restricting the *Annali* to mathematics. Excerpts from the letter are found in the following quote from Laura Martini's article on Tortolini.

> *'I have been waiting until today for either Prof. Brioschi's letter or Mr. Genocchi's; but I haven't seen any yet, therefore I have decided not to delay sending [January's number of the Annali] any longer.' Feeling that something was going to change for him and for his journal very soon, Tortolini thanked Betti (and all their common friends) for the contributions he had made to the Annali and, referring to Brioschi's proposal of redirecting the journal, he wrote: 'The [initiative] will certainly be directed to the improvement [of the journal], even though I am ignorant what it is about: and I will have to understand it before I decide. But I want to say something in advance, that I am already preparing an improvement for my Annali for the year 1858. There will not be any interruption in the publication and I'll make [each issue] longer. However, I look forward to the valuable observations of Brioschi,*

Genocchi, and yourself, and I'll take them into the consideration they deserve.' (Martini, 2003, p. 190)

The graciousness expressed in this letter was reflected in Tortolini's willing acceptance of Brioschi's proposal. Though he had founded the journal and had served faithfully and conscientiously as its editor, he was willing to give up his ownership if such action would better promote Italian mathematics.

In 1858 Brioschi, Betti and Casorati traveled to all the major mathematical centers in France and Germany, becoming acquainted with the latest research and establishing personal ties with prominent mathematicians in these places. They wanted Italy to take its place in the European mathematical community. That same year the new journal, *Annali di matematica pura e applicata*, appeared. The editors' vision for this journal was to facilitate the dissemination of new research throughout Europe. This would both enable the development of Italian mathematics and be a way of making Italian mathematicians' work known abroad. During its first few years the *Annali* was a big success. Its editors were the primary contributors but other Italian contributors included Cremona, Casorati, Mossotti and Tardy. The number of foreign contributors increased and included the English mathematicians Thomas Hirst and Cayley. Betti submitted a translation of Riemann's inaugural dissertation. However, by 1861 the *Annali* began to decline. Some of this may have been due to Betti's and Brioschi's preoccupation with their new roles in the unification government. In 1864 and 1865 Brioschi and Betti ceased publishing in the *Annali* and yet they continued to publish papers in other Italian journals. They were clearly disillusioned with the *Annali* and left it virtually in Tortolini's hands. (Martini, 2003, p. 192) But Tortolini was unable to fill the journal with solid new research articles. Then in 1867 Cremona, who worked with Brioschi in Milan, wrote to Betti on Brioschi's behalf. They proposed ending publication of the journal and beginning an entirely new journal. The letter states, "in Tortolini's hands….[it] is reduced to a shameful state." (Martini, 2003, p. 193) The new journal would have as its editors Brioschi and Cremona and be based no longer in the Papal States but in Milan. The Papal States were not part of the unified Italy until 1870. Lombardy, on the other hand, was the central player in the unification of Italy and publishing the journal from Milan (in Lombardy) reflected the political situation in Italy.

Again, only after Betti and Genocchi had given their approval to Brioschi's and Cremona's plan was Tortolini approached with the idea. He would no longer be an editor of the journal and it would no longer be published in the Papal States. The new journal would have more of an international dimension and would help establish Italy as a world player in the European mathematical community. We are told, "Tortolini once again graciously went along." (Martini, 2003, p. 193) Tortolini's influence over the content of the journal ebbed. Brioschi and Cremona did achieve their goal of publishing a world-class international journal which highlighted the work of Italian mathematicians. When Cremona moved to Rome in 1876 to run the newly opened School of Engineering. Brioschi served as primary editor of the journal with the assistance of Cremona, Betti, Beltrami and Casorati.

Tortolini continued to teach at the University of Rome until 1870, the year Rome was invaded and occupied by Italian troops. On the 20th of September 1870, after refusing to sign a loyalty oath to the King of Italy, Tortolini lost the chair of calculus. The year before he had become paralyzed. He was ultimately forced to retire from his various positions. He died in Rome on August 24, 1874. Brioschi and Cremona wrote a commemoration of Tortolini in 1875, noting that:

> *But Italy must be grateful to Tortolini particularly for having founded and published the Annali di scienze matematiche e fisiche (Roma, 1850-1857), and later, together with professors Betti, Brioschi, and Genocchi, the first series of the Annali di matematica pura ed applicata (Roma, 1858-1865). These periodicals, gathering and diffusing the works of the most productive and distinguished scholars of the exact sciences, served to meet two very noble ends: one, to revive and to make flourish a love for higher studies; the other, to represent with dignity, before other nations, the scientific activity of our peninsula, even when it was very far from having reached political unification. For this reason, the name of Tortolini will be honored for as long as the cult of science lasts.* (Martini, 2003, p. 180)

Perhaps there should be an addendum honoring Tortolini as a person who put the needs of his fellow mathematicians before his own interests, who sought to promote the work of others and of mathematics before his own ambitions and projects. He demonstrated selflessness and an ability to work with people from a variety of political, religious, and even national interests to promote the mathematical development of Italy. The concern and care he demonstrated as an editor and teacher was also exemplary.

Piola and Tortolini are but two examples of ways Christian mathematicians in the mid-nineteenth century Italy navigated the changing mathematical and political climate. They both demonstrated openness to other perspectives, an ability to work with a wide range of people, and humility of spirit. Their reaction to the changing political landscape within Italy was to promote what was good mathematically, to work with mathematicians from a wide range of political and religious persuasions, and to do so in a spirit of humility. All honored their names and memory and their impact was significant. This is in contrast to the memory of Fergola's and Flauti's school of geometry, which in Snapshot One we learned was all but forgotten (and willfully so, according to Trudi) until Loria's discovery of Chasles's reference to it. Perhaps there is a lesson for us here. How do we want to be remembered?

<u>Conclusions</u>

A love of mathematics, an interest in its advancement and a desire for Italian mathematicians to take their place in the European scientific community superseded both the ideological perspectives and the personal ambitions of Italian mathematicians during this period. Though the political landscape of Italy was changing there were not yet any external constraints that limited collaboration. The national mathematical identity that was developed during this period was the result of individual decisions to work together for a common purpose.

In the third and final article of this series, Snapshot Three: *Unification Brings Choices,* we look at the external constraints which developed in the decades before and after unification. Science was becoming the national secular religion, the temporal authority of the pope was coming to an end, and the doctrine of papal infallibility was being written. As the new Italian government and the papacy each set restrictions on participation in scientific and public endeavors, mathematicians found it harder to collaborate in the ways they had in just the decades prior to this period. Yet collaboration did occur and we will learn how some mathematicians were able to bridge this divide.

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[i] These Congresses were held annually in various regions of the country starting in 1839. They provided a venue for Italian scientists to come together, exchange ideas, and to meet with their foreign counterparts. (Martini, 2003, p. 174) They were a main contributor to developing a sense of scientific unity in pre-unification Italy. Piola was very active in the organizing committee for the 1844 meeting in Milan.)

[ii] To learn more about Fergola and Flauti see Snapshot One: Neapolitan Mathematics and the School of Fergola.

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