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## The time signal in Florence

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*Abstract:* I review a century of time signal in Florence, starting from the 1850s, when true solar time from the clock on the tower of *Palazzo Vecchio* was transmitted telegraphically to the railway stations of the Grand Duchy of Tuscany. At the onset of Italian Unification, midday was signaled to the city by means of a flag lowered on the *Torrino*, the tower of the old Astronomical Observatory of Florence. In the short period when Florence was the Italian Capital (1865-1871), the time signal from the *Torrino* served to regulate communication and transport services in the nation; after that, it continued as a city service only. At the end of the 19th century, the flag was substituted by the firing of the *votapentole* cannon from the *Belvedere* Fortress. From the Great War, the service began to be regulated by the astronomers of the newer Arcetri Observatory. Except for a brief interruption during the Second World War, the time signal continued until the early 1950s.

*Keywords:* time signal, solar time, midday, Florence.

### 1. Introduction

From the mid of the 14<sup>th</sup> century, a mechanical clock on the tower of *Palazzo Vecchio* marked the rhythm of urban activities in Florence.<sup>1</sup> As usual, the clock was regulated on true solar time, given by a sundial (Barbolini, Garofalo 2017) on the square below the tower, *Piazza della Signoria* (Fig. 1). After the adoption of the 12-hour clock in the Grand Duchy of Tuscany in 1750, the clock bell was set to strike 12 o'clock, midday, when the Sun passed at the meridian, the direction of the South.

However, the duration of a true solar day changes over the year, due to the Earth elliptical orbit around the Sun, and to the inclination of the rotation axis on the orbital plane. Instead, clocks had a uniform motion, and even more so as they were becoming more and more precise. Thus, they had to be frequently adjusted to keep up with the uneven pace of true solar time, with the risk of damaging the mechanisms or introducing errors in the regulation.

The easiest solution to the problem was to adopt mean solar time, with days being made of 24 equal hours all year along – the mean Sun being a mathematical formula coinciding with the true Sun only four times in a year. The first city that adopted mean time was Geneva in 1780 - not by chance, being a site of important watch-making

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<sup>1</sup> Apart from a few updates, this contribution abridges the research presented in Bianchi (2019), to which we refer for full details and references.

workshops. London followed in 1792, Berlin in 1810, Paris in 1812. The first city in Italy is said to be Naples, followed by Rome in 1847, and Turin and other towns in Piedmont in 1849.



**Fig. 1.** The clock on the Tower of *Palazzo Vecchio* (left) and the sundial in *Piazza della Signoria* in Florence (right).

Both true and mean time are local definitions, depending on the longitude. With the development of fast transportation and communication services spanning over a wide geographical area, it became necessary to adopt the time of a specific place along the service: in the UK, for example, most of the railway lines had adopted the Greenwich mean time by 1848 (Howse 1980).

## 2. The time of *Palazzo Vecchio*

By the beginning of the 1850s, Tuscany had a developed railway system, and a telegraph line along the path of the railway. The handbook for telegraph operators (Matteucci 1850) prescribed that each office clock had to be regulated weekly on the clock in the central office in *Palazzo Vecchio*, which presumably was regulated on that of the tower. However, there were frequent discrepancies between the telegraph (and railway) time and that of the civic clocks of towns hosting railway stations. As the curator of the clock of *Palazzo Vecchio* confessed to that of Lucca, “the clocks of the railway stations along the *Leopolda* line almost never agree with the Public Clock of Florence, and that of Leghorn very often differs by about 14<sup>m</sup> from the real time, [...] which is shameful (Verità 1851).

Such a difference could not have been due to the use of local time by civic clocks: the maximum longitude extent of the railways was of about 1 degree, accounting for a delay of just 4<sup>m</sup> in Leghorn with respect to Florence.

In 1858 a royal decree tried to fix the problem with a stricter regulation: the pendulum in *Palazzo Vecchio*'s telegraph office had to be regulated daily on the tower clock; the time had to be transmitted daily to other telegraph offices; private societies running the railway lines were compelled to use telegraph time (Giuntini 1991). Towns along railway lines were invited to use it for their public clocks. Still, *Palazzo Vecchio*'s clock was regulated on true solar time using the sundial of *Piazza della Signoria*, retraced on that occasion by the astronomers of Florence Observatory.



**Fig. 2.** The tower (*Torrino*) of the Florence Observatory (*Specola*) in Florence.

### 3. A flag for the mean time (1860-1899)

After the departure of the last Grand Duke, the Tuscan provisional government decided to switch to mean solar time “as used in Turin and in the most learned cities of Europe (Ridolfi 1860)”. The director of Florence Observatory, Giovan Battista Donati, wrote instructions on how to set clocks on mean time, which were published on the newspaper *Monitore Toscano* (Donati 1860) and sent to major municipalities in Tuscany. The switch became effective on 1860, December 24<sup>th</sup> (one of the four days in which true and mean time coincide). A signal was set on the tower of the Observatory (the *Torrino* of the *Specola*, Fig. 2): a national flag was raised 3<sup>m</sup> before, and dropped at 12 o'clock; at the same time *Palazzo Vecchio*'s clock rang.

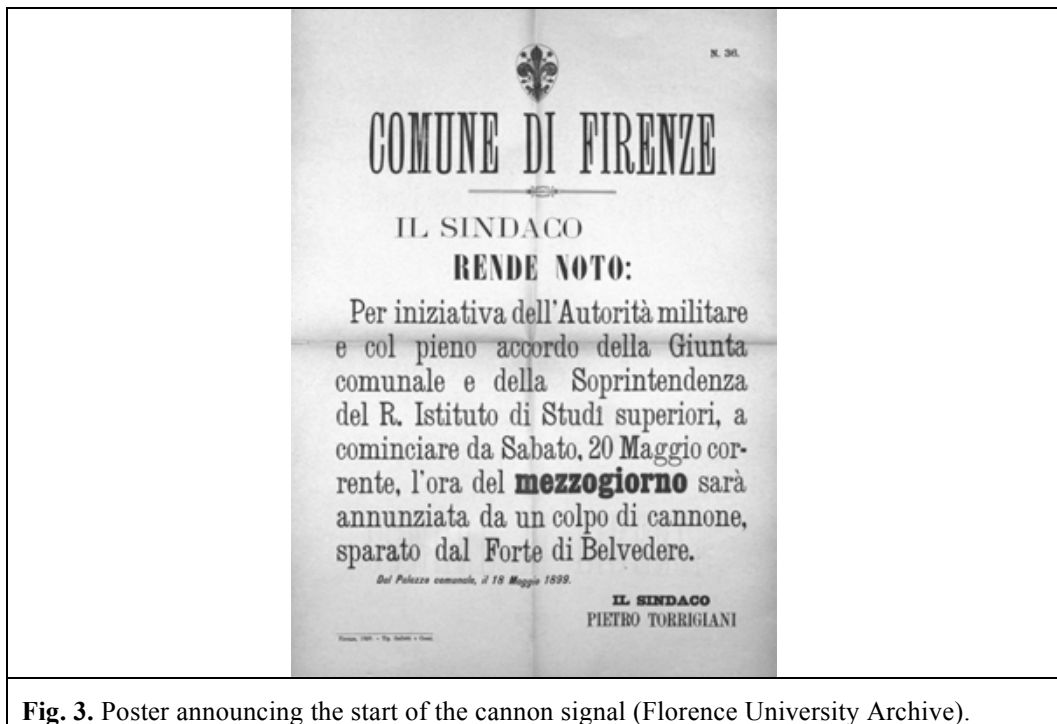
In the unified Kingdom of Italy, Florence mean time was used by the north sector of the railway line of the *Strade Ferrate Romane* (including the older grand-ducal lines of Tuscany) and, when the city became the capital in 1865, by the Italian telegraphs. For these services, time was transmitted from the *Specola* to the central office in *Palazzo Vecchio* via telegraph. From the end of 1866, a unique time standard was used for all the railway lines and other services in the Kingdom of Italy, Rome Mean Time (ahead of Florence time by about 5<sup>m</sup>). While several cities adopted the railway time soon after, Florence kept its own local time until 1878.

In the first decade of the time signaling from the *Specola*, the time was measured by observing the transit of the stars with a passage instrument. At the end of the 1860s, however, the old astronomical observatory was dismantled and all instrumentation was moved to the newer observatory in Arcetri. The time signal remained nevertheless at the *Specola*, reduced to a meteorological observatory. Time measurements were conducted by observing the passage of the Sun on a meridian line. The flag continued to signal midday to the tower of *Palazzo Vecchio* (for the sole service of the city, after the transfer of the capital to Rome in 1871), using Rome mean time from 1878, and Central European time (about 10<sup>m</sup> ahead of Rome time) from its adoption in Italy in 1893.

### 3. The *votapentole* (1899-1935)

On an initiative of military authorities, from May 1899 midday was announced by firing a cannon blank, from the Fortress *Belvedere* above the *Specola* (Fig. 3). A hand-controlled electric signal from the *Specola* commanded a bell next to the cannon, which rang at 1<sup>m</sup>, then at 30<sup>s</sup> before 12. At the third ring, at 12 o'clock, the cannon was fired and *Palazzo Vecchio*'s clock struck. With the cannon, the flag signal ceased. There were a few initial problems: the smoke and ejecta caused complaints from the neighborhood of the Fortress; also, after the fall of S. Marco bell tower in Venice in 1902, it was feared that the shock wave from the cannon could damage the tower of *Palazzo Vecchio*, but a detailed investigation found that the induced vibrations were uninfluential (Alfani 1904). The cannon continued its service and came to be known as *votapentole* (empty the pots!), a term jokingly indicating midday.

At the onset of the cannon signaling, the director of the Arcetri observatory, Antonio Abetti, offered to provide the exact time to the *Specola*. Later in 1912, Antonino Lo Surdo, director of the *Specola* meteorological and geophysical observatory, commented that "in Arcetri, time is determined with an exactness of 0.01s (Lo Surdo 1912)". Thus, it is likely that the reference time measurements came from the Arcetri Observatory, even if transferred to the Fortress through the *Specola*. During the Great War, Lo Surdo was called for military service and Abetti substituted him in directing the time signal. In that period, an artillery soldier in the Fortress received every day a direct telephone call from Arcetri at 11:00, during which a clock next to the cannon was set on exact time. This way, there was no hastiness when the same soldier had to fire the cannon at 12 o'clock. Abetti estimated an uncertainty of 1<sup>s</sup> in the time signaling, after taking into account the delay due to the sound speed.



**Fig. 3.** Poster announcing the start of the cannon signal (Florence University Archive).

The article by Lo Surdo (1912) was a polemic answer to the emphasis given by the press to the experiments carried on by Father Guido Alfani, director of the Ximeniano Observatory of the Piarists in Florence city center. Alfani set up the first Italian radiotelegraphic station to receive the time and meteorological signal of the Paris Observatory, broadcasted from the Eiffel Tower from 1910. A master pendulum at the Ximeniano was synchronized electrically with other clocks in the Observatory, including one at its entrance, intended to be for public use (Alfani 1928).

From 1933 Giorgio Abetti, son of Antonio and director of Arcetri from 1921, became director of the geophysical observatory of the *Specola*. According to Abetti junior “the system used today to transmit the signal to the soldier who fires the cannon is the most antiquated one can imagine with respect to modern methods (Abetti 1935)”. Despite projects for a new method, the time transmission continued in the usual way, with a voice communication over a telephone line.

#### 4. The last years of Florence time signal

From 1936 the midday was announced by the sound of anti-aircraft alarms. After the usual communication from the *Specola*, the main switch at *Belvedere* activated all city sirens from half a minute before midday till 12 o'clock. The signal continued until the harsher days of the Second World War in mid 1944. In the same period, the Arcetri Observatory provided the exact time to the public service broadcaster EIAR: the original supplier, the Brera Observatory in Milan, had been bombed in 1943.

The time signal with the *votapentole* cannon was restored on 1949, Nov. 4<sup>th</sup>. It did not last long, though. The *Specola* observatory was suppressed at the end of 1952. Abetti proposed to renew the service and transfer it to Arcetri, to no avail. The service employees signed their last timesheets at the *Specola* in May 1953. Probably the signal stopped shortly after, though it has not been possible to find the exact date of its end. The service could not have gone beyond the beginning of 1956, when the last soldiers, which could possibly fire the cannon, left the Fortress *Belvedere*, finally ceded by the Ministry of Defence of the Italian Republic to the Municipality of Florence.

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