# THE RAFFAELE BENDANDI FORECASTINGS INSPIRED BY THE GREAT EARTHQUAKE

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Raffaele Bendandi was born in Faenza,Italy on October 17, 1893. His family was one of modest wealth, which is why he attended elementary school up until only the fifth year. Later, he enrolled in a technical drawing specialization course since he was attracted to the mysteries of both astronomy and earthquakes. The great interest that ignited within Bendandi following the total eclipse of the sun on August 30, 1905 spurred him to pursue independent study on celestial phenomena and later influenced his decision to become an ornament woodcarver, which permitted him more time to devote to his studies.

**Figura 1** R. Bendandi in a foto of 1924.

News of the earthquake arrived to Faenza on the evening of December 28, 1908 and Raffaele Bendandi remained deeply affected by this terrible catastrophe which had hit the cities of Messina and Reggio Calabria Italy. From that moment onward his studies of earthquakes initiated. Guided astronomical knowledge, he adopted as a principle of studying the tide phenomenon, while the expert skills obtained in building precision mechanisms during a period as a watchmaker, enabled him to build a seismograph that was eventually sold worldwide. He became a member of the Italian Seismological Society in 1920. On October 27, 1914 he made his first attempt in predicting an earthquake for January 13 of the next year. This prevision was noted by Bendandi in one of his notebooks. When, in fact there was a seismic event on January 13 in Avezzano city this gave him further impetus to continue his studies. Bendandi went on to analyze more than 20,000 past earthquakes. On December 20, 1923 he made his first officially registered forecast by way of a notary act. [Bendandi 1924].

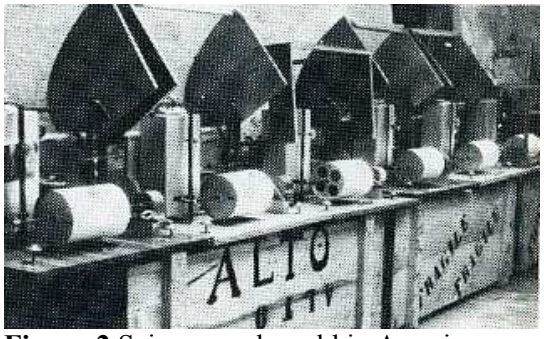


**Figura 2** Seismographs sold in America.

The realisation of many predictions made Raffaele Bendandi known throughout the world. Today, however, the name of this "Genius Italico" is no longer heard and his forecasting methods still remain mysterious. However, those who have had the opportunity to read and examine his many

forecasts must carry out a scientific study on these forecasts, before expressing an opinion on their value.

This work here has summarized the features for the first time, thanks to the collaboration of many Italian libraries, of the forecasts by Raffaele Bendandi. The importance of this catalogue is twofold: first, it brings together one of the fruits of the studies inspired by the terrible catastrophe of 1908 and second, it allow us to scientifically evaluate Bendandi's previsions.

**Data source**

Raffaele Bendandi published his forecasts mainly in Italian and foreign newspapers. This business, along with the income as a scientific adviser, were the primary financial sources throughout much of his life, thereby allowing him to pursue independent research. Part of the forecasts was published in weekly and monthly magazines, another small part was found in the news agency and in his notebook, while another part was found from radio broadcast scripts. Newspapers that published his articles included; PROGRESS ITALO AMERICANO, which had exclusive publishing rights in the 1920's and THE GLOBE, which had exclusive publishing rights in the 1960's. Additionally, Bendandi had close contacts with other newspapers. Firstly with "IL PICCOLO" of Trieste and later "IL RESTO DEL CARLINO", and "LA NAZIONE". More than twenty foreign newspapers published Bendandi's predictions, of which included: THE HAMILTON SPECTATOR, DAILY NEW, THE SPRINGFIELD, LOS ANGELES, LA PRENSA, LE MATIN, ALKRON THE PRESS, THE NEW YORK SUN, THE DIARY OF COSTA RICA , THE CHICAGO TRIBUNE and more.

Some documents were obtained from Bendandi's "Observatory House" at 17 Manara Street in Faenza, Italy while the remaining part was procured from Italian libraries. When newspapers were not found in the Observatory House the dates of the newspapers were recorded to carry out a further research. The total number of forecasts proved to be significant and equal to 103, of these 61 specifically concerned Italy.

**Forecasts**

The catalogue of earthquake forecasts by Raffaele Bendandi covers a period running from October 1914 to April 1977 [Fidani 2004] and includes, 143 events located in the Mediterranean region and 167 in the rest of the world. The seismic events listed are not distributed evenly over the 63 years. Between 1924 and 1927 forecasts are denser at monthly, weekly and fortnightly rates. Some weeks have more than one forecast, thanks to Bendandi's relationship with various publications which helped him update his forecasts.

The number of forecasts gradually declined until the end of 1927 and in early 1928 they completely disappeared when the Italian regime prohibited Bendandi to make further predictions. The motivation for this decision was "not damage Italian tourim", and also to prevent emigration. We have found some rare forecasts in the years 1939/40. From the beginning of 1950 to 1964 a consistent forecasting resumed. Furthermore, some forecasts were published in the years 1971 to 1977. As you can see from a comparison between the number of forecasts and the number of events, every prediction is characterized by several expected earthquakes. The number of events for each forecast results extremely variable - from a minimum of one to a maximum of 13. The events of each prediction include dates and locations, as well; the spatial and temporal intervals covered are highly variable. Generally speaking, forecasts up to the 1940's are more detailed and richer in events, than those coming later.

During the first forecasting period, Bendandi's articles dealt very precisely with the problem of indicating the time, location and intensity of the expected events. The timing of events is identified with a very high precision: within a day in most cases and within a few hours in other cases. To define the intensity of the shock, words such as

"mild", "moderate", "minor", "strong", "violent", "violent" and "parossisma" were used and in some cases the grades of the Mercalli scale were referred to. Bendandi explicitly stated that he was not yet able to determine with precision the location. An error in this forecast is estimated at several hundred km and rarely less than 100 km.

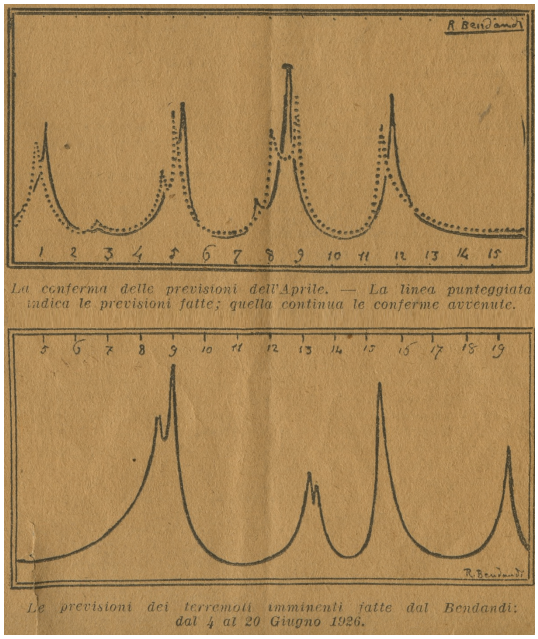


**Figura 3** Graphs of the forecast of April 1926 (dots) and their confirmations, top, and the forecast of June 1926 down..

As already mentioned, the accuracy of Bendandi's time forecasts proved to be remarkable. To demonstrate this, the two forecast charts of June 6, 1926 are appropriate [Bendandi, 1926] Figure 3. At that time forecasts were generally divided into two parts: the first was dedicated to the confirmation of his previous forecasts, with extensive discussions on the history of epicentres affected by strong earthquakes, while the second focused on the forecasting of future seismic events. Figure 3 evidences in the top part of the chart the forecasts made on April 4, 1926 [Bendandi 1926b] which is evidenced by dots. The continuous line from the same graph chart indicates the confirmations that were received from reports by various observatories. The shocks that Bendandi considered were those of highest intensity, capable of swinging the nibs of the most sensitive seismographs for several hours. In this type of graph he always referred the height of the curve as crust stress index which varied continuously, while the earthquakes occurred mostly near the peaks.

**Prediction method**

The estimates made by Bendandi evolve not only in range and accuracy for the events expected, but also for the scientific model in which they are included. Before World War II, in the context of the gravitational influence, estimates were accurate and detailed in place, time and intensity. From the 1950's onward, in the broadened context of solar influence, these estimates became limited in number, imprecise and part of a more general forecast. This change reflects the evolution in thinking of Bendandi which was stimulated by his ongoing scientific studies which sought to call into question existing ideas.

Bendandi never revealed his prediction method; however, he did not fail to recall that the principle on which he based his findings was the tides. Additionally, he repeatedly stressed that earthquakes are events that affect the entire globe. According to Bendandi, it was this lack of a global vision regarding the event that prevented others from successfully forecasting. Why he did not reveal the prediction method was due to the difficulty Bendandi had in identifying the location of events. As stated in several newspapers, those who had studied should have been able to solve this problem and would have quickly usurped his method. To reassert his paternity of the principle formulated in his forecasts, Bendandi wrote the first book devoted to solving the problem of the solar cycle [Bendandi 1931], noting that this principle needed to be universal, as it applied to both solar activity as well as earthquakes. In a second book on the same principle applied to solving the problem of variable stars [Bendandi 2006], he highlighted the universality of the principle. After the 1930's, radio equipment and radio-telegraphs [Fidani 2006] permitted Bendandi

to make observations on the electrical and magnetic phenomena produced by solar and terrestrial activity [Fidani 2005].

**Figura 4** Bendandi in his studio to work with parallelograms in the 1970's.

## Conclusions

Bendandi's studies were a consequence of the terrible catastrophe of 1908, but have never been neither tested nor further investigated. Being so, a collection of Bendandi's forecasts has been compiled. A comparison of the catalogue with that of recorded seismic events would be an ulterior step in statistically verifying their values. However, the methods developed in recent years for validating seismic forecasts [Console 2001 Zechar and Jordan 2008] would require a complete catalogue of all earthquakes.

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