

Images of ancient Calabrian-Sicilian earthquakes from a stereoscopic viewer of the early 20th century. The ethics behind a natural disaster photo-gallery

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Abstract

This research was inspired by an old stereoscopic viewer from the early 1900s, containing 42 glass slides depicting scenes from two Italian earthquakes that struck Southern Calabria and Eastern Sicily in the years 1894 and 1905, causing hundreds of deaths, but whose memory was blurred by the subsequent, great earthquake of the Messina Straits of December 28, 1908. The sequence of three-dimensional images shown by the viewer gave a deep and realistic visual impact to scenes of collapses, debris, and victims, arousing feelings of dismay. In this work, we describe the viewer apparatus; the places depicted in the stereoscopic plates, and the seismic phenomena that caused the disasters. But above all, we investigate the social and cultural aims that pushed to show the effects of local earthquakes through this kind of primitive multimedia mechanism. We exclude that the viewer, with its photographic equipment, was merely an instrument of entertainment. We rather assume that it carried out an educational task. The repetition of the sequence of tragic images of earthquakes through the stereoscopic viewer had the purpose of contributing to give awareness of the looming seismic risk and to accept rationally those recurring disasters.

Keywords: Stereoscopic Viewer; Calabrian-Sicilian Earthquakes; Observational Seismology; Seismic-Risk; Geo-Education.

1. Introduction

A stereoscopic viewer from the early 1900s, equipped with 42 transparencies on glass plates, shows the images of two earthquakes in Southern Calabria and Eastern Sicily, that can be considered forgotten by the general public. We refer to the earthquakes that occurred in the years 1894 and 1905, destroying some small towns and causing hundreds of deaths, but whose memory was overshadowed by the subsequent great earthquake of the Strait of Messina, on 28th December 1908 (about 80,000 deaths).

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The stereoscopic viewer was a wedding gift for a couple of young spouses of the Messinese bourgeoisie, who got married in 1904, and it was placed on a table in the living room where the newlyweds used to gather friends. It was a *taxiphote* model, a crafted but faithful copy of a French variant of stereoscopic viewers in vogue at the time of the *Belle Epoque* (Figure 1, 2).



Figure 1. The stereoscopic viewer.

The . . . **TAXIPHOTE.**

An Ideal Apparatus for Viewing, Classifying, and Projecting Stereoscopic Views.

See the Models at
Jules RICHARD,
23a, Albemarle Street,
Piccadilly,
London, W.

CATALOGUE FREE ON APPLICATION.

Figure 2. Advertising of the taxiphotes Richard of the late 1800s.

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The instrument consisted of a wooden box equipped with two eyepieces in front of which it was possible to position photographic transparencies realized in such a way to give a three-dimensional view of the scenery. It was a sort of augmented reality *ante litteram*. The sequence of three-dimensional scenes of collapses, debris, and victims (Figure 3a, b, c, d), aroused feelings of dismay. Nevertheless, the show had the hypnotic “charm” of the disasters and could be replicated at will with a few turns of a dial.



Figure 3. Some examples of earthquake images taken from the stereoscopic viewer slide set: a) Collapsed buildings in the Calabrian village of Sinopoli (1894 earthquake); b) interior of a semi-destroyed house in the Sicilian city of Messina (1894 earthquake); c) survivors in front of their semi-destroyed homes in the Calabrian village of Zammarò (1905 earthquake); d) total collapse of the roof in the Mother Church of Parghelia, Calabria (1905 earthquake).

In this work, we describe the stereoscopic viewer, the places depicted in the stereoscopic plates, and the seismic phenomena that caused the disasters exhibited. But above all, we investigate the social and cultural aims that prompted to show the effects of earthquakes through this primitive multimedia mechanism.

We wonder if the *taxiphote*, with its photographic equipment, was only an instrument of entertainment *pour épater les bourgeois*¹, or rather if it carried out an informative task, to spread the knowledge of the recurrent seismic crises which Calabria and Sicily are prone.

We highlight that contemporary Central European literature offers us the opportunity to compare the educational purpose of the stereoscopic viewer with that of earthquake fiction in an amusement park.

¹ Literally: “to amaze the middle class”. This phrase became commonly used in France in the 19th century. At first it indicated the purpose of the artistic European avant-garde; then it was used in a broad sense.

2. The stereoscopic viewers

2.1 The taxiphote model

The *taxiphote* consists of a wooden box in the shape of a rectangular parallelepiped (Figure 1, 2). In the upper part of the box, there is a pair of biconvex eyepieces with a focusing device, similar to opera glasses. They have the function of providing an enlarged view of the images placed at the focal distance. Inside the box, there is a rack that can be loaded with a few dozen transparencies on a glass plate. A rotating mechanism controlled by a knob allows to position each transparency in front of the eyepieces. On the side of the box opposite the eyepieces, there is a small window that allows the illumination of the transparency through a light source.

The *taxiphote* represented a more evolved version of the stereoscopic viewers invented by the physicists Charles Wheatston and David Brewster in the first half of the 1800s and then perfected by many other inventors [Besso, 1879]. The first models of stereoscopic viewers worked with photographic prints on cardboard, that had to be loaded individually, one at a time (Figure 4 a and b). In the *taxiphote* the revolving rack made it possible to observe, one after the other, dozens of slides without removing the eyes from the eyepieces (Figure 4 c).

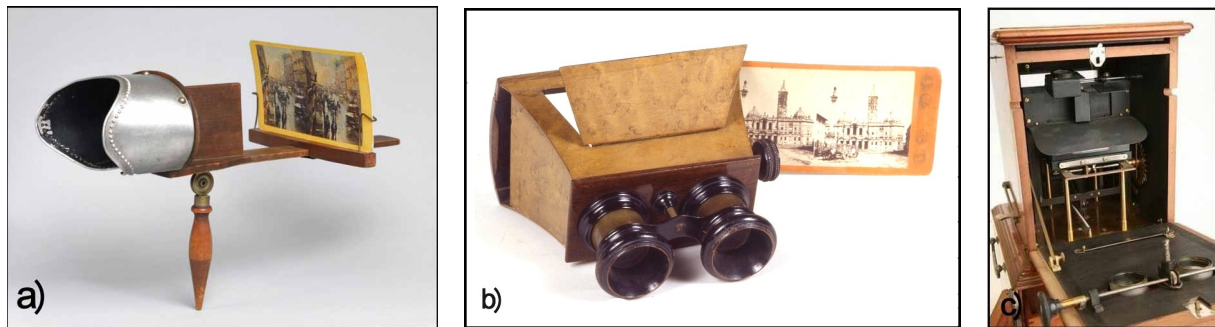


Figure 4. a) Holmes portable stereoscopic viewer for images on cardboard support, of the early 1900s; b) Brewster type stereoscopic viewer for images on cardboard support, of the second half 19th century; c) slide holder mechanism for images on glass plates, inside a *taxiphote* viewer built by the Richard company in the early 1900s.

Each transparency reproduces a couple of images of the same subject taken from two slightly different points of view, equivalent to the shift of perspective that we can perceive when we look at an object, alternating the vision with only one eye at a time (parallax effect). The observation of a couple of images through the eyepieces of the *taxiphote* creates a single virtual image that gives the observer the feeling of three-dimensionality [Ganot, 1887] (Figure 5).

To make a stereoscopic plate it was necessary to use a camera with two lenses, separated by a space equivalent to the average interpupillary distance of human eyes: about 6 cm (Figure 6). The use of the interpupillary distance similar to that of the eyes renders the stereoscopic effect well for subjects at distances of a few meters. The more distant the subject, the smaller the differences between the left and right images, the less the stereo effect (objects a few kilometers away, such as mountains, coastlines, etc., naturally appear less three-dimensional). The closer the object is, the more exasperated the three-dimensional effect will be. In certain photographic shooting situations, interpupillary distances other than 6 cm are used. For example, in aerial shots, the distance between the two images will be hundreds of meters, returning what in jargon is called the “giant’s view” similar to what one would have when observing a scale model from above. As shown by Wright [1924], the 6 cm interpupillary distance is suitable for distances up to 5-20m.

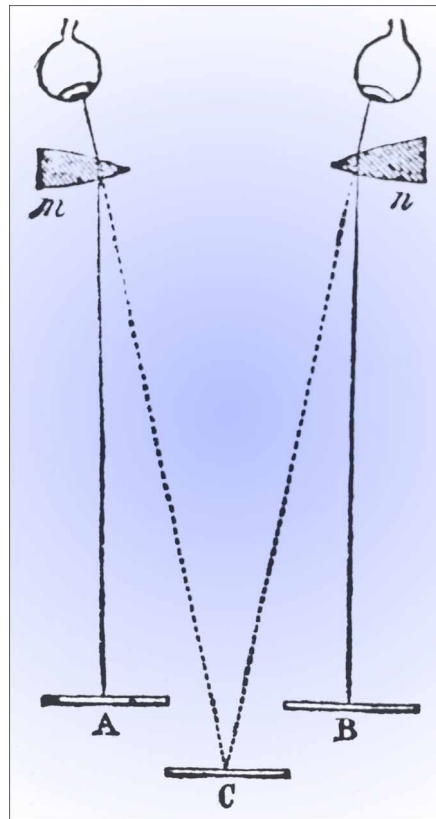


Figure 5. Functional diagram of the stereoscopic viewer, from a French treatise of elementary physics of the late 1800s, edited in various languages [Ganot, 1887]. The stereoscope viewer has two positive curvature (magnifying) lenses m and n , as oculars. The pair of images A and B are inserted at the focus of the lenses. The two figures A and B represent two perspectives of the same object, with a deviation equal to the perspectives that the sight naturally receives with the right and the left eye. The focus point of the image is changed by the lenses from its short distance (about 30 cm) to a virtual distance at infinity. The observer thus could see a new tridimensional image C resulting from the juxtaposition of the images A and B .



Figure 6. Double lens camera for stereoscopic photographs, Reygondaud model, 1890.

2.2 Use of the stereoscope in seismology

The invention of the stereoscope was widely used in the field of entertainment, accompanying and enhancing the development of photography. But the applications in various scientific and didactic sectors were also remarkable [Brewster, 1856; Persico, 1932].

In the field of geology, and in particular, in macroseismic studies, the English engineer and seismologist Robert Mallet was the first to use the stereoscopic photographs. After the disastrous earthquake in Basilicata on December 16, 1857, Robert Mallet, during a long stay in Italy, instructed a professional photographer to make hundreds of images, many of them stereoscopic [Mallet, 1862; Ferrari, 2017], (Figure 7). With the help of these reproductions, Mallet developed and became a pioneer in the studies of “observational seismology”, a discipline of which he was the founder [Ferrari and McConnell, 2005].

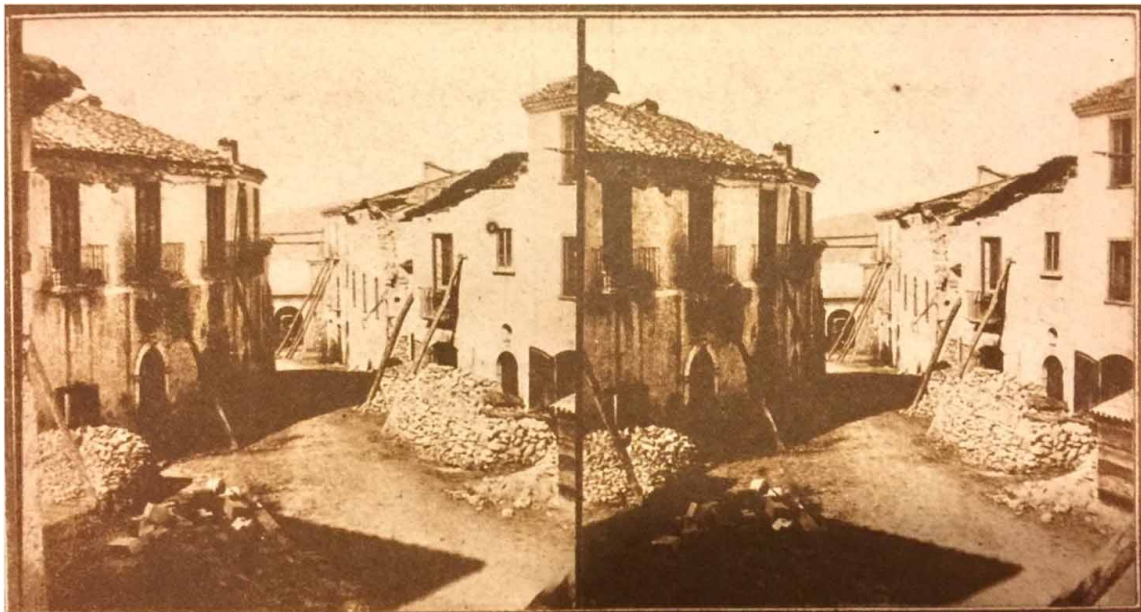


Figure 7. Damage to the city of Potenza due to the earthquake of 16 December 1857, in a stereoscopic photo "attached to the manuscript" of Robert Mallet, the English pioneer of observational seismology studies [Mallet, 1862; Ferrari, 2017].

In 1987 the Istituto Nazionale di Geofisica e Vulcanologia (INGV) and Storia Geofisica e Ambiente (SGA) published the four-volume anastatic reprint of Mallet's original work [Mallet, 1862; Guidoboni and Ferrari, 1987]. Subsequently, INGV and SGA edited the Italian edition of the same work [Mallet, 1862; Ferrari, 2004-2009] in two volumes edited by Graziano Ferrari. Both works have the advantage of re-proposing the entire collection of 156 images, 120 of which stereoscopic, that illustrate the effects of the 1857 earthquake in Basilicata.

3. Seismic sceneries

3.1 Calabrian-Sicilian earthquakes between the 1800s and 1900s

Between the last decade of the 1800s and the first of the 1900s, Southern Calabria and North-Eastern Sicily (Figure 8) were hit by four devastating earthquakes (Table 1).

The first three earthquakes, which occurred in the years 1894, 1905, and 1907, caused 100, 557 and 167 deaths respectively. The fourth most destructive and famous earthquake of the Messina Straits occurred on 28th December 1908, caused about 80,000 deaths, of which about 65,000 in the area of Messina (the exact figures have never been

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determined). This earthquake was followed by a tsunami and, from a historical perspective, had the effect of relegating to the background the importance of other previous destructive earthquakes [Bertolaso 2008; Castanetto and Sebastiano 2007; Guidoboni and Valensise 2013; Rovida et al., 2016].

Date (yyyy/mm/dd)	Zone	Epicentral Intensity	Macroseismic Equivalent Magnitude	Fatalities
1894/11/16	Southern Calabria (Palmi)	IX	6.1	100
1905/09/08	Southern Calabria	X	6.7	557
1907/10/23	Southern Calabria (Canolo)	VIII-IX	6	167
1908/12/28	Messina Straits	XI	7	80000

Table 1. Sicilian-Calabrian earthquakes between 1894 and 1908 (data from Guidoboni et al. [2019]).



Figure 8. Calabria and Eastern Sicily were the two regions of the Italian peninsula repeatedly affected by major earthquakes between the end of the 1800s and the beginning of the 1900s. Messina and Reggio Calabria were the two most affected towns by the earthquake and tsunami of December 28th, 1908.

3.2 The transparencies-collection and its purpose

Most of the 42 stereoscopic transparencies (uploaded on the INGV website at http://www.haisentitoilterremoto.it/14_calabria-1894-1905.html) document damages caused to some small towns and villages of Southern Calabria and North-Eastern Sicily by the earthquakes of 1894 and 1905. Only a few transparencies concern two other natural disasters of those years: the Etna eruption of 1892 and the Galati storm of 1906.

Each transparency, in the 8 x 16 cm format, consists of a double black and white positive image fixed on a support made of glass, in addition to a brief handwritten caption with the place, date, and sometimes other information. Based on the subjects depicted, the transparencies can be divided into three main groups:

- a) The largest group refers to the earthquake of 16th November 1894, which destroyed dozens of small villages in Calabria and Sicily and of which the seismologist Mario Baratta wrote a specific work [Baratta, 1895]. The transparencies of this group mostly illustrate the devastation suffered by towns and villages in Calabria, in particular: Bagnara, Seminara, Sinopoli, S. Eufemia, S. Procopio, Palmi. An image of Bagnara, which shows the crowd assembled in front of the royal office for the distribution of basic necessities to the earthquake victims, is remarkable (Figure 9). The only Sicilian town in this group of images is Messina. The related transparencies show the damage caused by the earthquake inside a private house (Verardo house).



Figure 9. Bagnara, Calabria. This slide shows the population, who survived the earthquake of 16th November 1894, crowding in front of the royal office for the distribution of food.

- b) Another large group of transparencies is related to the earthquake of 8th September 1905. Also, in this case, damages caused to some Calabria villages (Parghelia, Stefanoconi, Piscopio, and Zammarò) are documented.
- c) A third, smaller group of transparencies documents disasters other than earthquakes. Two slides refer to the great eruption of Etna in 1892 which occurred on the southern side of the Montagnola, at an altitude of 1900 meters, giving rise to the Silvestri Mountains. Two other slides illustrate the destruction caused in February 1906 by a violent storm that struck the town of Galati (on the eastern coast of Sicily, just south of Messina).

In the slides-collection of the *taxiphote*, there are no images relating to either the earthquake that occurred on 23rd October 1907 and the great earthquake of Messina in 1908.

The quality of the slides and the glass support allows us to state that they were not produced serially by a specialized company, but rather handcrafted, as for the stereoscopic viewer itself. Even the captions of the images, handwritten with rather uncertain writing, denote craftsmanship.

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As previously written in the introduction, we exclude that the use of the stereoscopic viewer was limited to entertainment. We put forward the hypothesis that the re-proposal of 3D images of past earthquake damages contributed to avoiding the process of removing those disasters from the collective memory, encouraging the adoption of seismic prevention actions. Certainly, at that time, the lesson from the past could be learned only by an *élite*, that is the wealthy and culturally updated social class. Based on testimonies collected by the heir of the owner of the stereoscopic viewer (Maria Ada Muscolino Basile, personal communication), we know that he practiced the profession of a land surveyor, developing also projects for the construction of rural houses. Moreover, he was the first in his village (Scaletta Zanclea, near Messina) to build a house for his family by using reinforced concrete, in the early 1900s. Therefore, it is plausible that the stereoscopic viewer had informative and educational purposes, addressed to a vast group of relatives, friends, occasional acquaintances, and perhaps customers.

3.3 Macroseismic effects of 1894 & 1905 earthquakes

The images of the effects give a more complete view of the earthquakes, thus representing a useful complement to the written descriptions. The use of these images can be helpful, to confirm and refine the macroseismic intensities assessed in the places where they were taken. All available information should be used to estimate the intensity of past earthquakes.

Here we show some examples of damage descriptions in the locations corresponding to stereoscopic images (source CFTI5Med, Guidoboni et al. [2019]).

In Figure 10, we show the CFTI5Med macroseismic field [Guidoboni et al., 2019] of the 16th November 1894 earthquake, M 6.1, maximum intensity MCS IX. The earthquake had destructive effects in an area of 80 km² and a total of more than 4,000 buildings collapsed. The stereographic images come from the villages of Seminara (Figure 10a) and the town of Messina (Figure 10b). Damages reported in CFTI5Med [Guidoboni et al., 2019] well correspond to the pictures. Seminara, MCS VIII: the earthquake caused serious damage, 31 houses collapsed completely; Messina, MCS VII: the shock caused damage to buildings, 35% of the houses were badly damaged.

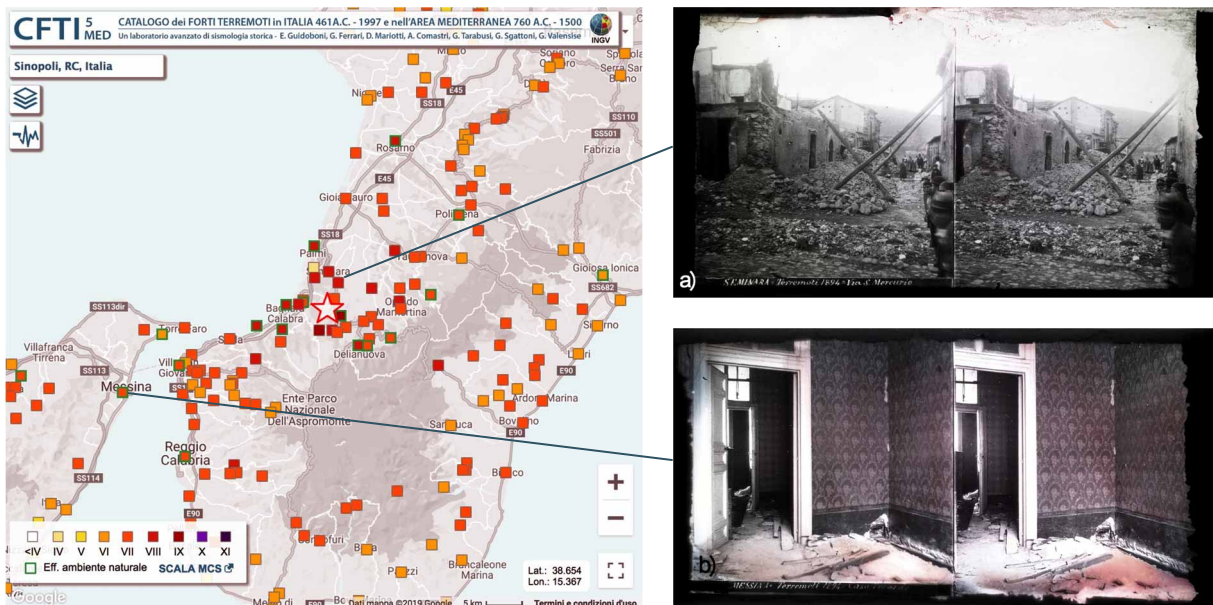


Figure 10. Map of the Calabrian and Sicilian area hit by the 16th November 1894 earthquake. The star indicates the epicenter of the earthquake (after Guidoboni et al., 2019). Two stereographic images of damages at a: Seminara; b: Messina.

In Figure 11, we show two examples for the 8th September 1905 earthquake, M 6.7, maximum intensity MCS X. The shaking was felt all over Southern Italy and a total of more than 8,000 buildings collapsed. The stereographic images come from the villages of Parghelia (Figure. 11a) and Zammarò (Figure 11b). The corresponding descriptions are exemplifying: Parghelia, MCS X - The earthquake caused the almost total destruction of the village. Zammarò, MCS X - All the houses were almost completely destroyed.

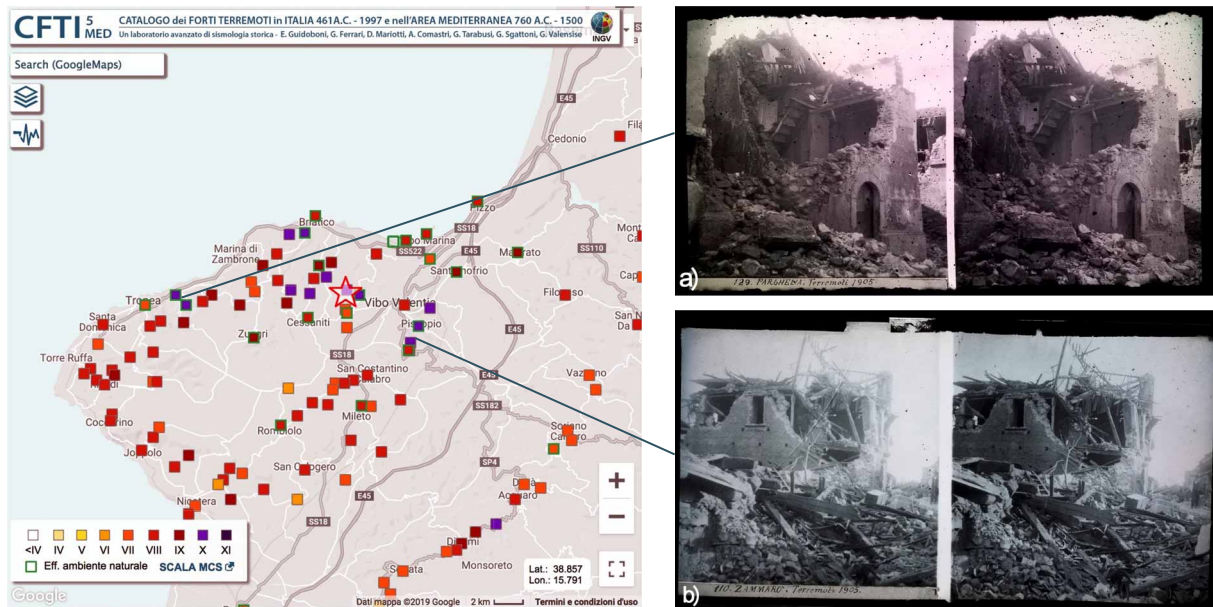


Figure 11. Map of the Calabrian area hit by the 8th September 1905 earthquake. The star indicates the epicenter of the earthquake (after Guidoboni et al., 2019). Two stereographic images of damages at a: Parghelia; b: Zammarò.

4. Ethics and pedagogy of a photo-gallery of disasters triggered by natural phenomena

4.1 Devastating earthquakes: a matter of fate or improvidence?

More than a century after the realization of the viewer and the stereoscopic images that are the object of our study, we wonder if we should limit ourselves to interpret their use only as a pastime, good to animate some hours with friends in the living room or to attribute other purposes to this apparent social *divertissement*. Before formulating some answers, it is necessary to go back much further in time and to mention the cultural impact that the great Calabrian earthquake of 1783 had in Italy.

On 5th February 1783, the territories bordering the Strait were struck by what is now considered the maximum earthquake recorded in the most recent history of Italy, whose epicenter has been localized south of Polistena in the province of Reggio Calabria and magnitude estimated at 7.1 Richter [Rovida et al., 2016]. Dozens of villages were completely razed to the ground and the two major cities of Calabria and Sicily, respectively Reggio Calabria and Messina, suffered serious damages. The estimated number of deaths is around 50,000 people. The first shock was the beginning of a sequence that lasted for weeks, with many destructive aftershocks and epicenters that migrated from Southern Calabria to Eastern Sicily and vice versa, each time aggravating the death toll and damages [Bertolaso, 2008].

The concepts expressed by the Enlightenment philosopher Jean Jacques Rousseau in 1755, at the time of the catastrophic Lisbon earthquake, were then repeated. We can summarize those concepts in a simple question: is it useless to ask whether the earthquake is the sign of divine punishment (in the 1700s century many people thought it so) when it is evident that man had concentrated vulnerable dwellings in areas naturally exposed to seismic

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phenomena? [Tagliapietra, 2004]. The debate on what we call today seismic risk prevention had timidly begun but, except for some warnings in the new building regulations of the time, which suggested wooden reinforcement structures and adequate foundations, it made no substantial changes in the reconstruction criteria of the cities so severely struck.

Just over a century later, between the end of the 1800s and the early 1900s, when the same areas near the Messina Strait were repeatedly hit by the strong earthquakes that we described in the previous section, it was evident that the multitude of houses in the villages and poor neighborhoods of the cities were still built with mud-bricks mixed with sun-dried straw, held together simply by clayey sand; to make matters worse, those fragile constructions were almost devoid of foundations [Guidoboni and Mariotti, 2008].

And yet, some far-sighted exceptions there had been and would have risen to international fame at the time of the 1908 earthquake, becoming the subject of a postcard. It was the case of the villa of professor Cammareri in Messina that remained unscathed because it was built on a single floor, with stone-bricks and very thick continuous foundation walls [Campione, 2009] (Figure 12). In the general heavy destruction of the city, the Office of Civil Engineering pointed out that Cammareri's house was an example to be followed for the good quality of construction criteria [Sciacca, 2008].



Figure 12. One of the rare dwelling houses in Messina that remained unscathed during the 1908 earthquake. (After Campione [2009]).

4.2 Depict the dreadful to exorcise the fear

In the early 1900s, the catastrophic earthquake of 1783 was a distant memory, but the devastation caused by the most recent seismic crises returned to ring the alarm bells: they were proof that Calabria and Sicily could not escape recurring seismic threats.

We are inclined to believe that the function of the stereoscopic viewer with its peculiar image gallery was a stimulus, not only for increasing the awareness of the ineluctability of the earthquake but also for suggesting ways of living with it. The three-dimensional scenes of public buildings and collapsed houses, toponymic plaques hanging from the rubble of unrecognizable roads, provided the demonstration of the risks inherent to the places, and the spur to realize buildings capable to resist. It is not a coincidence that in those years the use of reinforced concrete began to spread in Italy [Nelva and Signorelli, 1990] and that the wealthier social classes resorted to the most solid construction techniques when they had to build new houses.

On a more subtle psycho-pedagogical level, we can affirm that the gallery of images of cities and villages devastated by the recurrent seismic crises had a function similar to that of the fearsome characters in children's literature: that is, to depict the horrid to exorcise the fear [Benini and Malombra, 2010]. In the case under study, to rationalize the ancestral fear of the earthquake that shakes any certainty anchored to the ground. The literature of the early twentieth century offers an effective example in which this psycho-pedagogical function is performed by a stage fiction, in an amusement park. In the autobiographical novel "The tongue set free. History of a youth", written by the Nobel Prize (1981) for Literature Elias Canetti (1905-1994) (Figure 13), there is the intense page of a childhood memory that demonstrates how the terrifying representation of earthquakes was practiced for educational purposes.

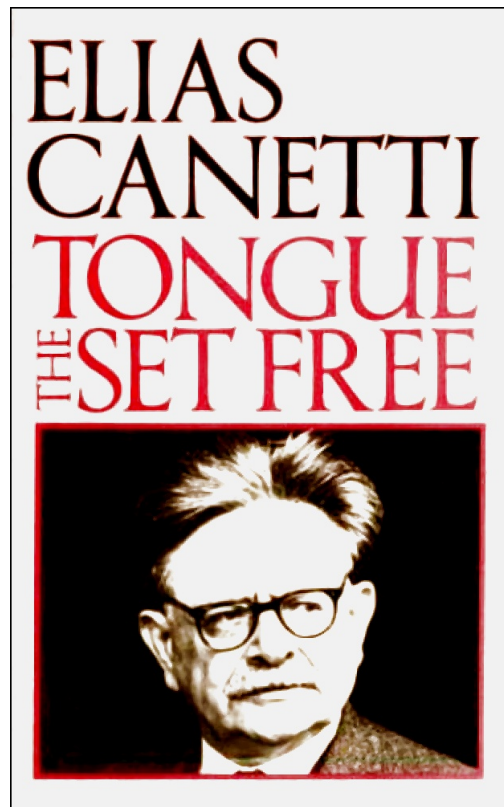


Figure 13. Cover of the autobiographical novel *The Tongue Set Free* by Elias Canetti, 1981 Literature Nobel Prize (Granta Paperbacks, London, 2011).

The scene takes place in Vienna's Wulsterprater, the historic amusement park in the Austrian capital, on an unspecified date in 1909 (the year after the Messina earthquake). Elias Canetti says that, at the age of three, accompanied by his nursemaid Fanny, he was pointing his feet and asking to go back to his favorite pastime: the gallery of horrors. There, a little train entered a dark cave where ghosts, orcs, wolves, and other fearsome fairytale characters were shown among clashes and chilling noises. But Elias, unlike his brothers, remained almost indifferent, anxiously waiting for what for him was the most formidable and attractive fiction: "...the chief attraction came: the *Earthquake at Messina*. There was the town on the blue sea, the many white houses on the slopes of a mountain, everything stood there, solid and peaceful, shining brightly in the sun, the train stopped, and now the seaside town was close enough to touch. At this point I leaped up; Funny infected my panic, held me tight from behind. There was a dreadful peal of thunder, the day turned dark, a horrible whimpering and whistling resounded, the ground rattled, we were shaken, the thunder boomed again, lightning cracked loudly: all the houses of Messina were swamped in glaring flames. The train got underway again, we left the ruins. Whatever happened after that, I didn't see..." [Canetti, 2011].

Canetti tells, more, that he was staggering out of the tunnel thinking: now we will find everything destroyed, all the Wurstelprater, the booths, and, on the other hand, the huge chestnut trees. Then he looked around, luckily he saw the trees still firmly in the ground and he sensed that the same nature which is a dispenser of devastation, could offer safe shelters: *“I grabbed the trunk of a tree and tried to calm down. I punched it, feeling its resistance. It couldn’t be moved, the tree stood fast, nothing had changed, I was happy. It must have been back then that I put my hope in trees”* [Canetti, 2011].

Therefore, one year after the December 1908 earthquake of Messina, in the Austro-Hungarian empire of Franz Joseph (1830-1916), the most serious seismic catastrophe of post-unitary Italy had already become a spectacle to represent in a children’s amusement park. And, on the other hand, Elias Canetti testifies that, after that show, he finds confidence and serenity in a mighty tree, a metaphor for something solid and well-rooted in the ground, something that no earthquake will ever crash. The happy ending of Canetti’s story seems to indicate, albeit metaphorically, the need to adopt anti-seismic criteria to make buildings capable of withstanding strong earthquakes and became solid and well-rooted like a tree.

5. Conclusions

The use of strong images of past earthquake damages, that can hit the feelings and beliefs of people living in earthquake hazard-prone areas, is a tool to increase the seismic risk perception. Its pedagogical purpose is to raise awareness about the necessity to build houses following seismic codes to avoid past disasters, so demonstrating the social function and the ethical value this form of geo-education may have for local communities. Developing and disseminating knowledge on earthquakes across society is essential to change how people perceive the risk, and to improve the way for preparing to resist future seismic events and to promptly react in case of an earthquake occurs.

Recovering and keeping alive the memory of past disasters is the first step to increase citizens’ awareness of risks. Greater awareness means greater responsibility and therefore a more active attitude by citizens in the defense against risks, with the long-term effect of increasing the resilience of human communities.

A geoethical approach to reducing the seismic risk needs to rediscover cultural and technical traces in our history to better shape modern and more effective ways to change social risk perception and to improve mitigation action.

Dedication and Acknowledgements. Dedicated to the memory of the spouses Antonino Muscolino and Amalia Andronico, owners of the stereoscopic viewer described in the text; with heartfelt thanks to their daughter Maria Ada Muscolino Basile, who made the apparatus available for this research. The authors are grateful to Dr. Graziano Ferrari for his valuable suggestions, and to the anonymous reviewers whose comments have improved this manuscript.

References

- Bertolaso G. (2008). Il terremoto e il maremoto del 28 dicembre 1908. Analisi sismologica, impatto, prospettive. A cura di G. Bertolaso, E. Boschi, E. Guidoboni e G. Valensise. SGA, Bologna, 814.
- Baratta M. (1895). Il terremoto calabro-siculo del 16 ottobre 1894, Estr., Pensiero Italiano, LI, Milano.
- Benini E. and G. Malombra (2010). Le fiabe per ... vincere la paura. Un aiuto per grandi e piccini. Franco Angeli, Roma, 176.
- Besso B. (1869). Le grandi invenzioni antiche e moderne. Fratelli Treves, Milano, VIII-263.
- Brewster D. (1856). The Stereoscope; Its History, Theory and Construction, with Its Application to the Fine and Useful Arts and to Education, Etc. John Murray.
- Campione G., G. Puglisi, and P. Callegari (Eds.), (2009). La furia di Poseidon: Messina 1908 e dintorni. Silvana Editoriale, vol. 1, 360.
- Canetti E. (2011). The tongue set free: Remembrance of a European Childhood, Granta Paperbacks, London.
- Castanetto S. and M. Sebastiano (2007). Calabria 8 settembre 1905: dal terremoto alla ricostruzione: il terremoto raccontato attraverso le cronache, i documenti e le immagini dell’epoca. A cura di Sergio Castanetto e Mirella

- Sebastiano. PCM-DPC, Roma.
- Ferrari, G. (2004-2009). Viaggio nelle aree del terremoto del 16 dicembre 1857. L'opera di Robert Mallet nel contesto scientifico e ambientale attuale del Vallo di Diano e della Val d'Agri, Bologna, SGA Storia Geofisica e Ambiente.
- Ferrari G. and A. McConnell (2005). Robert Mallet and the "Great Neapolitan earthquake" of 1857, *Notes and Records of the Royal Society*, 59(1), 45-64.
- Ferrari G. (2017). Il terremoto del 16 dicembre 1857 in Basilicata, le radici della fotografia scientifica dei terremoti, <https://ingvterremoti.com/2017/12/21/il-terremoto-del-16-dicembre-1857-in-basilicata-le-radici-della-fotografia-scientifica-dei-terremoti/>
- Ganot A. (1887). *Traité élémentaire de physique*, Librairie Hachette, Paris.
- Guidoboni E. and D. Mariotti (2008). Il terremoto e il maremoto del 1908: effetti e parametri sismici. In *Il terremoto e il maremoto del 28 dicembre 1908: analisi sismologica, impatto, prospettive*, Dipartimento della Protezione Civile, Istituto Nazionale di Geofisica e Vulcanologia.
- Guidoboni E. and G. Valensise (2013). *L'Italia dei disastri. Dati e riflessioni sull'impatto degli eventi naturali 1861-2013*. A cura di Emanuela Guidoboni e Gianluca Valensise, Bononia University Press, Bologna.
- Guidoboni E. and G. Ferrari (1987). Mallet's macroseismic survey on the Neapolitan Earthquake of 16th December, 1857, SGA, Bologna.
- Guidoboni E., G. Ferrari, G. Tarabusi, G. Sgattoni, A. Comastri, D. Mariotti, C. Ciuccarelli, M.G. Bianchi and G. Valensise (2019). CFTI5Med, the new release of the catalogue of strong earthquakes in Italy and in the Mediterranean area, *Scientific Data* 6, Article number: 80, <https://doi.org/10.1038/s41597-019-0091-9>.
- Mallet R. (1862). *Great Neapolitan Earthquake of 1857: The first principle of observational seismology as developed in the report to the Royal Society of London of the expedition made by command of the Society into the interior of the Kingdom of Naples to investigate the circumstances of the great earthquake of December 1857*. London (Reprint Istituto Nazionale di Geofisica, ed. Guidoboni and Ferrari, Bologna, 1987).
- Mercalli G., (1897). *I Terremoti della Calabria Meridionale e del Messinese*. Accademia dei Lincei, Roma.
- Nelva R. and B. Signorelli (1990). *Avvento ed evoluzione del calcestruzzo armato in Italia: il sistema Hennebique*, Edizioni di Scienze e Tecnica, Milano, 200.
- Peppoloni S., N. Bilham, G. Di Capua (2019). Contemporary Geoethics Within the Geosciences. In Bohle M. (Ed.): *Exploring Geoethics: Ethical Implications, Societal Contexts, and Professional Obligations of the Geosciences*. Palgrave Pivot, Cham, XIV + 214, ISBN 978-3-030-12009-2.
- Persico E. (1932). *Ottica*, Vallardi, Milano
- Rovida A.N., M. Locati, R.D. Camassi, B. Lolli and P. Gasperini (2016). CPTI15, the 2015 version of the Parametric Catalogue of Italian Earthquakes.
- Sciaccia G. (2008). Il ruolo dell'Ufficio del Genio Civile di Messina all'indomani del 28.12.1908. *Portale Regione Siciliana*: http://pti.regione.sicilia.it/portal/page/portal/PIR_PORTALE/PIR_LaStrutturaRegionale/PIR_AssInfrastruttureMobilita/PIR_Diptecnico/PIR_GenioCivileMessina/PIR_Convegno_Centenario_Terremoto/Il%20ruolo%20dell'Ufficio%20del%20Genio%20Civile%20di%20Messina%20all'in.pdf
- Tagliapietra A. (2004). Sulla catastrofe, l'illuminismo e la filosofia del disastro. Voltaire, Rousseau, Kant, a cura di Andrea Tagliapietra, con un saggio di Paola Giacomoni, Milano, B. Mondadori, XXXIX-151.
- Wright F.E. (1924). Stereoscopic photography in geological field work, *J. Washington Academy Sci.*, 14, 3, 63-72.

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