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NEOGEOGRAPHY AND SEISMIC RISK PERCEPTION. A COMPARISON BETWEEN TWO CASE STUDIES: CALABRIA, SOUTHERN ITALY AND MALTA

Francesco DE PASCALE
University of Calabria, Department of Languages and Educational Sciences, Rende (CS), Italy
francesco.depascale@unical.it

Marcello BERNARDO
University of Calabria, Department of Languages and Educational Sciences, Rende (CS), Italy
bernardo@unical.it

Francesco MUTO
University of Calabria, Department of Biology, Ecology and Earth Sciences, Rende (CS), Italy
francesco.muto@unical.it

Sebastiano D'AMICO
University of Malta, Department of Physics, Msida (MSD), Malta
sebastiano.damico@um.edu.mt

Rosarianna ZUMBO
rosarianna.z@gmail.com

Pauline GALEA
University of Malta, Department of Physics, Msida (MSD), Malta
pauline.galea@um.edu.mt

Matthew AGIUS
University of Malta, Department of Physics, Msida (MSD), Malta
matthew.agius@um.edu.mt

Abstract

Geography of perception aims at clarifying human behaviour by studying the concepts and images of the real world that a person elaborates on by considering the psychological and social aspects of man's behaviour within an environment. In this context, a questionnaire was given to primary and middle school pupils in an area of Calabria (Southern Italy), which has recently been affected by an on-going seismic sequence widely felt by the local population. The same questionnaire was given to students in Malta (Central Mediterranean), an area considered to have a low-to-moderate seismic hazard, and where earthquake awareness is not culturally strong. In this way, the knowledge effectively possessed by the students (relating to age, experience and area of origin) are analysed; their analogous and differing perceptions on earthquakes in different areas are highlighted. The data collected can be used to project and create new informative tools through which students will become "geographic information volunteers" studying natural risks such as earthquakes, and augmenting the territory's level of resilience.

Keywords: *Anthropocene, EUROGEO 2014, Geography of perception, Neogeography, seismic risk*

1. INTRODUCTION

In the last decades there was an increasing concern about the occurrence of natural hazards especially with regards to earthquakes. This is mainly due to the increased human exposure. The social and economic costs of natural hazards are substantial, not only as damages costs, but also due to recovery (Alexander, 1993; Alcántara-Ayala, 2002; Twigg, 2002). Seismic risk is the likelihood of loss and it might be defined as the combination of seismic hazard, vulnerability, and exposure, i.e., economic loss consequences of an earthquake (Sandi, 1986). The assessment of seismic risk is very complex due to the direct or indirect, immediate, or long-lasting effects at the surface of the earth.

Italy is one of the most seismically active countries in the European-Mediterranean region and, although it is a developed country, earthquakes frequently cause extensive damage and casualties (e.g. Belice 1968: 231 deaths; Friuli 1976: 978 deaths: Irpinia 1980: 2914 deaths; L'Aquila 2009: 309 deaths; Emilia 2012: 27 deaths). In recent years several geological and seismological studies have been undertaken so that now Italy has a high state of knowledge on its seismic risk. Calabria, located in the southern Italian peninsula is one of the most tectonically complex area and it is considered as one of the most seismically active regions (D'Amico et al. 2011; 2013).

The issue on seismic hazard and seismic risk for the islands of Malta located in the Central Mediterranean is a long-standing and often controversial one that has so far not been addressed in a fully comprehensive manner. In general, the local public perception is that the islands of Malta are relatively free from earthquake hazard. This perception probably stems from the fact that the last earthquake to produce some building damage occurred about 90 years ago, and the most damaging earthquake occurred about 300 years ago in 1693 (e.g., Galea, 2007). There is thus hardly any recollection of any danger in the collective memory of living people today. Historical records, however, reveal a number of earthquakes of local or regional origin events where building damage occurred. Meanwhile, the local building density has increased dramatically especially over the last few decades, and the building footprint has spilled over to geologically diverse and more unstable areas, making it even more important to tackle the issue of seismic hazard and risk in a serious manner.

The main goal of this paper is to discover the effective knowledge young students have with regard the correct behaviour to adopt in the event of an earthquake, their reactions during and after the earthquake, and their perception on seismic risk according to age, experience. A comparison is done between two different areas: Calabria, which has recently been affected by an on-going seismic sequence, and Malta, an area considered to have a low-to-moderate seismic hazard (e.g., Giardini et al., 2014; Agius et al., 2014). The data collected is used to project and create new informative instruments through which students will become "geographic information volunteers" studying natural risks such as earthquakes and augmenting the territory's level of resilience. Consequently, local institutions can refer to information about individuals' perception of seismic phenomena and use it to realise effective environmental planning and an efficient strategy of prevention.

2. A GEOETHICAL APPROACH IN THE ANTHROPOCENE GEOLOGICAL ERA

About two centuries ago, the Earth entered the Anthropocene (Crutzen, 2005), a new geological epoch in which humans have left a marked impact on climate and the environment. In comparison with the slow passing of previous millennia, our species has, in a

very short time, radically altered the world's ecosystems. Interest in geoethics and the ethical, sociological and cultural implications of Earth Sciences has been increasing rapidly in Italy (Peppoloni and Di Capua, 2012). This involves amplifying the prospects and expectations of geosciences and highlighting the fundamental role of geological and geographical studies in finding solutions to the practical problems that man faces when at the same time attaining the preservation of nature and the planet. Indeed, man can be an active participant in natural catastrophes in the sense that humans are able to amplify the damage and natural dynamics. On the other hand, as much as these phenomena can only be foreseen to a limited extent, intervention is possible with regards to the parameters of risk which are dependent upon anthropisation, such as those of vulnerability and exposed value that mark the difference between a natural event and a calamity. Therefore, through information about and knowledge of risk, it is possible to keep damage to a minimum by refining techniques of prevision and prevention.

2.1 Conceptual schemes on geography of perception

Perception is present in all human activities; this 'unique' ability has been studied by psychologists for a long time (Bailly, 1975). The knowledge of the world around us depends on the senses and on the stimuli that affect the senses themselves. The main purpose of the geographer is to know the relationship between man and environment, to discover how culture and experience influence perceptions, and to clarify the processes of creation of the urban image, even if, on the contrary, the non human environment is neglected in a lot of studies.

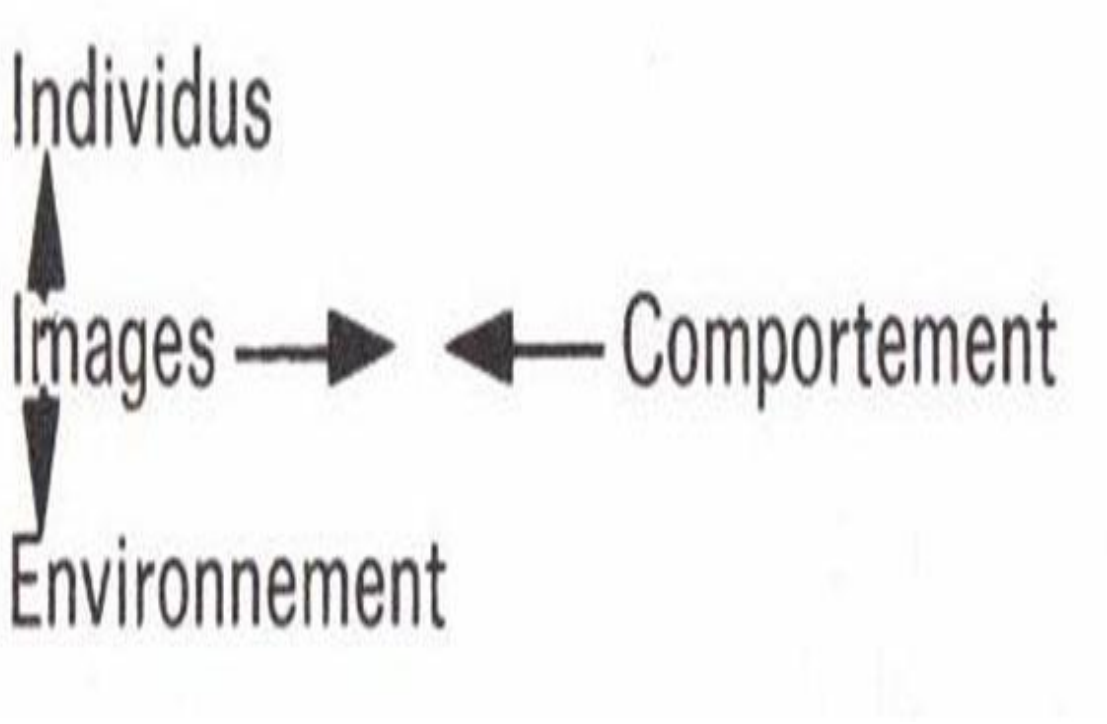

Figure 1. Scheme of Wood (1970).

In order to formalise the research done by psychologists in a geographical context, Kirk (1963) proposed to divide the analysis of the environment in two parts: the objective

environment and the environment's behaviour. The first topic focuses on the physical world modified by human settlements, whereas the second topic deals with psycho-physical facts. The interpretation of reality is outlined in the form of the relationships shown in Figure 1. It is necessary, as a first step, to study the relations between the environment and the images, and the relations between people and images, then it is necessary to deal with the links between image and behaviour. Bordessa identifies four research directions corresponding to Figure 1: the perception of the environment; attitudes and responses to the environment; spatial preferences; and perception and behaviour (Bailly, 1975).

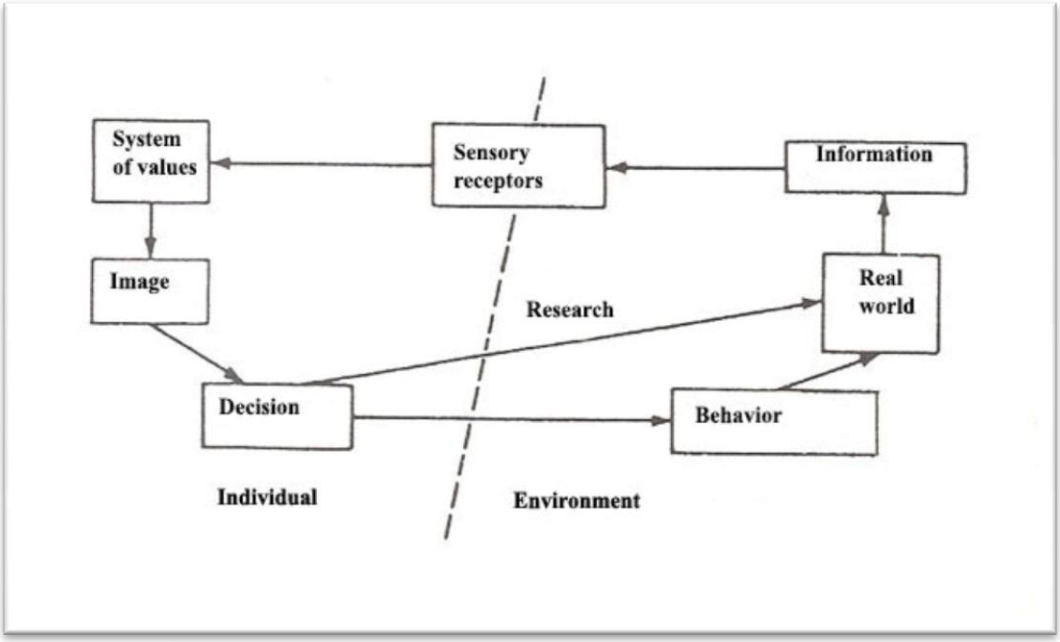

Figure 2. The conceptual model of geographical space perception developed by Roger M. Downs. From: Geipel, 1980a.

In the late 1960's, Roger M. Downs (Downs, 1970) was the first to develop a conceptual model explaining the perception of the environment. This model (Figure 2) was considered an important point of reference in the research on the perception of the space environment (Bianchi, 1987) because this put mankind in contrast with the living environment. The real world is the point of departure: it is the source of information that can be perceived by the sensorial organs. Once acquired, this kind of information is then interpreted by the value system of man. A mental image is created, however, this kind of image is not directly derived from the real world, but it is initially linked with the sensorial system and then with the individual values. In this way, every future decision made by a person is not directly originated from the physical environment, but from what he or she thinks and image about it. If these kind of decisions happen for real they can produce some kind of visible behaviour in the real world, which if occurred regularly enough, it is possible to talk about a personal role model. If they do not, they are followed by a further search of information in the real world. Downs (1970) has outlined a cyclic model of perception of the environment that will be activated if the physical environment produces new information. This model incorporates the theoretical basis of the geography of perception, such as the consideration of every man treated as a source of decision-making. This concept was developed by Simon (1957) through

the theory of the rational and limited man and was introduced in the geographical field by Julian Wolpert (1975). All these studies put the mental image as a leader of the behaviour. This theory was also proposed by Koffka (1935) and geographically developed by Kirk (1975); Downs thought that man has a complex system of environmental information processing, able to transform every information into a personal way influencing his own behaviour.

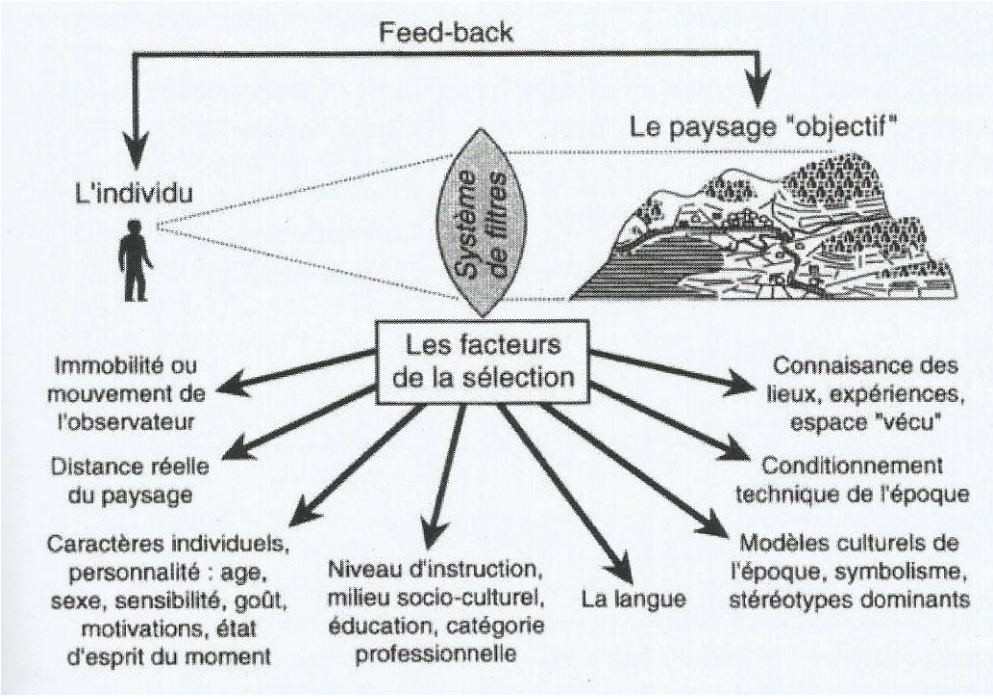

Figure 3. The conceptual model of geographical space perception developed by Roger Brunet, revisited by Jean P. Paulet. From: Paulet, 2009.

Roger Brunet, a French geographer who in 1974 proposed a new scheme of environmental perception (Brunet, 1974), considered the human being as a processor of information (Figure 3). Although he maintained more or less the same way of thinking theorized by Downs, Roger Brunet presented a more extensive and a more complex system of analysis of the cognitive processes that involved theorizing the existence of a "perceptual filter" element through which every man approaches the real world.

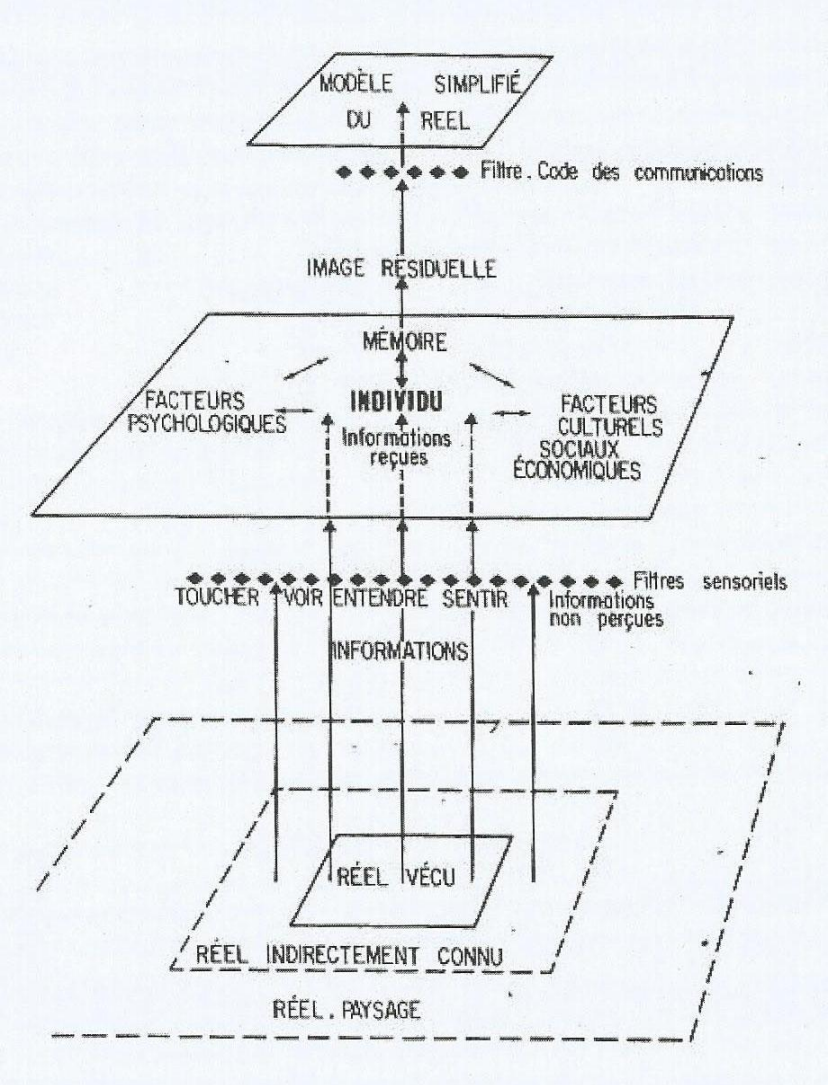

Figure 4. Diagram of the perception process developed by Antoine Bailly (1975)

The third effective scheme used in explaining the process of perception of geographical space is developed by the French geographer Antoine Bailly (1975) in 1975. In this scheme (Figure 4) we can see the desire to describe and analyze in a more detailed way the factors that constitute the perceptual filter, the same theory treated also by Brunet (1974). According to Bailly (1975) man knows only a small part of the real world primarily because of the limited ability to visit and experience it fully. This means that the majority of knowledge is sourced indirectly from tools such as books, the Internet, television and so on. One also has to consider the interposition of two perceptual filters: First is the sensory consisting of the sense organs transposing the information in the form of stimuli. This perceptual process is relatively similar from individual to individual, leaving out cases of sensory deficits such as vision or hearing.

The second filter consists of all the factors that characterize specifically the individual: psychological, emotional-affective, motivations and needs, memories and connections with the land, judgments and opinions, cultural, education and type of education, interests and future aspirations, social, relations undertaken, people frequented, economic, social class they

belong, standard of living, etc. This filter "deforms" the information from the qualitative point of view. It is only after applying these two filters on an individual will one be able to form the mental image the subject has on the environment. Bailly called the image "residual" stressing that a person, according to the codes of communication, transforms the image into a simplified model of reality. This model is qualitatively and quantitatively different from the real world; it is a deformation caused by multiple factors that have acted as a filter (Lovigi, 2013).

2.1.1 The perception of catastrophic events

The analysis of human behaviour during a disaster has an important role in the geography of perception field. For some scholars this kind of study can be considered as a different discipline having its own analysis and criteria as a well as a specific field of research. The differences are highlighted by the fact that this research field is strongly interdisciplinary between physical and social sciences, and is not restricted to researcher in the social sciences (Bianchi, 1987).

In most cases, studies on the hazard perception are divided in two main streams: studies related to natural hazard (i.e. natural catastrophes and associated phenomena) and man-made hazard (i.e. catastrophic phenomena induced by human activities; Geipel, 1980a, b). It is not always easy to distinguish from each other. For example, in this context, the advance of drought, a catastrophic phenomenon considered natural, can also be caused by humans as a consequence such as wrong land use or by the voluntary diversion of a watercourse. Nowadays the trend of separating studies between different catastrophic events, in particular as regards the division between natural and man-made hazard, is being less popular. We note that the response to calamitous events is so influenced by personal and cultural factors that the same kind of event can provoke very different reactions (Bianchi, 1987). Therefore, it important we fully understand how a certain risk can be perceived in order to hypothesize the right behaviour and to properly plan intervention strategies (Lando, 2006).

In this context, a questionnaire was handed out to primary and middle school pupils in an area of Calabria, which has recently been affected by an on-going seismic sequence that was widely felt by the population. In particular, on 26th October 2012, an event of magnitude 5 affected mainly the village of Mormanno. The same questionnaire was given to students in Malta, where the seismic hazard is considered to be low-to-moderate (e.g., Giardini et al., 2014) and earthquake awareness is not culturally strong. The Maltese islands have, however, been affected historically by a number of earthquakes, the epicentres of which were in Eastern Sicily, the Sicilian Channel or as far away as the Hellenic arc. Some of these earthquakes produced considerable damage (Galea, 2007). In this way, the knowledge effectively possessed by groups of young students (relating to age, experience and area of origin), and the differing perceptions of earthquakes in different areas are highlighted.

3. A QUESTIONNAIRE ON THE SEISMIC RISK PERCEPTION: RESULTS AND COMPARISON BETWEEN CALABRIA AND MALTA

This paper analyzes the results of 133 questionnaires completed by secondary level students attending a school in Malta, and two Italian municipalities: Saracena and Tortora. Both Italian towns are located in the Calabria area, "zone 2" in the seismic hazard map compiled by the Italian Department of Civil Protection (2014) (Figure 5).

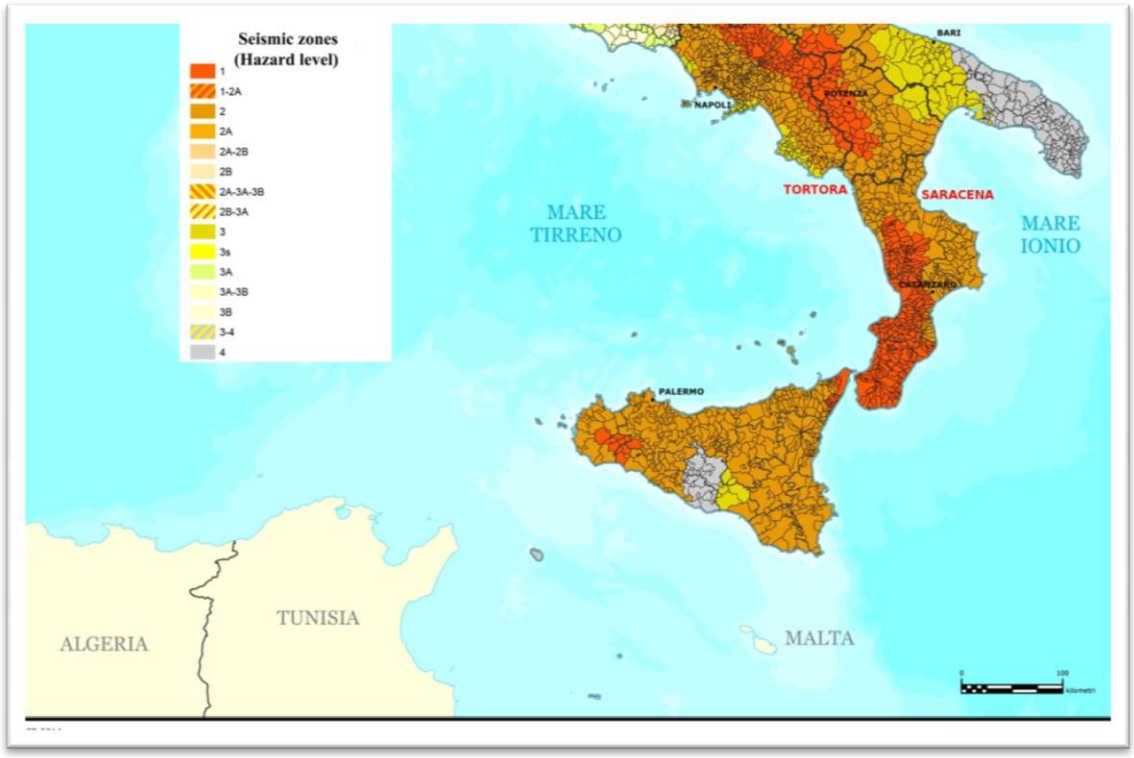

Figure 5. Calabria, Southern Italy in the seismic classification map, prepared by the Department of Civil Protection (2014). Saracena and Tortora are located in "zone 2"
From: www.protezionecivile.gov.it/resources/cms/documents/A3_class20140605.pdf.

To the first question, "Have you ever experienced an earthquake?" - 85.8% of Calabrian students said "yes" and 12.1% said "no", whereas 73.5% of students from Malta answered "no" and 26.4% "yes" (Figure 6).

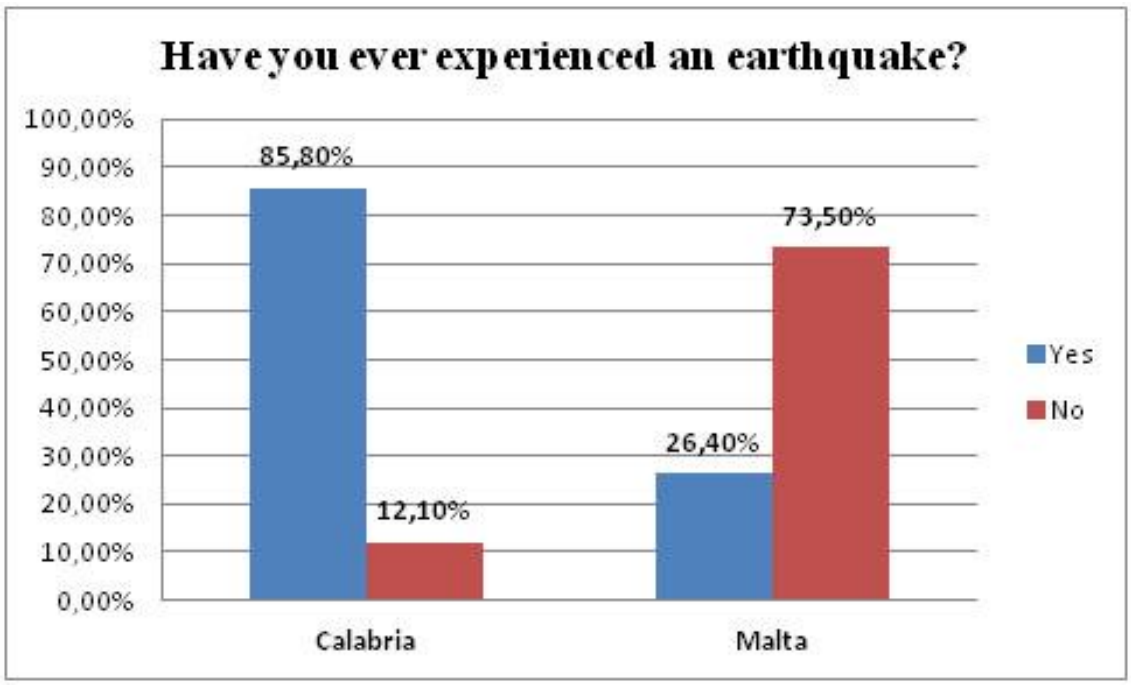

Figure 6. Data as a percentage of the students' answers to the question: "Have you ever experienced an earthquake?".

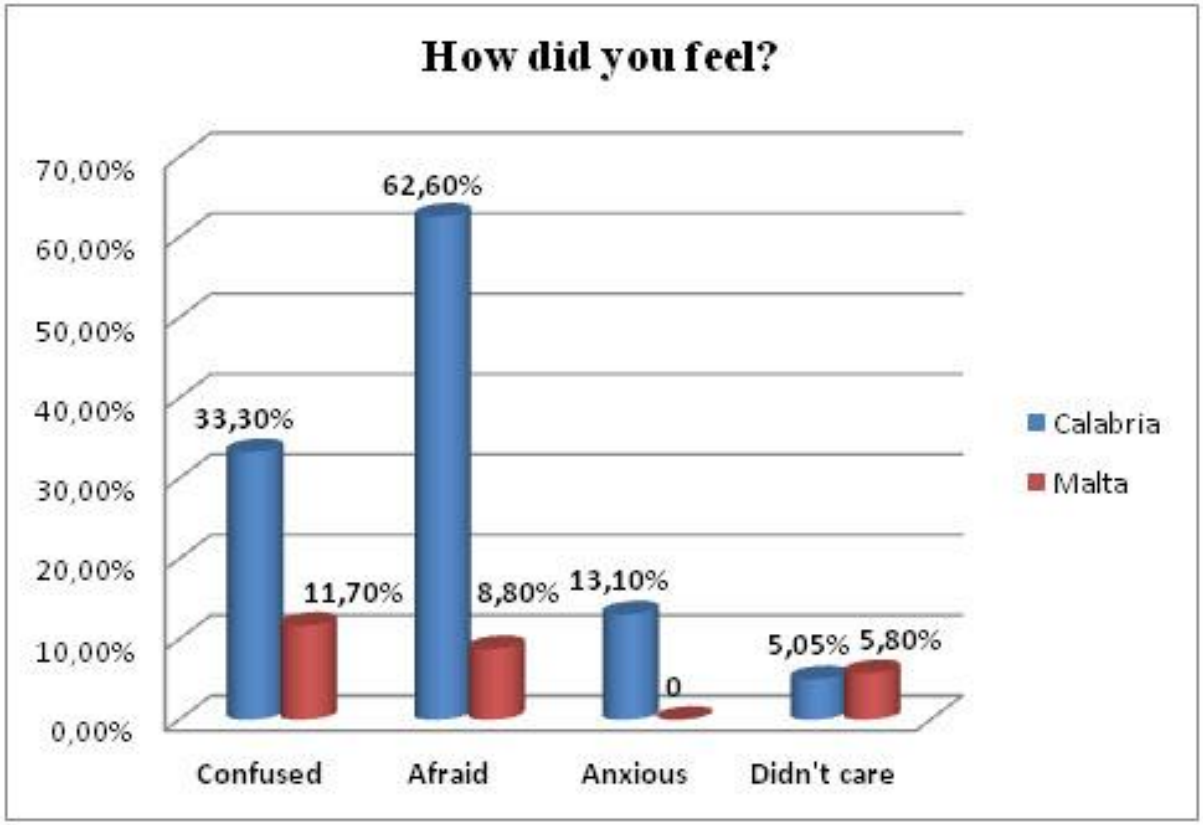

Figure 7. Data as a percentage of the students' answers to the question: "How did you feel?"

To the second question, "If yes, where you happened to live this experience" - 80.8% of Calabrian students responded "at home", 30.3% and 1% at school and in an open space respectively; whereas among the few Maltese who have experienced an earthquake answered as flows: 14.7% at home, 5.8% at school, 5.8% outside, 8.8% in other buildings; 59.4% did not answer to the question. The most common reactions of Calabrian students for an earthquake were: 62.6% fear, confusion 33.3% (Figure 7) and 30.3% “I must get out of here”, 23% “I do not have to move”. The 11.7% of the Maltese chose “confusion” and 8.8% fear (Figure 7). Among the Calabrian students we record a significant proportion of them (30.3%) that declared to run away from the building during the shacking while a smaller percentage, 23.5%, of the Maltese did not go out during the shock.

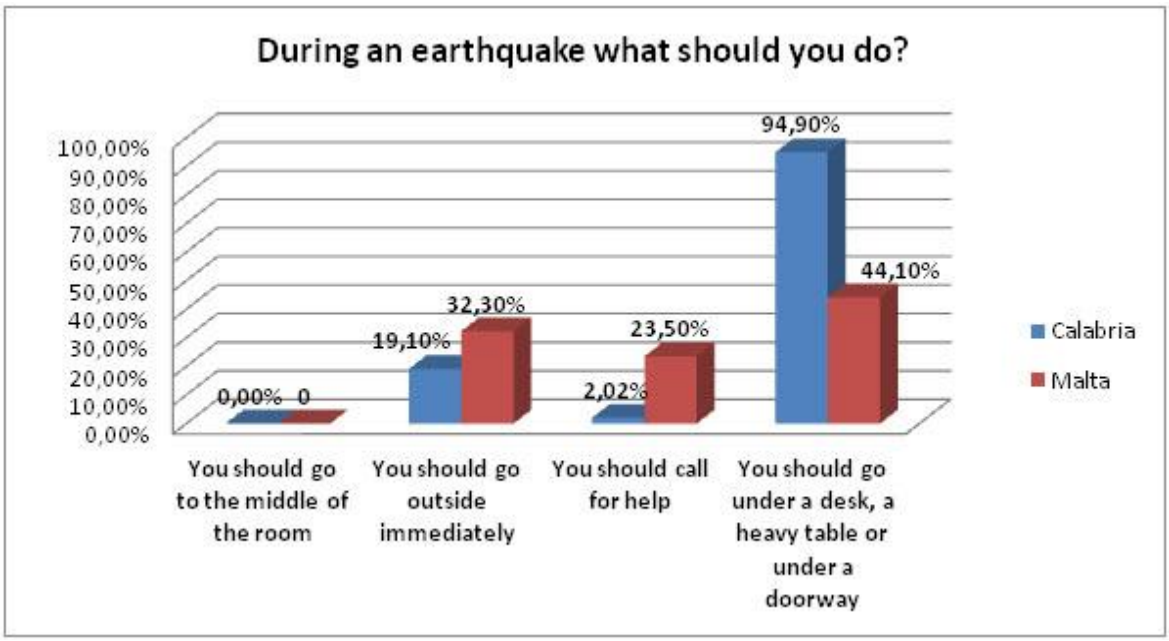

Figure 8. Data as a percentage of the students’ answers to the question: “During an earthquake what should you do?”.

To the question, “During an earthquake, what should you do?” (Figure 8), most Calabrian students (94.9%) answered correctly “You should go under a desk, a heavy table or under a doorway”. Also in answering to this question emerges that 19.1% of the Calabrian students replied “should go outside immediately”. 44% of Maltese indicated that they would go under the counter or under the lintel of a door while 32.3% would try to get out immediately, 23% would ask for help (Figure 8). Hence, from these few questions it is evident that earthquake hazard awareness and preparedness needs to increase to both the Calabrian and Maltese students in order to avoid kneejerk reactions and panic that may lead to immediately get out during the shaking. It should be noted that all the Maltese students and almost all the Calabrian ones participated in evacuation drill exercises: 94.9% of the Calabrian students participated to exercises related to earthquake risk and 28.2% related to fire risk while all Maltese participated in evacuation drills for fire risk only.

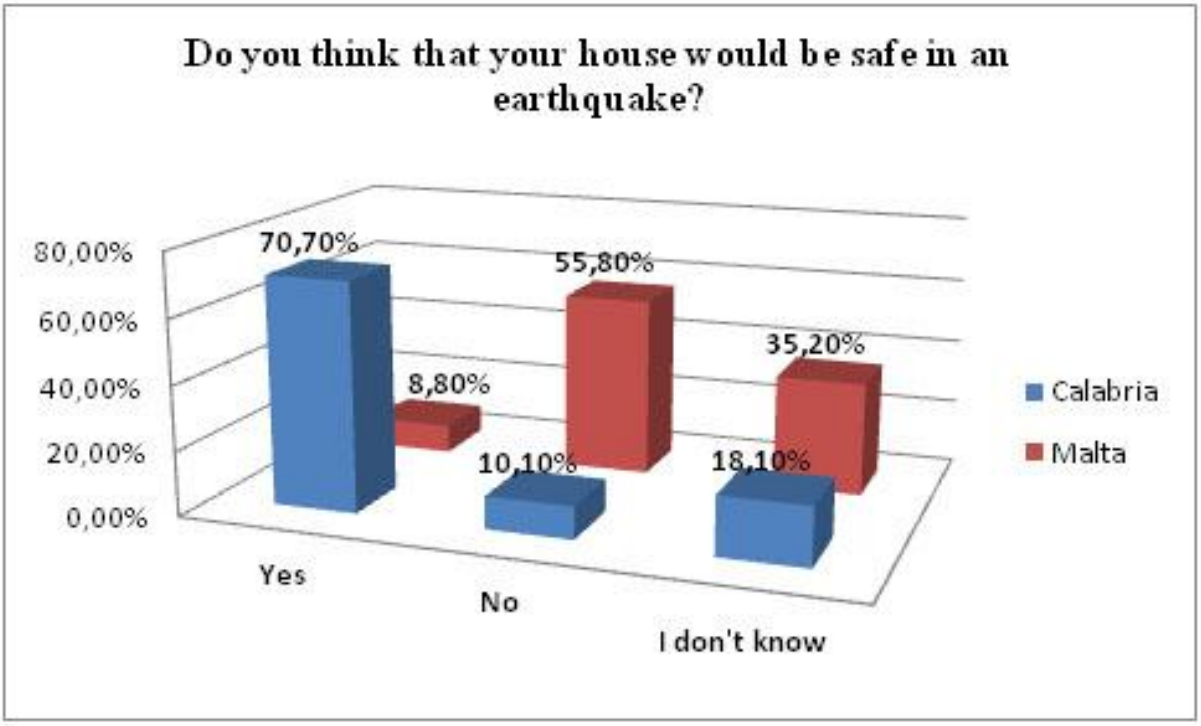

Figure 9. Data as a percentage of the students' answers to the question: "Do you think that your house would be safe in an earthquake?".

Nearly half of the Calabrian students (47.4%) feels secure from the point of view of seismic risk in their school, while 26.2% do not feel safe or do not know. 70.7% feel safe in their own home, while 10% no (Figure 9). The Maltese student population declared that in case of an earthquake they do not feel safe in their own home (55.8%) (Figure 9). The majority of the Maltese students (70%) believe that in order to make their home/school safer during an earthquake it is necessary to avoid keeping heavy objects on high shelves and furniture. 49.4% of the Calabrian students said they have a home emergency kit to carry in case one needs to leave the house immediately, while 27.2% do not have and 20% replied maybe. 41.1% of the Maltese students said to have possess to one too, while 20.5% do not have one, and 38,2% are not sure to have one of them at home.

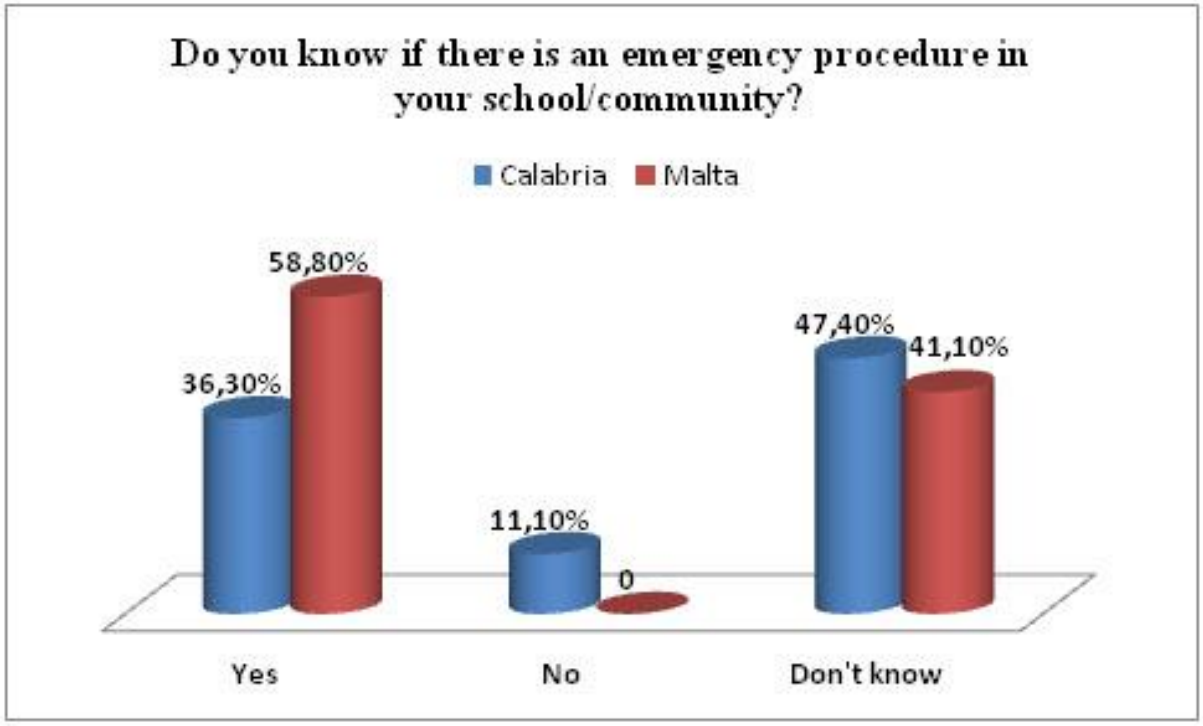

Figure 10. Data as a percentage of the students' answers to the question: "Do you know if there is an emergency procedure in your school/community? "

According to 77.7% of the Calabrian students said that the emergency kit should include a first aid kit, flashlight and radio, while 15% indicates that it must have clothing, blankets, and candles. According to 94% of the Maltese students said that the emergency kit should contain a flashlight (58.8%), and an helmet for each family member (41%). 47.4% of the Calabrian students do not know if there was a contingency plan in their hometown, while 36.3% said yes and 11% thinks there is no emergency plan in their city (Figure 10). In contrast, 58.8% of the Maltese students responded positively about a contingency plan (Figure 10). Nearly all the Maltese students (97%) knew the correct emergency telephone number.

The majority of the Calabrian students (54.5%) affirms that earthquakes can affect new areas or areas that have already been affected in the past, while, according to 24% of the student population, the earthquakes tend to always hit the same areas, but you cannot know precisely when and with what magnitude. 76.4% of the Maltese responded by stating that earthquakes can occur at any place on the planet. According to 42.4% students from Calabria, the most frequent danger in case of an earthquake is "being struck by falling objects" and 54.5% think that the danger is "to be involved in the collapse of the house". This also applies to the Maltese students (26.4% of respondents indicating "being struck by falling objects" and 61% indicated "be involved in the collapse of the house"). According to 67.6% of the Maltese students said there is no earthquake hazard for the Maltese archipelago, but 55% is aware that the island has been hit by major earthquakes in the past.

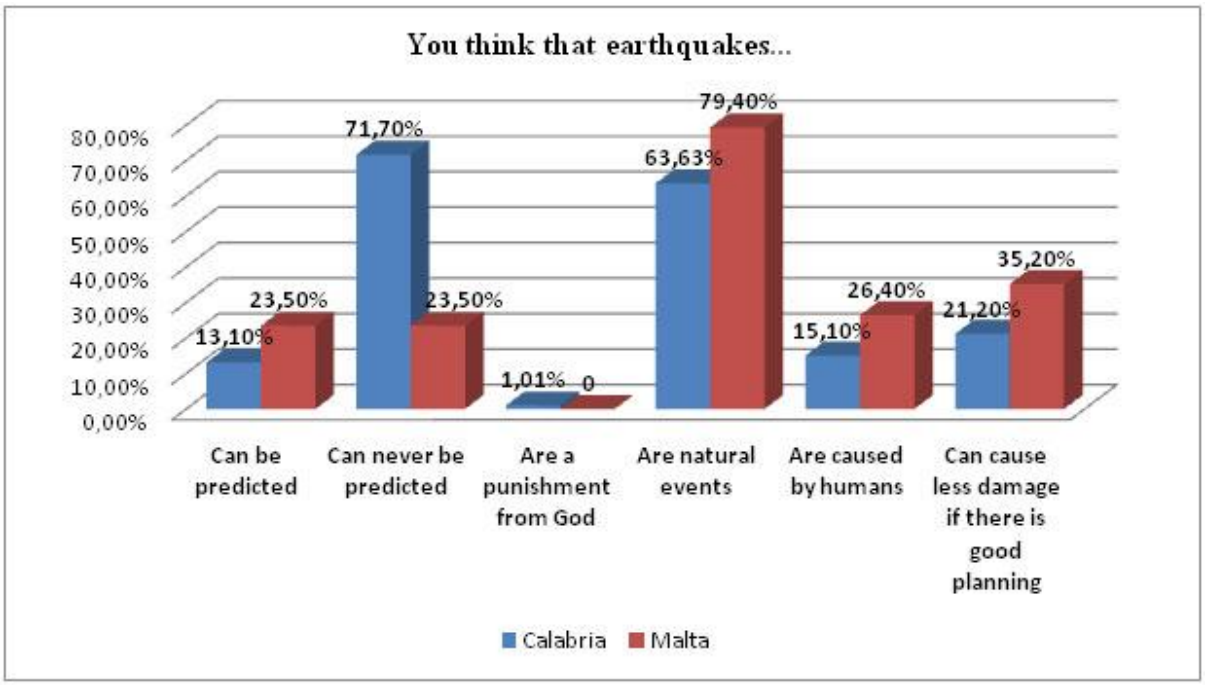

Figure 11. Data as a percentage of the students' answers to the question: "You think that earthquakes…"

The majority of Calabrian students perceives the earthquakes are an unpredictable (71.7%) and natural (63.63%) event (Figure 11). 13.1% consider this kind of phenomenon as predictable. There is a significant percentage of students that think that an earthquake is caused by human factors (15.1%), and that the damage can be limited with proper environmental planning (21.2%). We note that the percentages are higher for students living in Malta (26.4% think that earthquakes are caused by human activities, and 35.2% think that the damage would decrease with proper planning). Interestingly, the percentage of Maltese students who think that earthquakes can be a "predictable" or an "unpredictable" phenomenon, is equal (23.5%), while at the same time, the majority perceives it as a "natural" event (79.4%) (Figure 11).

The percentage of students who believes that the earthquake was caused by a divine punishment is null for Malta or close to zero for Calabria (1%) (Figure 11), severing, in this case, the "incontestable certainty" to the man on the destructive force of the earthquake as an expression of divine punishment.

In the event of a tsunami, 56.5% of the Calabrian students are aware of the sudden withdrawal of water from the coast, and according to the 36.3% suggest that there could be a sudden high tide. Even the majority of the Maltese students have chosen these two responses (64.7% and 20.5% respectively). Furthermore, for the same question 20.5% has chosen the following response: "the sea becomes rougher". Students who happen feel a strong earthquake when they are close to the shore line, or if they see a sudden withdrawal of the sea from the coast, declared that they would "immediately move away from the shore" (44.4% Calabria, 32.3% Malta) or "turn away from the shore and head up to the higher areas" (56.5% Calabria, 67.6% Malta).

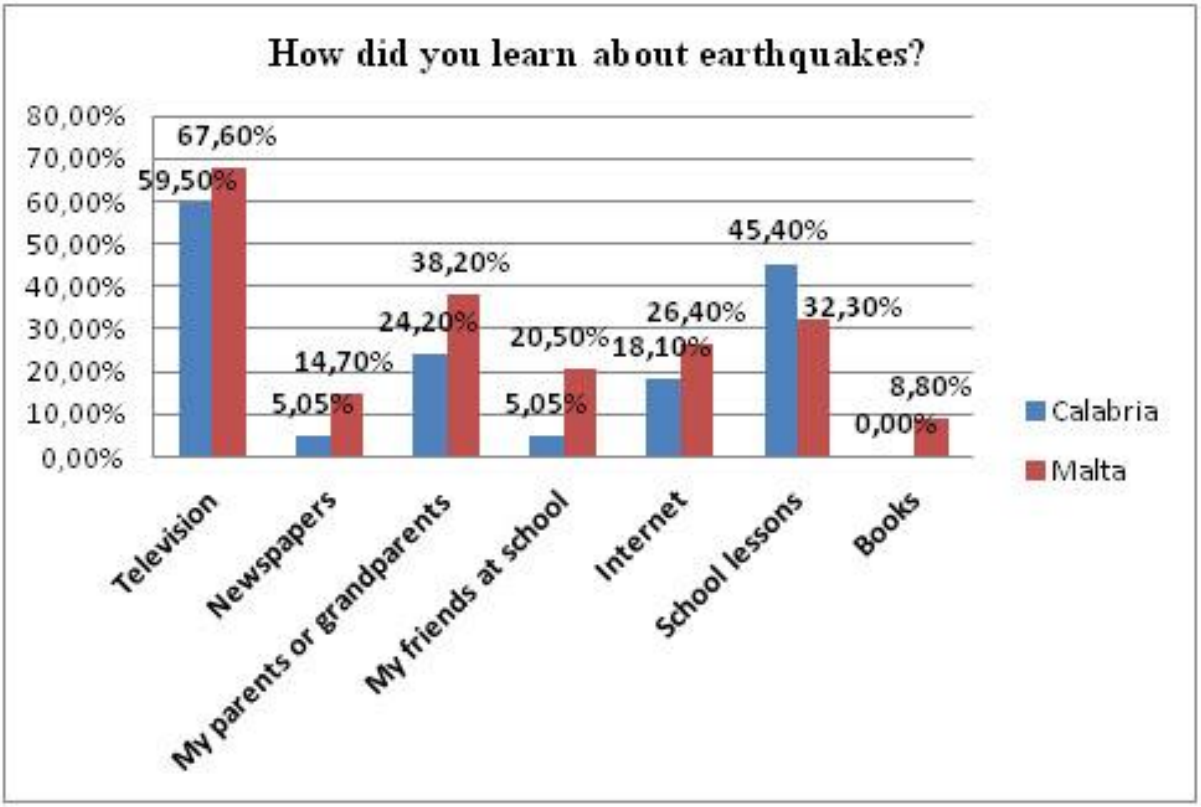

Figure 12. Data as a percentage of the students' answers to the question: "How did you learn about earthquakes?"

Finally, 59.5% of Calabrian students said they know about earthquakes from watching television, 45.4% learnt at school during class, 24.2% and 18.1% from family and browsing the Internet, respectively (Figure 12). 67.6% of the Maltese have learnt about earthquakes also by watching television, 38.2% at home, 32.3% in school during class, 26.4% from browsing the Internet, 20.5% from listening to friends and classmates, and 14.7% from reading of newspapers (Figure 12).

Therefore, it is plausible to state that there is a high percentage of students who have learnt about earthquakes from mass-media sources in both study areas. Taking this into account, it is necessary that proper dissemination of information on earthquakes should be done through popular media both at local and national scales. It is no coincidence that in August 2013, a joint statement between the Italian Civil Defence and the National Institute of Geophysics and Volcanology has drawn attention to accurate information regarding the earthquakes, asking for the cooperation of all the newsrooms, to convey a clear and correct message to the public, paying particular attention to the meaning of the terms used in such cases.

Studies on the geography of perception can be considered to be at the base of the research on natural disasters, and should help to stimulate the analysis of the relationship between human beings and environment. In particular, it is fundamentally important to understand how humans can interact with a high risk environment (Botta, 1987). In our study we show that there is significant number of students who consider the decisive human intervention in the unleashing of disasters. This supports the thinking of Paul Crutzen and of other scholars that we are in the Anthropocene geological era (Crutzen, 2005). It is essential that awareness

helps us to understand better what is happening to our planet, or "a geological revolution of human origin" (Bonneuil and Fressoz, 2013).

4. THE ROLE OF NEOGEOGRAPHY AND THE WEB: THE DEVELOPMENT OF NEW APPLICATIONS FOR EARTHQUAKE REPORTS

The World Wide Web (or Web 2.0), when incorporated with geographic information systems (GIS), can transform traditional geographic representation, manipulation and analysis beyond the 'standards' commonly used so far, thus extending the boundaries of geographic information science (Batty et al., 2010). The term Web 2.0 is commonly associated with web applications designed to facilitate interactive information sharing, interoperability, user-centred design and collaboration on the internet. Examples of Web 2.0 include web-based communities, hosted services, web applications, social networking sites, video sharing sites, wikis, blogs, mash-ups, and folksonomy (electronic tagging). A Web 2.0 site allows users to interact with other users or to change website content, in contrast to non-interactive websites where users are limited to the passive viewing of information (Batty et al., 2010). In 2006 Eisnor defined "Neogeography" as a different set of practices that operate outside of, or parallel or similar to those of professional geographers (Eisnor, 2006).

Rather than referring to scientific standards and methodologies, Neogeography heads towards the intuitive, the expressive, the staff, the absurd and / or artistic, but may simply be the application of 'real' geographical techniques (Turner, 2006). This does not mean that such practices are not also in use in geographic and cartographic sciences, but they usually do not conform to the protocols of professional practice (Haklay et al., 2008). Some governments collect geographic information on-line by the citizens, based on their observations relating to the needs or local problems (Ghose, 2003).

In recent years digital spatial datasets are being created thanks to the rapid increase in the number of mobile smart phones, digital cameras, and other handheld devices. These devices are using global positioning systems (GPS) technology to provide users with information based on their location or enable them to add the location information to other media, such as digital photographs. The Geotagging allows users to include content on-line information on the geographical location, described in both formal terms as in geographical coordinates and linguistic descriptors such as place names (Gartner et al., 2007). These developments contribute to a phenomenon that Goodchild (2007) and others (Sui, 2008) have called "Volunteered Geographic Information" (VGI): digital spatial data that are produced not by individuals and institutions formally recognized as producers of data, but rather, are created by people who use the tools described above to collect and disseminate their views and geographical knowledge (Elwood, 2008).

Today, the wide use of electronic devices constantly connected to the web provide geo-referenced information have resulted in the production of a wide range of spatial information. This trend has led to a "Wikification GIS" (e.g., geograficamente.wordpress.com), where mass collaboration plays a key role in the context of spatial information (hardware, software, data and people). Miller (2006) and others have described how the citizens of New Orleans have used a mapping platform together with Google Maps in order to publish information about local conditions that needed relief after Hurricane Katrina.

Williams (2007) illustrates how content-enabled spatial data could provide new information about local needs, using, as an example, how a rapid increase in complaints about the presence of rats might indicate a problem with waste collection. Activists around

the world are using the services of geo-visualization on-line to create new forms of a political language, communication and network, often spreading information that the authorities might be trying to cover (Miller, 2006; Gharbia, 2007; Zook and Graham, 2007).

Similar tools could also be useful to improve the perception people have on earthquakes and to know the reactions of young people and adults when a seismic event happens. The confirmation that the so-called "participatory science" is an important, low-cost tool that is complementary to research comes from a study conducted by the U.S. Geological Survey (USGS) (http://www.usgs.gov). At a global level, the number of sensors used for earthquake detection are few, when compared in proportion to territory; this means that communication signals can take about several minutes before they can be processed by a research center.

Dedicated smart phone applications (apps) for earthquakes typical feature a user questionnaire called "Did you feel it?" such as that of the USGS (http://earthquake.usgs.gov/), then Seismic Monitoring & Research Unit of the University of Malta (http://seismic.research.um.edu.mt), and the Italian "Hai sentito il terremoto?" (http://www.haisentitoilterremoto.it). These questionnaires allow citizens to report the experience of any felt earthquakes. The introduction of these services are cost effective and prove to be a good solution to be integrated into traditional networks. The reporting of an earthquake through mobile phone or Internet also becomes a tool of psychological support for an individual who strives to identify some positive aspects to serve as consolation, thus enhancing resilience. In fact, the resilience is important for what concerns the scope of his ability to effectively manage stress and daily difficulties, and in this case, a very traumatic event like earthquake.

A popular real-time earthquake information website is provided by the European-Mediterranean Seismological Centre (EMSC, http://www.emsc-csem.org), well known in the Euro–Mediterranean region. It attracts an average of 1.5–2 million visits a month.

Flash sourcing is a new approach used by researchers based on the real-time detection from the monitoring of traffic surges observed on a specific website, in this case that of the EMSC website after a widely felt earthquake (Bossu et al., 2008, 2011), Such internet traffic surges are common on rapid earthquake information websites (Wald and Schwarz, 2000; Schwarz, 2004, Agius et al., 2015). In the first minutes following the magnitude 5.8 earthquake in Mineral, Virginia, (17:51 UTC on 23rd August of 2011), by considering website visitors as earthquake sensors, researchers were able to locate the epicenter within 30 km accuracy. This supports the hypothesis that the traffic surges observed immediately after the felt earthquake were caused by eyewitnesses who felt the ground shaking and rushed onto the Internet to search for information about the earthquake. Identifying a higher ratio of the number of new visitors to the number of inhabitants could discriminate localities where the public is alarmed by the shaking (Bossu et al., 2014).

More studies are needed to evaluate whether the intensity above which people become alarmed changes as a function of the frequency of felt earthquakes; researchers speculate that the more frequent earthquakes are felt, the higher the level of shaking is needed for the public to become alarmed. The flash-sourcing approach does not replace any monitoring techniques or any macroseismic studies, but it does give insight on the public reaction to a significant earthquake. As such, it could probably help to better target awareness initiatives and communication of earthquake risk, and might provide new insights into the reporting of historical earthquakes (Bossu et al., 2014).

CONCLUSIONS

Defending ourselves against natural hazards is possible, however, to achieve concrete results it is necessary to put in place interventions and conduct proper activities in an organized and coordinated way. In fact, prevention aims to minimize the damage and casualties, and takes into account the knowledge gained in foresight activities. This is implemented through active or passive interventions on the environment, building, and also on people's behaviour during emergencies crisis (e.g. information and educational campaigns). Of particular importance is the development of emergency plans. For example, for municipalises in Italy they represent an operational tool for the planning of actions to be undertaken in the event of a crisis. The plans also identify population assembly points for their temporary settlement or any further actions (e.g. evacuation of an area towards another). The emergency plans are based on expected possible scenarios and/or existing historical information. The more the information is numerous and precise, the more realistic scenario will be defined and better planning of emergency activities can be taken. The emergency plan must also report possible precursory phenomena of the natural event expected (Peppoloni, 2014).

In our study we analyse the response to a questionnaire provided by young students living in two distinct regions, Calabria and Malta. From the responses it is clear that a high percentage of students do not know if there is a municipality have an emergency plan. This can be considered as an alarming situation that merits consideration. It would be appropriate to increase information campaigns and awareness in schools through lectures and seminars focusing on risk reduction. Appropriate risk mitigation, leading to the progressive reduction of the effects of a disaster can cause to humans, buildings and the environment can be scheduled by acting on different temporal levels: short-term actions by planning an announcement or warning; in the medium term by monitoring the phenomena, the preparation of emergency plans and the creation of works of soil conservation; long-term by acting on urban and territorial factors that directly affect the vulnerability of environmental contexts, developing security policies and regional knowledge, and disseminate information and education to the public and in schools. The main goal of prevention activities is to promote the study of natural hazards and associated risks in the school aiming to teach on how to react to such kind of phenomena.

The development of a social conscience in this research field requires the involvement of each school. It is a task that has been often ignored by educational entities, failing an essential regulatory statement. In addition, the use of participatory mapping allows a direct involvement of the student, who voluntarily contributes to the creation of geographic content. The ubiquity of global positioning systems (GPS) and mobile devices, interactive mapping tools and social networks has the potential of creating the next generation of mapping.

An application for mobile devices that collect user reports in the case of an earthquake could be of important interest to seismic networks that compile and process such information to be used for the study of future seismic events. It is crucial to stimulate the population by acquiring individual and social behaviour, positive to reduce the risk. For example, the impulsive attitude of students, examined in this research, to go out immediately when they experience a tremor is a negative behaviour that needs to be corrected with specific educational interventions.

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