A matter of buildings.
Damage to material elements of landscape and uncertainties about the future after the Pianura Padana earthquake (May-June 2012)

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Abstract

The Pianura Padana earthquake caused heavy material damage to a relatively wide and composite geographic system. Cultural heritage was also seriously affected by the earthquake; several landmarks in the area were lost. Large buildings, including socially relevant ones, will not be used any longer either because destroyed in the seismic sequence or because repairing of suffered damage is not feasible or cost-efficient. Beyond the immediate economic and material consequences of the disaster, therefore, the earthquake induces non negligible changes in the region’s landscape. Although the problem appears to be limited to technical and economic evaluations, it turns out to be important from the standpoints of cultural and social geography as well. Any change in spaces brings about changes in the way they are perceived and felt by inhabitants. In other words, according to the well-known Yi Fu Tuan’s interpretation, any change in spaces implies a change in places. The Pianura Padana earthquake caused a tragic toll of victims and heavy impacts on local economies; but it also determined conditions which will affect, in the medium and long run, some views that people in the area will have about places of their daily life. Strange as it seems, in the final analysis this change in views, that is to say, something intimately geocultural in nature, depends upon the fact that some structures could stand the earthquake stresses better than others; or that some structures – even unique landmarks – were not fitted with strengthening equipment to upgrade their seismic-resistance capabilities. The sense of a belonging to a place and a community is something deeply immaterial and intimate. But it does depend, in a certain degree, on the perception that individuals and groups develop about the material elements surrounding them. In some cases, therefore, some part of the amor loci may become a matter of buildings.

Keywords: Post-Earthquake Survey, Oblique Aerial Imagery, Cultural Geography

Between May and June 2012 a relatively wide region of the Pianura Padana was struck by a seismic sequence. The main-shocks occurred repeatedly between May 20th and June 3rd, but the sequence continued with lower energy throughout the summer. Over 2,400 earthquakes were detected in the area by the Istituto Italiano di Geofisica e Vulcanologia (INGV). The damaged area, spanning over 50 kilometers east-west and about 20 kilometers north-south,
includes portions of three Italian administrative regions1 and six provinces2. The strongest shocks (5.9 Richter on May 20th3, 5.8 and 5.3 on the 29th4, 5.1 on June 3rd5) caused 27 fatalities, over 300 injured and about 16,000 evacuees (Casagrande, 2012). As of this writing, a few thousand people are still waiting for new permanent accommodation after having lost their homes.

As a resident in the area, I personally experienced several moments of the events. As a researcher in geography I also visited and surveyed several sites in the area, both during the days of the earthquake and in the following months. Some surveys were conducted with the aid of micro-UAVs. Four additional aerial-photography missions for lab documentation were flown using a micro-light aircraft. This survey methodology, described in a previous work of mine (Casagrande, 2011) is particularly simple and effective for a qualitative comprehension of several geographic phenomena.

The earthquake affected, overall, at least 800,000 people in over 100 townships. Between May 20th and July 27th, firefighters conducted a total of 63,067 basic inspections to buildings in the three regions (Dipartimento della Protezione Civile, 2012). National and regional Civil Protection operators documented over 37,475 building inspections according to the AeDES procedure5 in the Emilia Romagna region. The latter produced a relevant conclusion: about 36% of said total was classified usable, another 36% unusable and the rest was usable or recoverable under specific technical conditions6 (PCER, 2012).

The earthquake took most of the population in the area by surprise. The region was known to have a moderate seismic potential and in the past 600 years (CPTI, 2011) several major earthquakes had occurred. Furthermore, over the past thirty years occasional earthquakes caused minor damage in neighbouring areas. Nonetheless, a widespread opinion arose and a consolidated one also that no dangerous earthquake could occur there. Such idea, taken for granted by the population through at least four centuries, led to specific, material consequences in how “reification” (i.e. the process of materially shaping the landscape) was managed. In particular, for many years before new requirements were established by law, little attention was paid to designing and constructing buildings so as to fit them with specific seismic-resistant morphological and structural features. In several cases of damaged architecture experts ascertained the lack of basic elements for strengthening and protecting the structures from seismic shocks. They just seemed to not belong to the building tradition of the area; and this in spite of the fact that such elements were typical in other parts of the Italian peninsula, where the population was more accustomed to dealing with seismic phenomena (QUEST, 2012, p. 5).

Many large buildings in the area were constructed, until a recent past, featuring structural configurations and geometries which would not be adequate to stand strong earthquakes. It is worth noting that even when the issue had become more and more evident as engineering, geophysics and architecture progressed, the widely shared idea that seismic

1 Emilia Romagna, Lombardia and Veneto.
2 Provinces of Modena, Ferrara, Bologna and Reggio Emilia (Emilia Romagna), Mantova (Lombardia), Rovigo (Veneto).
3 Recorded by INGV at 04.03’52” local time on May 20th. The shock originated at a depth of 6.3 kms with epicenter in Finale Emilia (Modena), coordinates 44,889 N; 11,228 E.
4 INGV recorded an earthquake at 09.00’03” local time on May 29th. The shock originated at a depth of 5.8 kms with epicenter in Medolla (Modena), coordinates 44,851 N; 11,086 E. Three other major shocks occurred between 12.55’57” and 13.00’25” (5.3, 4.9 and 5.2 Richter) with epicenters in proximity.
5 AeDES (Agibilità e Danno nell’Emergenza Sismica, i.e. Usability and Damage in Seismic Emergency). AeDES procedures allow appropriately
6 PCER 2012 presented the following data: 17.53% of the considered buildings was temporarily unusable, but usable with provisional repair; 0.55% temporarily unusable, to be examined in more depth; 4.23% partially unusable; 5.47% was unusable due to an external danger.
events in the area would not be relevant did in fact delay or prevent the deployment of safety upgrades. As I will try to demonstrate below, this produced two different, distinctive consequences: the first one involves mainly human and economic geography; the second one social and cultural geography.

Let us now focus on the first outcome of the earthquake, dealing with human and economic geography.

When the 2012 earthquake struck, a large majority of collapsed or seriously damaged structures were industrial facilities, towers, castles, churches; but also other kinds of large buildings such as hospitals and schools. Two consequences are worth noting: the first one is that partial or total destruction of primary landmarks and monuments caused major losses in heritage of the past; the second one is that by damaging or destroying industrial facilities and production sites, the earthquake struck one of the crucial elements for present-day communities’ life. Besides direct damage, long term economic impacts will also follow. In a highly tertiary economy, as the one involved, many services may be jeopardized if some among the most valuable portions of the urban areas become unusable.

It is important to notice that if more conservative approaches had been followed with regard to the seismic resistance of large buildings, some of them might have suffered less damage. This would have ensured protection, on the one hand, to precious pieces of historical heritage; on the other hand, to some of the most valuable nodes of the economic system. Both types of assets were in fact “pillars of excellence” for the area at different scales in the national and international contexts. Such excellence is now being questioned due to concerns about the region’s ability to recover.

Damage to historical heritage and production facilities are two aspects of the earthquake with an enormous impact on economic life. Surprisingly, both problems were triggered by a cause which appears to be a minor one, from a geographic standpoint: the lack of anti-seismic features in large buildings.

Such kind of protection, although expensive in itself, would have been cheaper than the currently planned interventions to reconstruct or reactivate damaged buildings, not to mention the fact that some of them are lost for good, either because their violated unicity (monuments) or because they were centers of activities which are now being moved somewhere else (industries).

As far as houses and residential buildings are concerned, the case is quite complex and somewhat different. Old structures in historical areas within towns and cities suffered damage and collapse. The number of recent buildings which collapsed totally or partially is high only in a few locations near the epicenters of the strongest seismic shocks. Considering the whole area struck by the earthquake, most recent houses and buildings survived with moderate, minor damage or no damage at all. In several cases, structures were assessed to be damaged beyond repair so demolition is planned; nevertheless they survived a long and relatively violent seismic sequence without catastrophic collapses. This circumstance did yield the fundamental outcome of a low number of fatalities and injured. From the standpoint of public safety this is a very important fact, possibly an indication that residential architectures, although not technically anti-seismic by design, were built for decades according to good concepts and accurate construction techniques: this might have played a role in giving them some degree of natural seismic resistance.

After a general review of the reported effects, the following conclusion can be drawn. In comparison to other strong earthquakes in Italy, this earthquake took a relatively modest toll of lives and caused heavy material damage. The latter determined failures in the economic system of the area, although it did not determine a general catastrophic collapse. This circumstance, along with a vigorous reaction of local operators towards quickly resuming their activities, gave publicly the impression of an earthquake causing only a few victims and moderate damage. If the first belief might be true, at least from a statistical point of view, the second one is not. As a matter of fact, material and economic damage is extensive and will take a long time to recover; active participation by the European Union and the national Italian government with material and financial aid is
required, or the initial resilience shown by the region’s economic system will run out of resources (Confindustria, 2012).

Let us now focus on the second consequence of the earthquake, i.e. the one related to social and cultural geography.

Landscape in the stricken region is likely to change significantly; and so is the people’s perception of the places they live in. With particular regard to buildings, a first obvious comment is that some of them have a more or less high social relevance depending on their nature and functions: once a specific building is eliminated, its functions might not be fully recovered. In some cases there can be a correspondence of newly constructed buildings to the old ones. In many other cases, the spaces left empty by the old building are just re-allocated for “a new thing”. In addition, buildings and spaces used by any population exist in the context of a landscape, of which they are, in turn, components. Both individually and as a complex they serve as material referents that the community perceives, shares and – so to speak – “breathes” in everyday life; a significant part of socially-shared symbolization is linked to this network of referents (Vallega, 2010, pp. 82-86). This suggests that any future development of “reification” will impact on the intellectual control and, possibly, on the social perception of space. In other words, given that a community lives and feels its land through experience (Tuan, 1977) a change in spaces will probably produce significant changes in places as well (Calandra, 2012).

Furthermore, if “organization” of production spaces (for farming, industry etc.) within a certain area was traditionally established according to specific features, at a certain point this might become a socially-shared way of “doing” and “thinking” spaces even beyond technical or operational needs. This means that a landscape which was originally “constructed” based on material needs, may become, after a sufficiently long period of time, a cultural and social combination of places whose general appearance marks the identity of a community.

Many traditional production spaces and buildings, along with significant pieces of cultural heritage have become somewhat “minor” landmarks whose widespread presence in the landscape before the earthquake did effectively identify a specific subregion of the Pianura Padana. A dramatically large number of these buildings collapsed partially or totally during the seismic sequence; many others will be torn down and eliminated. As can be easily understood, the very nature and history of these buildings make it possible that no detailed documentation about them exists.

A particularly effective example of the statements above can be found in Cavezzo, a town in the province of Modena, with about 7,000 inhabitants. It is the highest ranking location in terms of macro-seismic in the INGV QUEST team assessment. The historic center of the urban area is surrounded by fairly wide recently constructed expansions. Other small settlements lie within the municipality’s borders. The farming tradition of the area is widely indicated by the presence of many rural houses, warehouses and utility buildings. Many of these structures collapsed during the earthquake and are now visible as ruins. We flew over Cavezzo three months after the earthquake. In spite of some persisting seismic activity, works were in progress to ensure the safety of the damaged buildings and to conduct major demolition in the center of the town. In the aerial view, at first sight the town showed isolated spots of debris in an otherwise apparently intact urban setting. A careful study of images revealed indications of much wider problems: large cracks, provisional fences around structures were evident. In some buildings, the window shutters closed at mid-day indicated no current human presence inside. A simple ground-truth visit in Cavezzo confirmed an astonishing reality. A surprisingly high number of buildings downtown was so seriously damaged that even the worthiness of their repair is in question.

It is clear that in the near future some traits of that landscape will be changed by people much more than they were changed by the earthquake.

This kind of evolution is nowadays in progress at every corner of the geographic zone struck by the seismic sequence. Paradoxically, the relatively rapid re-start of activities in the areas of Emilia Romagna, Lombardy and Veneto which are striving to get back to “normality”
pushes the evolution forward. In the past six months many industrial and production activities abruptly interrupted by the seismic sequence were resumed; most of the tertiary sector even in the most heavily damaged areas went back to work. Meanwhile, these very actions are showing us the first examples of “places of after” which will replace, in the daily life and amor loci of the communities, the feeling of the “places of before”.

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References

Figure 1. The “Ceramiche Sant’Agostino“ industrial building collapsed at 4.03 on May 20th, taking the lives of two workers in the night-shift (Sant’Agostino, Ferrara). The facility was one of the plants operating in the area for the production of ceramic components and tiles. Photo: GREAL.

Figure 2. Collapsed buildings in the Mirandola (Modena) industrial district. Mirandola is a famous manufacturing area for biomedical instrumentation. Several plants in the whole earthquake area moved materials and activities from the damaged structures into provisional shelters such as tensile structures. One of them is visible in the photo. Photo: GREAL.
Figure 3. Mirandola. Damaged buildings surround the collapsed San Francesco church. The masonry structure failed catastrophically during the May 29th main-shocks.
Photo: GREAL.

Figure 4. Downtown Concordia sulla Secchia (MO). Buildings in this area are very old masonry structures; many of them suffered partial or total roof collapse. Window shutters are closed in most of the visible buildings and there are no pedestrians nor cars in the streets. Since the picture was shot at 9.50 AM on Monday August 6th (a working day), the element suggests that almost all the blocks visible in the picture were deserted by inhabitants at the time.
Photo: GREAL.
Figure 5. Disvetro is a hamlet in the township of Cavezzo (MO). The image shows two buildings of social relevance in the area: the church, well recognizable although almost destroyed by the May 29th shocks, and the school (top right), apparently intact but severely damaged. The school catalyzes much of the inhabitants’ attention and public campaigns are being conducted in these months to ensure that a school will be put into operation at Disvetro, without being delocalized somewhere else. The church, a typical rural religious landmark of the area was sided by a now disappeared bell-tower; large wooden-beams, from the collapsed roof are still leaning against the left side wall. Debris of the ruined parts lie outside and inside the building. In such conditions, a restoration attempt could well be beyond feasibility. Most of the other houses visible in the image are deserted or declared unusable.

Photo: GREAL.

Figure 6. The historical center of Cavezzo shows extensive damage. In the foreground, debris from two houses grounded by the earthquake and demolition. Traffic visible outside the core of the town is clearly absent in the main square. Buildings around it suffered evident lesions, partial failures.

Photo: GREAL.
Figure 7. The San Felice sul Panaro (MO) castle was one of the most important landmarks for this town, dating back to the age of the Estensi. The structure had been recently restored when the strongest shocks of the seismic sequence struck it repeatedly. The three minor towers collapsed and the rest was so badly damaged that the authorities were making arrangements for the demolition of the entire building. An emergency consolidation saved the castle. The grayish traces visible on the walls are the chemical fillings injected into the largest cracks. Attentive examination of the image reveals evident mis-alignments among different parts of the walls.

Photo: GREAL.

Figure 8. After demolition and removal of debris, the site where the Camposanto (MO) kindergarten stood became an empty space. A playground and the emergency stairs, oddly standing against nothing, will keep a memory of the original function of the area for a brief time.

Photo: Riccardo Paioli (December 13th, 2012).
Figure 9. Camposanto (MO). Slightly over six months after the earthquake, what used to be the town soccer playground became the site of the new school, built from prefabricated modules. The new building was inaugurated just a few days after the regular school-year begun and is now fully operational. If necessary, the structure could remain efficient for two or three decades. In that case, it would become a “landmark of experience” for one or two generations of pupils. None of them will share, as the previous three generations do, memories of the school that existed before.

Photo: Riccardo Paioli (December 13th, 2012).