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THEORIES AND MORE THEORIES

The Research Project

The San Lorenzello case study provided an opportunity to test one of the first "theoretical" products to come out of the Network's activities: the grid for analysing global vulnerability developed at the seminar on the vulnerability and protection of historic centres in earthquake zones held at Ravello in December 1987. But before operations began in the field it was deemed appropriate to perform some of the conventional analyses of the "physical" vulnerability as well.

When this grid was applied to the case of San Lorenzello it at once became clear that additions were needed. The seismic behaviour of buildings cannot be totally understood unless analysis encompasses the context, the site of the building, the available resources and the needs of the community; this is because the technical details need to be understood better, but also because buildings have been constructed, modified and used in response to both exogenous and endogenous factors.

This integral approach led indirectly to a re-testing of the grid, in which its methodological principles were applied to a geotechnical analysis of the site, with a view to identifying the danger signs which are there today and were certainly known in the past, assuming that old centres were generally built in the safest area of the territory. In essence, the aim was to identify relevant factors other than the earthquake culture of the community, to reassess them and thus to reduce the system's overall vulnerability.

However, the theoretical plan had to be amended and redesigned several times in the course of our research work.

For example, it was thought initially that the proportion of the community's resources spent on maintaining buildings could be estimated from traditional indirect indicators of revenue such as tax records, consumer indices, etc. Since these were found to be unreliable and unsuited to our objectives it was subsequently decided to take the "visual aspect" of buildings as a direct and meaningful indicator of the factor we were interested in (cf. page 64). To explain an anomaly seen in San Lorenzello (why are window-sills always made in two parts?) the survey had to be extended to neighbouring towns (cf. page 76). And there was no shortage of explanatory theories which could not be verified or which prompted fresh theories.

The process of collecting documents was begun by a small group of members of the Network, who were at once joined by the municipality's technical department and then by the local cultural circle (the Laurentino historical society), local experts and retired masons.

One objective of the initiative was to get the community more and more involved, and in this respect the test was unquestionably a success.

But perhaps the most significant result obtained was the "spin-off". The Municipality of San Lorenzello drew up a Rehabilitation Plan for valuable rural buildings and implemented a variant of the Rehabilitation Plan for Historic Centres: on the one hand by insisting that the pursuit of knowledge of buildings as required by the Plans should be based on the grid and, on the other hand, by insisting that new town planning instruments should seek to modify the behaviour of the different players involved, rather than impose rules and constraints. In this way, measures taken will respect both the buildings themselves and the needs of residents and the community in general. This meant that the original theoretical grid had to be redrawn, since it had not initially been realised that town planning rules were a factor which could increase vulnerability.

Anyone who knows how contentious town planning measures can be will appreciate the influence which the Project had on the local system: the local administration spontaneously adopted a relatively novel plan for the protection of rural buildings and reworked a plan to rehabilitate the historic centre which was barely three years old.

The Research Project thus brought about concrete *changes* in the behaviour of the system.

The San Lorenzello case, then, took the form of a research project. The theoretical formulae on which it was based benefited from de facto testing against the system in place, which produced indicators for action and changes in the system as well as new hypotheses.

Step by step

The first step was to reconstruct the physical context of San Lorenzello as it is today and as it used to be. The influence of *geographical position and climate* on buildings is well known. To eliminate any possibility of error in interpreting the earthquake resistance features of local techniques, an analysis was made of the resources actually available in the past for housing construction.

The next step was to see if elements of an earthquake culture could be identified from the way in which construction sites were chosen. In the case of

visible sites this was relatively easy. Most of the danger signs identifiable today in the field were even more obvious in the past. And in an attempt to pick out from all the visible signs those which presented a real danger - the ones which were repeated in the most serious earthquakes - geomorphological analysis was completed by analyses of historical seismicity.

In the case of *invisible sites* however, this process of identification was harder. Given that geologists had to drill, record a gravimetric curve and study geographical maps of the entire region in order to reproduce a credible model of the subsoil, how on earth can the earliest human settlers have had any understanding of the realities?

In addition to an analysis of the physical context, an analysis was also conducted of the community, aimed at identifying from present-day *culture* and *customs* those permanent features which doubtless existed in earlier times and which may have influenced building techniques.

Then, using the grid, we addressed the analysis of the buildings, analysing for each increase factor the level of understanding possible today, the level of understanding at the time of construction, etc. It was immediately realised that in order for studies of *techniques* and *materials* to be meaningful we needed to know how far the boundaries of construction had spread at the time of the major earthquakes. This explains why the historic centre was dated in relation to the major earthquakes rather than to changes in style, historic events, etc. Techniques and materials were thus recorded and identified in relation to the resources available at the time and to the earthquakes which occurred, in such a way as to highlight any significant pointers.

The same process was used to identify the commonest "types" together with the various additions or transformations which today make them virtually unmistakeable. In this way it was possible to trace the *construction history* of individual buildings and the architecture as a whole.

The damage caused by the different earthquakes was analysed to assess and compare vulnerability in bygone times to that of the present day. Earthquake historians reconstructed the map of *damage* caused by the major earthquakes, whilst the Municipality's technical department mapped the damage from the 1980 earthquake. At this stage of the Research Project, a first division was made into vulnerability factors arising from the *understanding of buildings* and those arising from the *behaviour of the community*.

Analyses and hypotheses were then considered together, in an effort to recreate the earthquake culture of the community by adding to the present-day culture those features of earlier cultures which were still valid. After analysing the *present-day earthquake culture* and the distortions and increases in vulnerability it causes, we sought to understand how buildings as a whole *react to seismic shocks* (identifying "dynamic groups").

The preliminary analysis of techniques and materials was then rounded off by an assessment of the differences in *economic value* between the various versions of a given technique.

The later stage of the Research Project recorded anomalies, that is to say elements for which there is no obvious reason, which are out of tune with the style of the building and the architecture generally or which have been added at a later stage.

Comparison of the map of anomalies against the map which dates buildings in relation to the timing of earthquakes and the map of techniques and materials enabled a first selection to be made, whereby anything anomalous in the entire catalogue of town planning and architectural features could be picked out. Then, by comparing those anomalies against the *vulnerability factors* obtaining in old buildings, it was possible to distinguish between those anomalies which certainly were designed to provide reinforcement or protection against earthquakes in some way and those which fulfilled a similar function but were there for the convenience of the inhabitants. For other anomalies no plausible explanation was found, or they were explained by theories which remained unconfirmed.

The documentation assembled in this way was put before the specialists meeting in San Lorenzello and

Ravello. This enabled corrections to be made, facts to be confirmed and comparisons to be made with similar cases, but above all it provided pointers as to how subsequent work should proceed.

The approach followed was thus a cyclical one, typical of research projects, which actively involved the community concerned. This formula proved essential in revitalising earthquake cultures. The information which was gathered on different techniques and the origin of anomalies, on memories and traditions, current terminology, etc. proved an invaluable aid to understanding why buildings were built as they were and thus rediscovering knowledge of earthquakes which had long been forgotten.

But the search for information does not in itself guarantee that the local culture will be revived. It is merely a different way of exploring bodies of knowledge from which the clever technical expert will then extract knowledge which is not otherwise classified, such as information on "vernacular" matters.

But if we underpin traditional practices by a rigorous theoretical base and involve users, if the resulting dialectical situation can identify the difference between what residents actually want and what the dominant models of the living environment impose on them, if the technical expert can come up with housing improvements which respect the integrity of the buildings concerned, this gives rise to an exciting exchange in which the technical expert acquires a new understanding through the "rules" he discovers little by little, and the user selects from the vast range of traditional techniques those which are most suitable (either because they are vindicated by scientific analysis or because they allow him a more comfortable lifestyle).

A process of osmosis thus operates which not only helps to rediscover the earthquake culture but also favours the intelligent re-use of old buildings so that they can perform their essential function of continuously adapting to the requirements of new users.