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BUT WHAT IS "LOCAL EARTHQUAKE CULTURE"?

Everyone accepts that local building methods in earthquake zones may vary according to the balance between specific needs and available resources, but they generally incorporate special features designed with earthquake resistance in mind.

Recent disasters have shown that most damage to buildings results from failure to include these technical features - which are deemed to be obsolescent or known only to the experts - and from legislative constraints which create unnecessary extra cost. In plain terms, the local culture seems to have lost its former understanding of earthquake resistance methods and specifically of their effectiveness.

The result is a perverse process of impoverishment of the community, culturally to begin with but then materially too, culminating in situations which appear to be but are not really paradoxical: the "experts" feel useless, whilst the "technicians" passively implement rules and methods whose purpose and sense eludes them; the whole community, after gradually delegating to the technicians skills which were formerly commonplace, becomes more and more suspicious of them.

Consequently, ordinary privately owned buildings, which are not monuments or in the public domain and thus do not qualify for any institutionally organised restoration measures, tend to become even more vulnerable: they are unlikely to receive any preventive or systematic assistance, and are far more likely to suffer inappropriate modifications or repairs.

So if effective protection is to be ensured it is necessary not only to define and popularise the best possible earthquake resistance techniques but also to get the local community to identify, master and ultimately to apply spontaneously "its own" techniques, techniques which have been tested in every earthquake the community has experienced and are thus probably the ones best suited to the local system.

But how do we identify these in buildings which have been changed through centuries of use? How do we identify and measure the antiseismic effectiveness of things which became "decorative" as the memory of the earthquake faded and with it the understanding of their original purpose?

It is of course essential to understand old buildings if we are to protect them. But whilst those who specialise in historic centres may conduct historical, stylistic and economic analyses which are exceptionally well researched and thorough, they rarely use interdisciplinary methods. Methods of the kind which enable archaeologists to chart the history of long-vanished communities using mineralogical analysis of pottery shards, or which enable the location of ancient caves to be pinpointed or various craft techniques to be understood from the chronology of inscriptions, data on trade, etc.

Even where it is all-embracing and deep, an understanding of the architecture is not in itself enough to reconstruct the local earthquake culture or improve its protection. Deterioration occurs firstly as a result of inappropriate action and secondly because regular maintenance is not carried out. The way in which a community uses (and re-uses) its buildings is a major feature of the system's earthquake culture.

It is clear, then, that identifying the local rules for earthquake control is an essential, though not fully adequate, requisite in reducing the vulnerability of the system. If the community has no reason to care about maintenance (because housing is rented, for example) or if it does care but that concern proves incompatible with architectural features (for example where gateways need widening to make garages), the result is neglect or decay which ultimately has implications for vulnerability. But as long as preventive structural measures remain the responsibility of property owners and reconstruction the responsibility of the authorities, it is obvious that no preventive programme will work, given the reluctance shown by property owners.

The protection of cultural heritage is thus a complex issue, not only in terms of techniques but above all in terms of policy and management. If a project is to be effective we must look not only at its target but also at factors which determine the behaviour of the players involved. The topic of the vulnerability of cultural heritage and the protective measures required must therefore be addressed via a systemic approach, relating analysis and projects to the local "system" which comprises not only its architecture (with its morphological and technical features, etc.) but also the community which uses it (with its culture, ways of doing things, financial resources, etc.).

With this in mind, if the community is to be encouraged to rediscover its "earthquake culture", it is important to adopt methods which involve it actively. And if methods and findings are to be transferable and more widely applicable, it is vital to have an exact definition of the concept of "local earthquake culture".

But what is meant by "earthquake culture" today? In earlier times? What must we relearn in order to make the system less vulnerable? How do we do that?

And once we have identified the necessary techniques, how do we persuade the community to employ them? How do we persuade it to carry out continuous maintenance rather than sitting back and waiting for an earthquake to happen or choosing solutions which are supposedly once and for all? Once these questions are answered we can move on from a global approach to a more specific and more rigorous method.

The Research Project's "systemic" approach enabled us to define a community's earthquake culture as "the totality of understanding (of the characteristics of a seismic shock, of the way in which ground and buildings react, etc.) and of resulting behaviour patterns."

This highlights the objective and subjective factors which influence our understanding of buildings or the behaviour patterns of communities and which, by helping to shape the earthquake culture of the local system, may heighten its "physical" vulnerability, the vulnerability which stems from architectural features: wall thickness, quality of materials, etc.

One of the most important factors influencing our **understanding of architecture** is without doubt the ability to predict how buildings - and especially all the buildings in a given place - will react to stress. Today our understanding of buildings and their vulnerability, depend on whether subsoils, soils and buildings can be simulated using credible structural models. Generally, when analysing vulnerability, structural models of buildings are used primarily to assess stresses in the event of seismic shock, compare them with the maximum resistances of materials and thus to deduce how safe the whole structure is (this helps to define the parameter of "vulnerability").

But it is not always necessary to define vulnerability and/or the degree of protection in absolute values. It is enough to trace the "seismic history" of buildings which provides proof of their resistance. The vulnerability of buildings can be reduced by simply reinforcing the existing structures, even though one cannot then measure their resistance in terms of numerical parameters.

But the way in which techniques, including empirical techniques, are perfected depends very much on our understanding of how buildings behave during a seismic shock. Simulation techniques, now in common use, can solve only some of the problems, since their results are valid only where the model used is sufficiently representative of structures as a whole. In the case of cultural heritage it is obvious that a faithful model of the object to be reinforced cannot always be constructed (modified walls, imbricated buildings, etc.). Moreover, modern researchers tend to use abstract models, in order both to understand the dynamic behaviour of structures and to define the lines along which their projects should proceed. It is thus clear that the feasibility or otherwise of representing the structure by a credible structural model will certainly have repercussions for the community's earthquake culture and thus for the vulnerability of the system.

Another factor which has implications for understanding and vulnerability is the identification of techniques and materials.

Clearly, the more we know about these the easier it is to integrate them into the model and/or devise satisfactory action programmes.

When identifying materials and techniques it is also a good idea to estimate their intrinsic value compared with contemporary materials and techniques. This will make it easier to compare any damage with damage seen in buildings constructed using similar but inferior techniques, and to draw from that any conclusions useful to the project (does damage to a building stem from the fact that the technique used is inappropriate or from poor-quality materials or bad workmanship?).

Another factor which increases vulnerability is the changes which are known or can be seen to have been made to a building over the ages. It is most important to know the history of any modifications to a building, as this will help not only to choose the right measures to strengthen or repair it but also to ensure that the project proceeds along the right lines.

Then there is a second group of factors which influence the **behaviour of the community** and thus the vulnerability of the system.

The first and by far the most decisive factor is who owns the building concerned. Probably the degree of care invested in analysis and action will be greater or smaller depending on whether the building is in the public domain, state-controlled or privately owned.

The use to which buildings are put is also something which can markedly increase their vulnerability. The stress to which buildings are subjected over the years will be different depending on whether or not they are used as originally intended, or whether they have fallen into disrepair.

Another aspect of the community's behaviour which affects the vulnerability of the system is of course *total spending on maintenance.*

Similarly, the way in which measures are administered affects vulnerability. Quality control is better or worse depending on whether measures are publicly administered, or directly or indirectly controlled.

Town planning and earthquake control regulations are paradoxically a factor which can adversely affect vulnerability. The problem clearly arises when these are too lax or inappropriate, but also when they are too inflexible or too restrictive. Where this is the case they push up the cost of any measures and prevent old buildings from being adapted to present-day needs; this leads to behaviour patterns on the part of the community which heighten vulnerability further.

By way of an example, where a rehabilitation plan insists on "typological conservation" it is impossible to adapt older units, organised in terms of a vertical plan, to present-day needs. This older plan catered well to the needs of the time (the sequence of stable-kitchen-bedroom reflected the production structure of the age and saved energy). But it is incompatible with the rhythm and pattern of present-day living. Thus the system's reaction is either to move out of the historic centre (unless property values there are high) or to make any desired changes illegally. In both instances, the buildings are made more vulnerable.

By identifying the factors which determine people's understanding of buildings and the behaviour patterns of the community it is thus possible to plot a kind of "grid" which analyses any objective and "physical" increase in the system's vulnerability occasioned by the earthquake culture of the community.

A "theoretical" seminar of the PACT Network (Ravello, December 1987) carried out a first summary test of the methodological value of the grid. All the experts agree - though they rarely express it systematically - that the problems entailed in protecting archaeological ruins, monuments and more recent historic buildings are not comparable.

This claim can be objectively and rigorously proved if one applies the grid to cultural heritage as a whole using a conventional scale of three levels of vulnerability increase as dictated by the system's "earthquake culture".

In our table, the grid shows the three categories into which all heritage items are divided. These categories show increases in vulnerability which are different, but homogeneous within each category.

It is readily apparent, for example, that historic buildings which are not monuments are the most likely to become more vulnerable as a result of the system's earthquake culture. All the factors cause a considerable increase in vulnerability, with the exception of use. Thus it is worth restating the principle that one of the best possible ways of reducing a building's vulnerability is to use it appropriately.

Naturally the grid does not claim to replace traditional analyses of physical vulnerability, but simply to complement them. It may provide further information which can be used in designing projects better tailored to the specific realities of the local

INCREASED "PHYSICAL" VULNERABILITY OF CULTURAL HERITAGE IN RELATION TO THE "EARTHQUAKE CULTURE" OF THE COMMUNITY

Degree of increase
- ° *none or small*
- \+ *moderate*
- ++ *large*

				CULTURAL HERITAGE					
				ARCHAEOLOGICAL MONUMENTS		HISTORIC MONUMENTS		HISTORICAL BUILDINGS	
			INCREASE FACTORS	*level of understanding/uses*	*incr.*	*level of understanding/uses*	*incr.*	*level of understanding/uses*	*incr.*
SEISMIC CULTURE	FACTORS THAT MAY INFLUENCE	UNDERSTANDING OF THE BUILDING	modelling	simple	°	usually possible with varying degree of difficulty	*	possible only in individual cases	++
			identification of techniques & materials	easy	°	nearly always possible	+	not always possible	++
			value of techniques & materials	high	°	higher than normal	+	not always good	++
			events in history of buildings	known or easily checkable	°		+	hardly ever known, hard to reconstruct	++
		BEHAVIOURS OF THE COMMUNITY	ownership	Public institutional	°	mostly public or institutional	°	mostly private	++
			use	no longer used	++	nearly always used, though not always for original purpose	°	still used, though rarely for original purpose	°
			resources available for action	usually sufficient	°	hardly ever sufficient	+	sufficient only in individual cases	++
			administration	public	°	public or under direct public control	+	nearly always private or under indirect public control	++
			town planning & earthquake control standards	applicable at authorities' discretion	°	exemptions possible if shown to be justified	+	no exemptions, even to improve comfort	++

system, especially where the customary aids to knowledge cannot be used, as we have seen.

Analysis of what makes up an earthquake culture shows, for example, that whilst factors influencing people's understanding of buildings can be corrected by education, those which affect the behaviour of the community are very much conditioned by local and central budgets and procedures. Furthermore, people's behaviour varies considerably depending on how likely they think it is that they will get what they want. For this reason a project which sought to recreate the entire earthquake culture of a system - understanding + consistent behaviour - would be a fruitless exercise if it did not at the same time address the nature of grants, supervisory procedures, etc. This first field trial thus confined itself to an exploration of what were the factors in the community's understanding of architecture, that is to say factors which prompt questions from the community which the experts can answer and which can thus be understood not only by them but by the community as well.

A change in the "behaviour" of the system was achieved, however: the municipality of San Lorenzello has initiated a campaign to preserve its global earthquake culture to best advantage using tools which will not only foster a better understanding of buildings but will also influence the behaviour patterns of the community.

Grants will be based on the cultural value of the buildings, and will cover the additional fees charged by professionals for adapting old units to new uses, the invoices of craftsmen who restore or reproduce typical features of old buildings, etc.