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REDISCOVERING EARLIER CULTURES

Catalogues and procedures

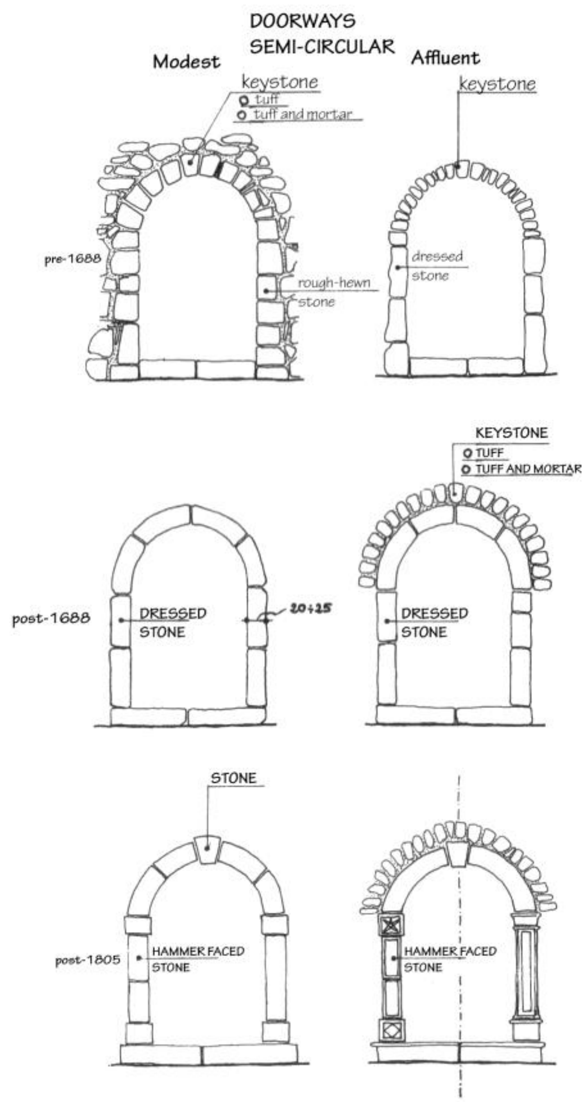
Obviously earthquakes are extremely good tests of methods and materials and as such generate innovations which reflect our expanding knowledge. This is how a community's earthquake culture comes into being. Then, as memories of the earthquake fade, awareness of the earthquake resistance function of certain measures fades too, as those measures are absorbed into everyday building practice and become part of the repertoire of ornamental architecture. This is an inexorable physiological process which helped earthquake culture to take root in the past but which makes it far more difficult in modern times to understand the full range of the earthquake resistance methods applied to a given building in earlier times.

And in reality things are ambiguous. Buttresses, wall bracing and tie-beams are all commonplace features which are virtually ubiquitous and help buildings to resist earthquakes, but they are also measures of general reinforcement.

But identification of standard methods from the outside, and the lists and monographs put out by the experts, are not enough to revive the community's earthquake culture. If the community's understanding of its architecture is to influence its behaviour (and if all this is to create an "earthquake culture") the community has to be encouraged to rediscover "its own" techniques. This objective can be more easily attained through a *standard procedure* whereby the local community can understand the *specific techniques* visibly recognisable in the buildings it uses, compare them with the resources and requirements of the time, and update them in response to the requirements and resources of the present time. This procedure reveals how a given community, in a given context, will have successfully combined immediate benefits (improved amenities) and future benefits (reduced vulnerability to earthquakes).

In San Lorenzello, for example, typological analysis of buildings and their location enabled us to trace the development of the "typical" doorway in relation to the main earthquakes which the village had experienced. It is easy to see how a hinged frame prior to 1688 gave way to a recessed door after 1688 and then to an improved recessed door after 1805.

It thus seems likely that the junction between jamb and sill was stiffened in the light of the damage observed in 1688 and that when the 1805 earthquake proved the worth of this solution it became an established part of the local culture. It subsequently evolved into a stylistic feature.



Anomalies

In San Lorenzello it was thought that the community could more easily rediscover its traditional earthquake resistance techniques if analysis of its "own" architecture was based on simple observations which made people think; in other words observations which were within the grasp of the layman and enabled him to work out why those techniques had come into being in the first place. Beginning, for example, with the identification of "anomalies", additions or features which had no obvious raison d'être or were not an integral part of the whole, or which were consistent in style but had differing variants over time.

We thus recorded all the anomalies and variants seen in masonry work, balconies and windows. We then marked them on the plan which describes the extent of the area of settlement at the time of the various earthquakes. By listing and siting anomalies in relation to the period when the buildings were constructed we found that variations in window and door surrounds are very probably the result of the gradual development of an earthquake culture within the community.

We did not learn enough about other anomalies, however, because each earthquake occasions repairs to and strengthening of the building fabric as a whole which overlie and obscure the previous structure.

We thus concentrated on those signs which chart the history of structures, namely additions and modifications. To ascertain which of them performed an earthquake resistance function we applied a "systemic" criterion. We assumed that everything done to buildings was prompted by the desire to improve the occupants' quality of life, by strengthening the building or improving its amenities.

On the basis of this criterion we divided the anomalies into three groups:

a) those which strengthen the building without improving or reducing its amenities, e.g. "contrast" arches between two buildings or tie-beams, which are inconvenient; buttresses or wall bracing which take up street space;

b) those which perform both functions, e.g. vaulted and covered passageways; staircases between two buildings; loggias and outside staircases, additions;

c) those designed purely to improve the amenities, such as added floors and widened doors and windows.

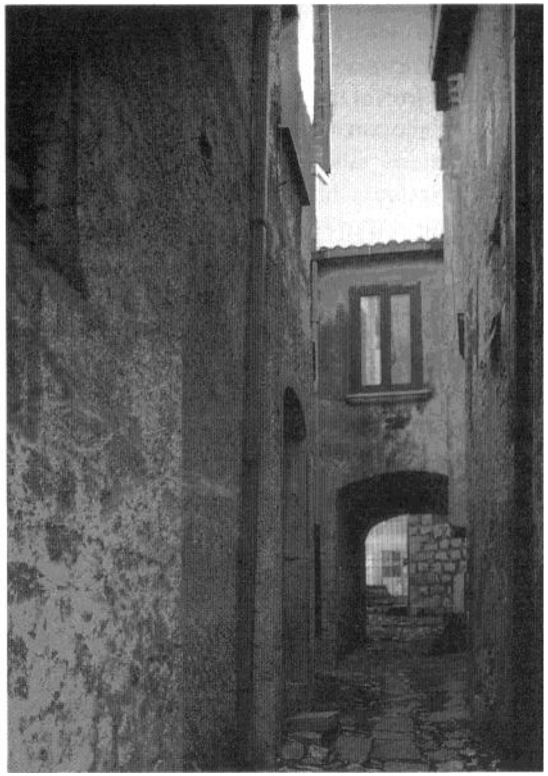
We also found that some anomalies can belong not just to one of the groups but to all three (e.g. sealed openings), whilst others, which we called "atypical" anomalies, seem not to belong to any of these groups (why, for example, are window-sills made in two sections?).

It appeared obvious that the community had and still has a sound understanding of the earthquake resistance value of certain reinforcing features. It is also clear, however, that it regards counterforts and tie-beams as old-fashioned compared to "modern" techniques (those required by the building codes and

ANOMALIES AS MODIFICATIONS TO BUILDINGS AND THEIR EFFECTS

EFFECTS ON BUILDINGS

	REINFORCEMENT ONLY (with reduction in amenities for village and family)	REINFORCEMENT PLUS IMPROVED AMENITIES	IMPROVED AMENITIES ONLY (bringing increase in vulnerability)
ANOMALIES	• "contrast" arches • Buttresses • bracing, angled or vertical • tie-beams	• Covered passageways • Staircases between buildings • outside staircases and loggias • extensions	• added floors • widening of coverings and doors • modification of structural elements



which were widely used after the 1980 earthquake precisely because they made a lot of money for the industries concerned). It is very seldom, though, that measures to improve amenities are perceived as dangerous in the event of an earthquake.

Something which has disappeared altogether is an awareness of the antiseismic usefulness of dual-purpose features such as vaulted passageways, stairways and loggias which are at best seen as "typical" village features.

To recreate the "architectural understanding" which is a part of the community's earthquake culture, we planned initially to restore those features which were lacking and to correct those features which had been changed for the worse. But we quickly realised that the resulting rise in awareness would have served no great purpose. Technical specialists might easily have explained the function of counterforts (which everyone knew anyway); they might have alarmed the population slightly by showing them the potential danger of adding floors and widening doorways (which does, after all, enhance the quality of modern-life).

But they might well have failed to convince people about the component which was lacking in the community's earthquake culture: dual-purpose features. In this case, since earthquake resistance value cannot always be identified with certainty, the sceptic will have difficulty seeing anything more than the obvious functional value of such features.

For this reason, if a deeper architectural understanding was to be translated into consistent behaviour patterns and thus a true "earthquake culture", it was essential to involve the community in the search for earthquake resistance values in traditional buildings. We also realised that measures could not be confined just to mixed anomalies or anomalies which constitute a danger.

We thus devised a procedure which we applied to all the anomalies and which enabled the experts to draw the attention of inhabitants to features which obviously had an earthquake resistance function, in such a way as to deduce from these features the criterion which the builders had followed and apply that criterion to the group of mixed-function anomalies, to identify those whose function was essentially one of earthquake resistance. The criterion could then be adopted as a parameter for assessing the danger posed by measures taken to improve amenities.

To check "objectively" whether dual-purpose measures were taken with earthquake resistance in mind, we checked the map of anomalies against that showing older vulnerability factors (corner doors, added floors, poor techniques, etc.). It seems reasonable to suppose that the greatest damage occurred at the most vulnerable spots, necessitating further reinforcement measures which were also used to improve amenities.

We found that virtually all the dual-purpose features added at a later time (vaulted passageways, staircases linking two buildings, outside staircases with loggias, etc.) corresponded to older vulnerability factors (doorways close to the roof ridge which often showed traces of repaired damage; jetty walls, etc.). But we also noted that where these same features were contemporaneous with the original building there was no relationship with vulnerability.

Of course, one cannot simply conclude that because a measure was taken close to a vulnerability factor it forms part of the community's earthquake culture. We need to be sure that it was in fact efficacious, especially if it is to be made a part of the present-day culture.

We thus conducted a new analysis to see whether or not the observed anomalies eliminated the vulnerability factors to which they corresponded. By superimposing the three maps we were able to see the full range of reinforcement measures discernible in the building studied, whether or not they were taken with earthquakes in mind, and to pick out those which had proved effective.

To recreate the local earthquake culture from "anomalies", then, we:

1) drew up a list of anomalies;

2) classified them in terms of their main functions (static reinforcement/improvement of amenities);

3) pinpointed them on the map showing the building fabric at the time of the various earthquakes;

4) listed and pinpointed vulnerability factors (distinguishing between old and recent, certain and probable);

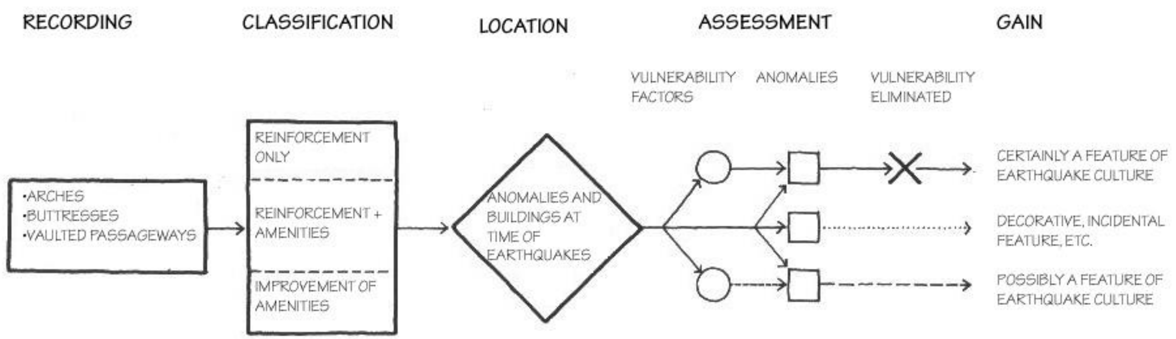
5) listed and pinpointed anomalies which caused buildings to be reinforced (again distinguishing between old/recent, certain/probable);

6) picked out those anomalies which had proved effective in reinforcing buildings, by superimposing the three maps (old vulnerability factor + additional measure + successful reinforcement = feature of local earthquake culture).

This sequence was easy to follow. Although general in nature, it enabled us to reproduce the stages in which buildings were constructed and, in virtually all cases, these coincided exactly with the recollections of the oldest inhabitants.

It may thus be a useful aid in reviving a local earthquake culture.

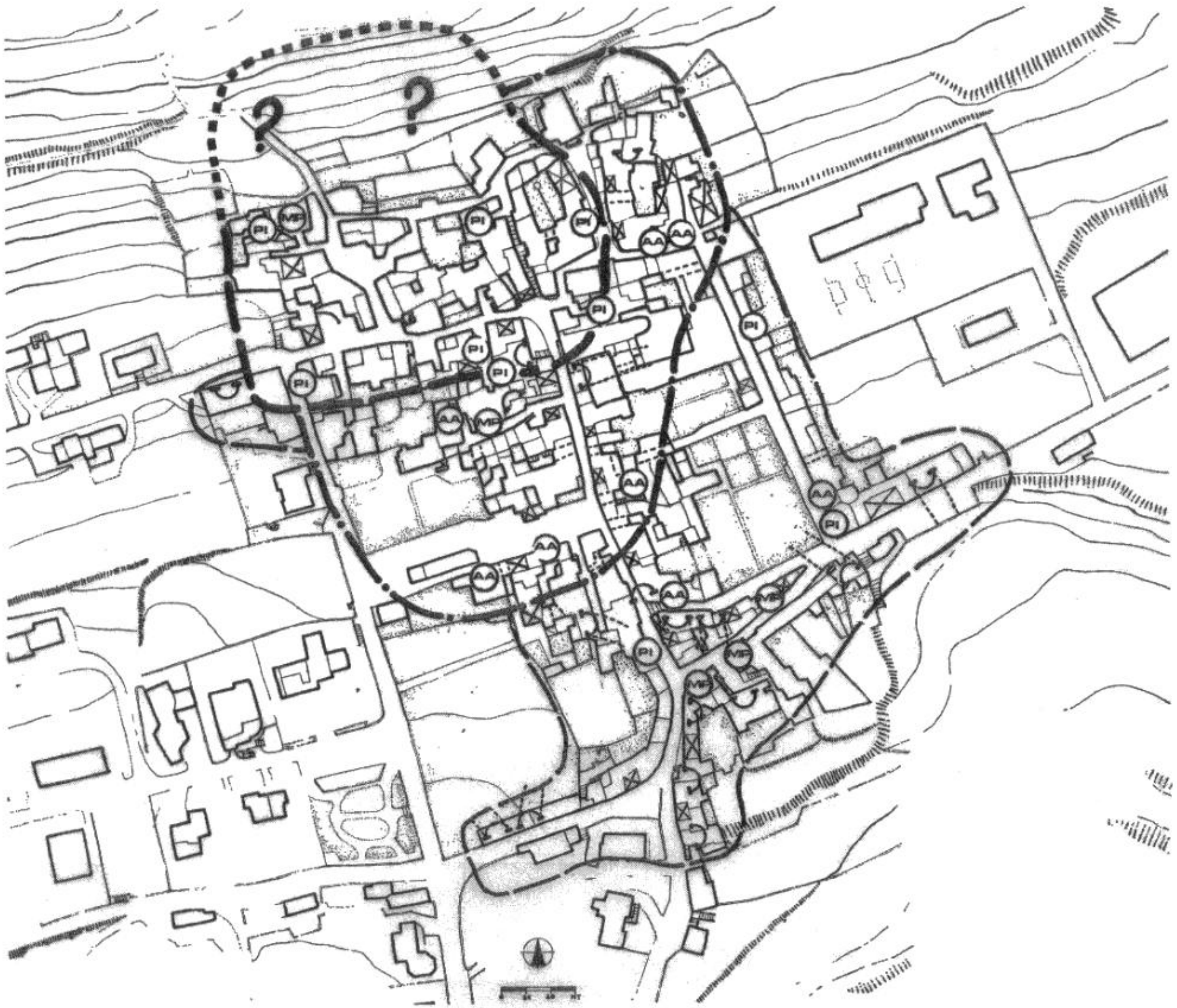
ANOMALIES IN THE LOCAL EARTHQUAKE CULTURE



REINFORCEMENT MEASURES
OLD
RECENT
CERTAIN
PROBABLE

VULNERABILITY FACTORS

- CELLARS
- ADDED FLOORS
- AA CORNER OPENINGS
- MP POOR MASONRY WORK
- PI ENCASED GUTTER SPOUTS
- TS ROOFS WITH NO TIES
- CF CHIMNEYS AND VENTS




MODIFICATIONS AND ANOMALIES
IN BUILDINGS
ANGLED BRACING
VERTICAL BRACING
RIBBED/WIDE BUTTRESSES
"CONTRAST" ARCHES
VAULTED AND COVERED PASSAGEWAYS
OUTSIDE STAIRCASES AND LOGGIAS
EXTENSIONS AND ADDITIONS
ADDED FLOORS
TIE-BEAMS
ANOMALIES
IN BASEMENTS
CELLARS AND CAVES