Historical investigation on the use of masonry pointing in Italy

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Pointing is a finishing used in facing masonry walls with the aim of avoiding rain penetration through mortar joints, one of the principal causes of the different surface decays.

Pointing consists in filling the bedding mortar joints, left recessed to a variable depth. Often the regularity of masonry facades is improved with different tooling methods, that can be performed compressing the pointed mortar joints and realising peculiar esthetical effects.

The study of the different pointing methods applied during the historic periods in Italy was strictly connected to an investigation on the choice of the best mortar for repointing.

The historical research was carried out in order to explain the differences in composition and tooling found during the on site investigation included in the contract. The study of the different historic mortars used for pointing in Italy is of great interest and useful in order to understand its evolution and changes along the centuries.

The first information on pointing comes from the Roman period and its use continued in different historical period till nowadays. This technique was alternative and/or contemporaneous to other finishing techniques which had the aim of protecting masonry and giving it an elegant aspect.

The historical and experimental research on pointing was carried out in a EC contract and had the following aims:

1. to establish the historical periods when pointing was used in Italy;
2. to detect the pointing typologies recognising the historical period when they were proposed for the first time;
3. to collect information on mortars, on their execution techniques and on the used tools.

One of the most difficult tasks during the EC research was to connect the Italian terms and names defining the different types of pointing, to the English one. It should also be noted that these terms can be different in different Italian Region. What in Italy now is called «stilatura» for pointing, in the literature can be defined with different names such as, «lisciatura», «allisciatura», «stuccatura», «profilatura» and other as reported in Table 1.

In the following a brief history of pointing is reported, showing the most important applications of this technique along the centuries.

The technique was not applied with continuity; in fact there were periods during which alternative techniques such as joint smoothing were used.

The historical analysis shows how pointing and its execution on a facing wall are influenced by different factors:

1. the historical period in which pointing was realised;
2. the particular geographical area;
3. the material used (stones or bricks);
4. the workmanship ability;

<table>
<thead>
<tr>
<th>Other Italian Terms</th>
<th>Period in Use</th>
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<tbody>
<tr>
<td>stuccatura</td>
<td>1784-1999</td>
</tr>
<tr>
<td>lisciatura</td>
<td>1957-1996</td>
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<tr>
<td>rigiuntaglio-rigiuntatura-giunto rigiuntato</td>
<td>1982-1996</td>
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<tr>
<td>allisciatura</td>
<td>1971-1996</td>
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<tr>
<td>rabboccatura</td>
<td>1840-1986</td>
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<tr>
<td>profilatura</td>
<td>1853-1974</td>
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<tr>
<td>Intonaco-intonacare</td>
<td>1885-1928</td>
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<tr>
<td>sigillatura</td>
<td>1925-1994</td>
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<tr>
<td>rinzoppatura</td>
<td>Since 1840</td>
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<td>speratura</td>
<td>Since 1874</td>
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<td>raffilare</td>
<td>Since 1925</td>
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<tr>
<td>rasatura</td>
<td>Since 1982</td>
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<tr>
<td>giunto rizunto</td>
<td>Since 1982</td>
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<tr>
<td>imboccare</td>
<td>Since 1633</td>
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<tr>
<td>fugatura</td>
<td>Since 1987</td>
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<td>ripasso</td>
<td>Since 1996</td>
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<td>giunto rebocato</td>
<td>Since 1521</td>
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<td>giunto trullisato</td>
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<td>giunto smaltato</td>
<td>Since 1521</td>
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<tr>
<td>giunto rebuffato</td>
<td>Since 1521</td>
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<tr>
<td>giunto infrescato</td>
<td>Since 1521</td>
</tr>
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Table 1
Different Italian terms used for «stilatura» (pointing)
5. the economical factor;
6. the importance of the building;
7. the cases when a rendering of the masonry surface was applied over surface.

The paper will stress the importance of the historical research when dealing with a correct conservation of facing walls of historic buildings (Naldini et al. 2001b). A brief history of the pointing is then presented which does not intend to be totally exhaustive.

TYPES OF POINTING IN THE HISTORY

The types of pointing historically known are presented in the following table and the first five are the most popular. In the table the Italian definition is reported in brackets together with the English one.

Each of them corresponds to a certain historic period; none of them is older than the time of the Roman Empire.

All the types of pointing mentioned above developed during the Roman times, except for \( v \)-shape pointing, which was introduced and developed between the 16th and 17th cent. This shows on one hand the important role of the Roman period and on the other hand how our technical culture is still hardly connected to that great civilization.

The \textit{cut to shape} pointing seems to be used only in the Roman time, while other types of pointing were applied also in the successive historical periods. In particular, \textit{concave} pointing seems to be the most used in the history, till the 17th century, while the \textit{weather struck} pointing was more used in the Middle Ages. In the Byzantine times both the \textit{weather struck} and the \textit{flush} pointing were frequently used. The latter was used till the 16th and the 17th cent. (Vananzi 1971; Marta 1986; Carbonara 1996).

After the Middle Age the pointing technique was still used, even if it was less accurate and precise. Nevertheless reference is lost on the use of specific types of pointing (concave rather than weather struck, cut to shape, etc.). For this reason it seems more sensible to talk about the history of pointing from the point of view of the historical periods rather than from the types of pointing.

\textbf{ROMAN TIMES}

To the Roman times belongs the first information on the use of the pointing in Italy. From that times through various developments pointing has arrived to the present times (Luci 1957).

The Romans largely used pointing as a protection of joints for facing walls. Nevertheless most of the walls that now appear as facing walls were actually rendered in the Roman times. In these cases the very accurate technique of pointing, which required skilled masons, was not applied. On the contrary, tooling was often applied on mortar joints before rendering; therefore this technique was also used to reproduce the rough surface necessary for an easy application of renders, in addition to esthetical reasons.

Usually only small and simple buildings which could not be rendered for economical reasons had facing walls with pointing of mortar joints. For this reason tooling was diffusely applied to funerary monuments; nevertheless rare examples of pointing of important walls were also found (Luci 1957).

Pointing was applied to the entire masonry surface and concerned buildings made with bricks or \textit{tufelli}, small tuff elements. For facing walls, special bricks were used, thinner then usual, wedge-shaped to give better adhesion to the internal leaf and to show externally mortar joints as thin as possible. In order to increase the homogeneous aspect of the façade pointing was carried out, giving a very smoothed surface (Figure 1), (Marta 1986; Carbonara 1996).

The fundamental aim of pointing was to obtain a very smooth surface by tooling the mortar joint with a trowel, so that all the roughness and the voids could be eliminated; the joint became perfectly smooth and aligned with the brick or stone courses (\textit{flush} pointing). The difference between the joints and the masonry elements was only declared by the different colour. In some cases also the colour tended to be similar, particularly when the pointing was done mixing with the lime a certain quantity of brick powder (\textit{cocciopesto}). The wall surface, in this case, assumed a chromatic uniformity obtained on purpose.

Pointing also was a way for compacting and filling completely the joints, so that a better protection to the masonry against aggressive environment was given. In order to realize this type of finishing very skilled masons were needed (Adam 1988).
Table 2
Types of pointing historically known in Italy
The «concave» pointing appeared only in the 3rd cent. A.D. during the period of Antonino Severo and Aureliano (235–270 A.D.) and became very popular under Massenzio and Costantino (306–337 A.D.). It was dropped at the end of the 4th cent A.D. and substituted by re-pointing; then it appeared again in the 6th cent and applications can be found also in the 7th cent. It was not realized with the blade but with the round part of the trowel, so the joint assumed the typical concave configuration (Figures 3 and 4).

Concave pointing was often used (during the Roman Empire and also later on), together with or alternatively to the «toolings». This finishing technique is sometimes considered the opposite of the «pointing» because it does not need to add new mortar; on the contrary, it requires a removal of mortar from the joints with the trowel or other tools and in the meantime a mortar compaction (Lugli 1957).
Tooling was performed to have smooth regular curtain walls. It developed in the Roman times and was used until the 12th century. Then it appeared again in the second half of the 16th century, above all in poor and not very valuable masonry. Since the Republican period of ancient Rome, the two techniques, pointing, and a tooling, above all the concave type, lived together or alternatively till the 12th and 13th century (Marta 1986; Marta 1989). The weather struck 2) pointing had a limited use in the Roman times and it never became popular afterwards.

The mortar used for pointing was applied in thin layers and composed by lime and sometimes very fine pozzolana sieved to the very fine size (perhaps to ensure the pozzolanic reaction) and fine sand. The binder quantity was much higher than the one used for bedding joints so that the mortar became a sort of glue (Lugli 1957)

In the following table the list of the most important examples of pointing found for the Roman times is given (Figures 5 and 6):

### Palaeochristian times

The palaeochristian architecture became popular in Rome during the 4th and 5th centuries A.D., when the culture of construction was at the top of its technical capacities. Together with important buildings of civil roman architecture, the first Christian churches were in fact built such as the Basilica of Massenzio (306–312 A.D.), enlarged then by Constantine (312–337 A.D.) (Benevolo 1987). The palaeochristian building techniques were very similar to the Roman ones, from which both the building methodologies and techniques derived to better protect masonries from the atmospheric agents; one of them was pointing.

Two types of masonry structures were developed, from the Roman times:

- opus latericium, with only bricks binded with mortar;
- opus mixtum, with brick and stones (usually «tufelli») in alternate courses 31–36 cm high, with about 5 courses for each material.

The construction of this masonry was usually followed by pointing of mortar joints and then by
Building's Name | Location | Date | Pointing Type
--- | --- | --- | ---
Diomede's House | Pompei | | Weather struck
External wall of Lateranense Baptistery | Roma | | Cut to shape
Villa dei Misteri | Pompei | | Cut to shape
Northern aisle of San Giovanni in Laterano | Roma | 313 - 337 A.D. | Cut to shape
West end and corner of the San Pietro in Vinculis façade | Roma | 432 - 440 A.D. | Cut to shape
Gordiani's House | Roma | 225 - 270 A.D. | Concave
Works of Sisto III SS. Giustino and Cipriano chapels in San Giovanni in Laterano Baptistery | Roma | 432 - 440 A.D. | Concave
Terme deciane | Roma | 235 - 270 A.D. | Concave
Terme di Diocleziano (Fig. 5) | Roma | 284 - 305 A.D. | Concave
Giulia Basilica | Roma | 284 - 305 A.D. | Concave
Spacus Aquae Marciae | Roma | 284 - 305 A.D. | Concave
Massenzio Basilica | Roma | 306 - 312 A.D. | Concave
Templum Divi Romuli | Roma | 306 - 312 A.D. | Concave
Templum Veneris et Romae | Roma | 306 - 312 A.D. | Concave
Cosantino Basilica | Roma | 312 - 337 A.D. | Concave
Santa Sabina (Fig. 4) | Roma | 337 - 526 A.D. | Concave
SS. Giovanni e Paolo | Roma | sec. 5th A.D. | Concave
Harbour walls | Ostia | sec. 5th A.D. | Concave
Lateranense Baptistery | Roma | sec. 5th A.D. | Concave
Porch of «Dei Consenti» and hall of the Church of San Balbina | Roma | sec. 5th A.D. | Concave
Church of Santo Stefano Rotondo | Roma | sec. 5th A.D. | Concave

Table 3
Examples of pointing found in Roman Buildings

tooling, showing the upper edge of the bricks, in order to have a weather struck pointing 3) (Testini 1934).

The first example of this pointing in the palaeochristian architecture is the Mausoleo of S. Costanza in Rome, of the 330 A.D. (Figure 6). As it can be noticed the joint was very thick reaching frequently the thickness of the brick.

**THE BYZANTINE TIMES**

The Byzantine architecture was characterized by innovation between the precept of the Roman time and the reviews of the palaeochristian time.

The high skill of the Romans in the construction of masonry walls was put under discussion as the expansion of the Byzantine Empire started in the 4th cent. A.D. (Benevolo 1987). Even if the fundamental principles of the Roman wall construction technique were not refused, the Byzantine period gave a new great supremacy to the brick. The walls were not rendered anymore so that the beauty of the brick texture of the facing wall could be seen. In Italy the city of Ravenna, which became the Occidental center of the Byzantine technology, clearly shows this new taste.

Also Byzantines as the Roman built with a three-leaves masonry, but the internal leaf became less
homogeneous and solid while the external leaves became even more important not only under the aesthetic but also under the structural point of view. In fact, first the external leaves were built and only later the internal cavity was filled with crushed stone and mortar. Five rows of bricks were laid at regular range through the depth of the wall connecting the external leaves and reinforcing the structure (Figure 7; Mango 1978; Latina 1994). A new supremacy of the curtain wall started, showing the beautiful texture pattern of the facing bricks. These bricks had square shape with sides of 35–38 cm and a height of 4–6 cm. They were laid complete and not broken in diagonal as the Romans usually did (Latina 1994).

The mortar used for Byzantine masonries appears as a concrete, rich in sand, gravel and brick fragments also of large dimension. For that reason the mortar joints were finished by pointing with finer, more homogeneous and with a very high cohesion mortar. The pointing mortar was then compressed in the joints with a special beveled tool, which engraved a thin groove (Figure 8). Weather stuck (2) pointing was also used showing part of the edge of the lower brick (Zanini 1994). Another fundamental characteristic of the Byzantine buildings is the high thickness of the mortar joints, which increased in the centuries, passing from a joint/brick ratio of 1:1 in the 4th cent. A.D. to a 3:2 ratio or more two centuries later (Mango 1978; Latina 1994).

The pointing was in these cases connected to a special technique for facing masonry walls, which was called «recessed brick», consisting in brick toothed layers (Figure 9). Only later on, the most recessed bricks were hidden under a new mortar joint creating a peculiar flush pointing, which could also be underlined by horizontal tooling. The effect was that of thick mortar joints even thicker than the bricks, made regular by horizontal incisions. This technique in use since the 5–6th cent. continued to be used also later, since the Byzantine architecture used it until the 12th cent.

Also in this case the documents point at the use of a mortar for pointing which was finer and more homogeneous than the bedding mortar (Figures 9 and 10), (Mango 1978; Latina 1994).
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**FROM THE SIXTH-SEVENTH CENTURIES TO 12th CENT**

Starting from the 6–7th cent. until 1084, when Rome was invaded by the Normans, the masonry of the external surfaces loose the previous regularity, having irregular brick courses not respectful of horizontality and very thick mortar joints. The lack of good materials and skilled masons was the cause of the missing of good construction rules and of some finishing techniques as pointing (Marta 1989). Only in the 13th century there will be a new revival for pointing.

**THE AGES FROM THE 13th CENT. TO THE 14th CENT**

Pointing as a technique of surface finishing reappeared in 13th cent. The weather struck 3) pointing (Figure 4), seldom used in the Roman times, was very popular during the Middle Ages.

Other types of finishing were also used, as the «false curtain wall» which was called in Italy «muratura di tevolozza» (Figures 1 and 12). In this period this technique became more popular than other finishings, even more than pointing. In fact in the medieval times there was a reduction of the productive and technical capacities also due to the frequent reuse of materials removed from old constructions. This explains the use of different and non-homogeneous elements in the same wall. Therefore the masonry was usually out of plumb and with irregular courses.

The false curtain wall was developed in this period: it is a peculiar executive technique which gives the idea of a regular and homogeneous wall, using a fine layer of limewash applied to the masonry and fairly hiding the single bricks. Afterwards, before the hardening of the mix, the joints were either horizontally or vertically tooled and, sometimes, without correspondence with the underneath joints (tooled false curtain wall). The tooled false curtain wall appeared during the second half of the 11th century and became popular in the 13th-14th century.

Sometimes a reddish colour was used to imitate bricks, while tooled joints were left white, simulating mortar joints (painted false curtain wall). The painted false curtain wall developed between the 12th century and the beginning of the 13th century, but also in the 15th century it had a considerable use. Usually it was
not applied on the whole building, but only on the main parts (Carbonara 1996; Marta 1989).

Then, even if the rendering of the masonry «di
tevolozza» was the quickest and most practical remedy to give the impression of good masonry work, also pointing was used. The use of tooling flush of the mortar joints with the trowel, in order to eliminate the overflowing of mortar from the brick or stone, could give the alignment and aesthetically the impression of a better work. The pointing was done with a fine and soft mix made with a mortar rich in finely sieved rich lime.

After the 13th century the «false curtain wall» substitutes the pointing remaining the most used technique of masonry finishing for the rest of the medieval times.

Anyway pointing continued to be applied on curtain walls, even though seldom. Its use, in that period, showed traces of the productive and economical events, as well as of the particular geographical area.

Examples can be given by Pisa and Southern Lazio.

Some careful studies showed that during the Middle Ages there were two different masonry typologies, which were often used in the urban buildings of Pisa, whose joints were pointed:

— the first one refers to the tower buildings, realised with re-used materials, essentially stone, laid in homogeneous and regular courses with pointing and tooling of thick mortar joints (half of the 11th century-beginning of the 12th century)
— the second typology is represented by buildings formed by two towers, joined by a covered passageway. In this case the courses are not always regular and the mortar joints are high, with pointing and sometimes also with tooling (first half of 13th century).

Referring to the South Lazio case, small blocks masonry, mainly tuff, was frequently used during the
Building name | Location      | Date  | Pointing Type | Type               
---|---|---|---|---
Walls with small square tuff blocks | Palombara Sabina (Roma) | 13th cent. | weather struck 3) | 
Right Tower of the San Cesareo façade at the «Terme di Caracalla» | Roma | 13th cent. | weather struck 3) | 
«Fortezza dei Savelli» in Aventino | Roma | 13th cent. | weather struck 3) | 

Table 4
Buildings with weather struck pointing in Middle Age

Table 4 reports a list of weather struck 3) pointing examples:

**Sixteenth and Seventeenth Century**

Within the 16th century a new chapter on the techniques of construction of masonry walls is written. The brick facing walls are seriously re-proposed not only from the structural but also from the aesthetic point of view. The brick masonry was consistent, strong but what is most important, of great beauty and effect.

In the first half of the century the attention is devoted to bricks; their external face is submitted to polishing, sharpening and shearing processes. In the second half, the interest is given to the joint finishing. The joint was now part of a masonry made with poorer bricks but with joints completely filled also with the use of finer mortars and subsequently pointed. As already seen in the Mediaeval times, the pointing became the way for simulating verticality and smoothness in rough masonry.

In the 17th century both the bricks and the mortar joints were treated respectively with smoothing and pointing in order to reach a perfect monolithicity appearance of the masonry surface as reported on the contemporary contracts. The expression «sharpened, smoothed and joint marked wall («cortina rotata, stuccata e segnata») meant a wall built with sharpened bricks (on site or before the construction) and with joints tooled by pointing (Figures 13, 14 and 15). This particular technique was adopted in Rome and in the Lazio Region (Bertoldi et al. 1983)

The pointing was considered particularly important for its properties of covering bricks inhomogeneities and giving verticality to curtain walls. When pointing
was applied to masonry of poor quality, the mortar joint was tooled in such a way to cover the brick edges, in order to protect them from the aggression of time and environment. Flush pointing was so obtained, but the outline could assume a concave configuration using a tool with a cylindrical shape. In the lining walls built in a masterly fashion, pointing was made in the middle of the joint, using a tool which left a not very deep semi-circular sign, whose diameter was about 4 mm. A tool with a triangular section, which cut deeper into the mortar, was used but not very frequently (V-shape pointing).

The mortar for pointing was different from the bedding mortar; this last in fact was easily crumbling and with large grain size. The pointing mortar was usually finer, compact and then strong; it was obtained by mixing pozzolana finely ground with selected lime. Useful information can be deduced from the contracts with the producers: they always mention a good quality lime without clots or powder and well fired. Special recommendations were also made concerning the necessity of a long time of accurate slacking in order to avoid the formation of CaO lump once the pointing was carried out. Together with the lime, the pozzolana is always mentioned. While the sand is never recommended as a necessary aggregate. The pozzolana should be of good quality with high hydraulicity and without bad inclusions of clay or soil (Bertoldi et al. 1983).
In the 19th century the use of cement started; the very first recommendations for the use of a cement based mortar for pointing can be found in the manuals or in the contract briefs. It was especially suggested to use painting after the joints were filled in order to make the operation less invasive from an aesthetic point of view. The colors had to be chosen in order to underline the texture of the masonry (Latina 1994).

**The twentieth century**

The 19th century brings the richest evidence of the use of pointing, which is described in the manuals as a technique for refining the joints and protecting the masonry. Several manuals also report a detailed description of the mortar types to be used. The cement based mortars were preferred as they were already used at the end of the previous century and totally substituting the lime mortars. Only some mention is made of the lime based mortars during the first two decades of the century: an hydraulic high fluid lime mixed with pigments in order to reduce the difference in color between the pointing and the bricks is suggested. Therefore it is possible to find suggestions of mixing lime with different colored materials as brick powder, colored ashes, iron oxides and even soot.

Usually starting from the third decade of the century only the use of enriched cementious mortars composed by cement and fine sand is suggested. The two components should be mixed dry and sieved before adding the water. Furthermore colored cements and sands with different tonalities are suggested, different from the bedding mortar materials and used in order to give a special appearance of brightness and colorfulness (Smith 1974).

Only in the nineties the idea of using mortars similar to the bedding mortar is stressed out being the pointing mortar richer and with finer grain size distribution (Tubi 1993). The pointing mortar has to be compatible with the bedding one and also attention is paid to the esthetical aspect.

The mortar can be white and clearly mark its difference from bricks or be mixed with colored pigments or brick powder in order to give more uniformity with bricks (Menicali 1992).

In the last decades also the possible mechanical role of pointing as joint reinforcement is supported to
give more strength to the masonry in seismic areas (Latina 1994; Baronio et al. 2001).

CONCLUSION

An overview of the history of pointing in Italy was presented as a background for the evaluation and planning interventions.

Pointing plays not only a technical role, as a protection of masonry, but also an aesthetical role and contributes to the definition of the façade aspect, varying in the course of time. It is strongly dependent on the building techniques used, the available materials, the workmanship ability and the importance of the building.

The aesthetical role of pointing and tooling of mortar joints reflects the current building techniques of its time; therefore the original surface material should be preserved if not damaged due to deterioration processes.

Restoration works should guarantee the chemical-physical and mechanical compatibility from a technical point of view but also a compatibility from an aesthetical and historical point of view with the original support. It should be noticed that unfortunately important Roman monuments changed the aspect of their façades as a result of radical restorations, loosing the original surface and thus the original document. After a recently photographic survey, a lack of respect of the historical materials and of the techniques used in the past appeared evident. This aspect will be studied in a further research in order to choose appropriate mortars for re-pointing.

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