THE CAVE REVEALED. THE MONASTERY OF AYNALI AND THE REPRESENTATION OF RUPESTRIAN ARCHITECTURE

Marco Carpiceci, Carlo Inglese, Fabio Colonnese
Department of History, Drawing and Restoration of Architecture, Sapienza University, Rome, Italy

Introduction

Architectural survey and representation have changed remarkably in recent years, and this is particularly evident in the field of rock-cut architecture. In the context of an Italian National Research on the Rock-cut Architecture of Cappadocia\(^1\), we are charged of surveying a number of carved monuments in the area of Göreme Open Air Museum and its surroundings. The specific spatial characteristics of rupestrian architectures suggested us a light laser-scanner to be easily carried and used both in the difficult orographic conditions and in the dark and narrow caves. The advent of laser scanning technology improved the precision during the acquisition of dimensional data, reducing costs and time of taking. At the same time the procedures of computer representation enabled surveyors to refine the traditional representations and offered them a wide range of innovative envisioning and navigation three-dimensional models.

The Monastery of Aynalı

The monastic settlement of Aynalı is about 1 km distant from the large semi-circular rock cavea constituting the heart of that singular confederation of monastic communities today known as Göreme Open Air Museum. Possibly the whole area was ruled by a common social structure, in which each core was constantly in touch with the other ones, sharing the need for subsistence and contemplation.

\(^1\) Arte e habitat rupestre in Cappadocia (Turchia) e nell’Italia centromeridionale. Roccia, architettura scavata, pittura: fra conoscenza, conservazione, valorizzazione. National coordinator: Maria Crocifissa Andaloro; scientific director of Sapienza University unity: Marco Carpiceci. The research involves three scientific areas: L-ART/01 – History of Medieval Art; ICAR/17 – Drawing; GEO/07 - Petrology and Petrography. This paper is the result of the synergistic collaboration between the three authors. In particular Carlo Inglese has edited Introduction and The Monastery of Aynalı; Fabio Colonnese has edited Standard representation of Cappadocia rock-cut architecture and A critical approach to rock-cut architecture survey through laser-scanning; Marco Carpiceci has edited Representing the Monastery of Aynalı and Conclusions.
Fig. 1. Göreme, Aynalı Monastery hill
Source: Photo by C. Inglese.

Fig. 2. Göreme, Aynalı Church
Source: Photo by C. Inglese.
The church and the rooms of the monastery are on two main levels and surround a rectangular courtyard whose southern façade is articulated in three levels of openings and arches. Two of the three doors in the exterior wall open into the largest room of the complex, the Sala Maior: its walls are articulated by pilasters, support a barrel vault with arches and are barely decorated with red geometric patterns. An opening in the same wall leads to a smaller barrel-vaulted room that can be entered from the courtyard, too. Another room lies near this one: it is accessible from outside, but most of it is lost after the cliff partially collapsed. An opening in the internal wall of the main room leads into a cave with a curved stair leading to the upper floor, while an opening in the western wall leads to the church.

The third opening in the south face of courtyard is the main entrance to the Firkatan Kilise. A small square narthex with cross-arms welcomes believers and tourists: a dome covers it, just above four primitive pendentives in the corners. A side opening leads into a side square tomb room, with a niche and benches on two sides, while the front opening leads into the approximately square church. Four large columns (with one partially collapsed) divide church space into three naves covered by barrel vaults and decorated with red symbols: a large central horseshoe-shaped apse and two smaller ones at its sides opens in the east wall with their floor as high as the continuous bench running at the base of walls.

Smaller irregular rooms characterize the upper floor. The stairs leads into a large storey carved over the main room, with niches and shelves on every wall and two more openings. A small tunnel leads into a circular cave in the north-west corner while a latter zigzagging one in the east wall leads to a cave protected by a rolling door. A narrow oblique pit connects the latter cave with the lower room, where a second rolling door used to protect the passage from the rectangular room with a flat ceiling behind the courtyard east face. The missing parts of the ceiling reveal another room above, which is part of a linked rooms system with stables and a vinery extending along north-east cliff and accessible through many openings in the partially fallen cliff.

**Standard representation of Cappadocia rock-cut architecture**

The church and the other parts of the monastery follow approximated geometrical rules and are only occasionally comparable to simple geometric shapes. This would suggest they are the result of an extemporaneous and uncoordinated program of excavation that probably lasted many generations. Conversely, ground floor rooms crowning the rectangular court seem to share a geometrical attempt to imitate the forms of traditional additive architecture. The traditional form of such environments, however, is only apparent: in fact even the main hall, although to a lesser degree than the church, is suffering from a sensitive deformation that alters the alleged rectangle of the plant. Yet until a few years ago these deformations were completely absent from the documents elaborated and used for studying Cappadocian heritage.

---

2 A virtual tour of this room is available at: https://www.360cities.net/image/aynali-firkatan-church-goereme-cappadocia-turkey-3 (accessed 15.03.2015).
3 A virtual tour of the church is available at: https://www.360cities.net/image/aynali-firkatan-church-goereme-cappadocia-turkey-2 (accessed 15.03.2015).
Not too different from idealistic images of the *Edifices de Rome Moderne* made by Paul-Marie Letarouilly⁴, rupestrian habitat representations seem to be generally influenced by the quest for the idea behind the form. The drawings of many of the churches and monastery of Cappadocia that were obtained only a few decades ago with traditional procedures show plans and sections with rectangular rooms, definitely regularized if not invented. It is enough to see the drawings in the book of Lyn Rodley⁵ and widely used by historians and archaeologists to speculate and conjecture on builders’ procedures and targets. As following the historical model of Père de Jerphanion’s plans⁶, they actually show more than a problem. For example, caves look systematically extracted out of their physical environment. Walls and openings appear as if they were built in masonry, with a constant thickness and orthogonal mutual T-junctions. Some of the rooms either of the examined settlements or near to them are generally either ignored or censored; vertical sections are partial or missing; generally no altimetry information is reported in drawings and this appear a serious omission in the case of Cappadocian morphology. Opposite than traditional architecture, in such a rock-cut architecture neither a wall can be assumed as a vertical surface nor a floor as an horizontal plane and this strongly influences its experience as well as oriented the choices of its ancient builders.

Eventually some of Rodley’s book drawings seem to suffer also from the occasional stretching for – we suppose – editing opportunities due to the book format that even deprive them of metric properties. In general Rodley, like most of Cappadocia scholars, aimed to offer an idealized imagine of rock-cut settlements and the abstraction of the graphic code he adopted contributes to the intention to assimilate their image to that of traditional architectures.

How can such a *fictional* result be explained? Of course the difficulties involved in surveying rock-cut spaces are not to be underestimated but both methodological and psychological reasons must be considered. Such a representing practice would strongly echo scholars’ perceptual and formal prejudices acquired with the experience of additive architecture forms as well as disciplinary specificities⁷. It bases on the diffuse hypothesis that Cappadocian builders just intended to reproduce traditional architecture forms in negative which consequently offers the opportunity to analyse those spaces through traditional mental and operative instruments. Yet today that position seems only partially sharable, as we cannot exclude that a specific sensibility to specific qualities of carved space inspired the latter generations of builders towards something different and original. Moreover as both their form and destiny are strongly tied to the rock morphology status,

---

⁷ On the contrary, speleologists’ approaches to survey and representations of cavities often produce drawings with a rich and accurate endowment of spatial and environmental information. See, for example, Roberto Bixio’s studies on Cappadocia.
it should be evident in every drawing. These are some of the reasons for elaborating a different way of representing rock-cut habitat rock-cut, with selection criteria and graphic codes able to take in account all their specific qualities.

A critical approach to rock-cut architecture survey through laser-scanning

Till few decades ago, scholars observed those caves expecting to find the efforts of people pursuing the spatial conditions similar to those of brick-and-wood constructions. But it was not, and latest surveys offer today a profoundly different perception of that people and their habitat. Indeed rupestrian habitat seems one of the application fields in which the “objective eye” of laser technology, beyond the ordinary savings in time and resources, can actually lead to a significant knowledge increase. We could cite the evidence that ceilings often considered flat revealed to be convex *a corda molla*: a feature that suggests a formal intentionality possibly inspired by static principles\(^8\). Only a representation after a laser scan can envision this feature, generally ignored by traditional surveys.

---

On the other hand the comparison between old and current surveys, highlights how the tools are subtly leading scholars towards an approach that is totally antithetical to the traditional one. Today, laser scanner operators have a tendency to simply accept uncritically the metric outcomes provided by the machine, without determining directly the nature of those surfaces: they are satisfied by simply launching the scan without experiencing and studying the environment. The result is that they may not have the critical tools to evaluate and possibly adjust and finalize the representations from the numerical model.
While scanning the rooms of the Monastery of Aynali, instead of just waiting in the caves for the scans to complete, we have been walking around taking pictures and sketching hypothetical plans and sections of carved rooms, like in the old-school survey procedure. These activities offered us both a direct memory of our body measuring those spaces and a graphic trace to be used as an enquiry tool for an active exploration. Moreover they contributed to form a critical idea of the monastery architecture that constitutes a fundamental ingredient during the data elaboration e representation.

Anyway, despite the mental model we had constructed, results have been often surprising. For example, the scanner revealed the existence of a narrow channel of aeration we had missed during our inspection. After downloading and assembling the clouds of points on the computer, the different levels of rooms revealed their actual shape as well as their unpredictable formal autonomy. Even if they are correlated with a pit and a stairs, the rooms seem to ignore each other: not only each room seems to have been developed on its own but corridors and vertical connections are generally curved preventing people from both knowing what lies on their way and gathering information about the general spatial organization: like in a classic labyrinth, the only way to know is to walk all the way.

Yet perhaps the most significant moment of such a reproductive and knowledge process, is the assemblage of the clouds of points relative to the interior rooms with those describing outside surfaces. The opportunity to measure and envision the changing relationship between extrados of the cones and intrados of the caves, gives the carved space the value of an effective architecture that can be finally compared with other traditional examples.

It seems that the proper attitude towards rock-cut architectures should find its equilibrium halfway between the intellectual approach of the traditional method, which tends to identify the irregular surfaces of the environments with elementary geometric solids according to hypothetical architectural intents, and the laser-scanner chrono-visibilism, determining all its information by the time response of the laser beam on heterogeneous surfaces and visible.

**Representing the Monastery of Aynali**

The process of representation requires the critical interpretation of the scholar. He is requested to translate the model point patterns into drawings to display the metric data, meeting the specific demands of customers and communities without removing the collected spatial information.

Not too different from a photogrammetry model, the cloud of points offers the enviable opportunity to study the spatial properties of a physical envelope in the calm of an office. But the vision of an eye-catching coloured cloud of points or its virtual navigation are not the survey but only the proper registration of a certain amount of points describing the surfaces that form the image of a skin.
The representation in terms of a scientific document to be queried for the purposes of knowledge and heritage preservation is instead the result of a critical processing of such data through scholars’ experience.

The drawings elaborated after the cloud of points should be intended to give information to a number of subjects and disciplines as wide as possible, even if thematic graphics are to be taken in account to respond to specific requests.
After the decimation of the points of the cloud and their coverage with triangular meshes, the resulting surfaces model is the geometrical base for every projective representation. At this moment, the eye of the surveyor must decide what is to be translated into lines and what is to be excluded from the final image. Our experience suggests the use of contour lines is to be favoured as the priority form of description of the rock-cut architectures in the graphic rendering phase. A description through both horizontal sections at different heights and vertical sections according to different unparalleled planes is necessary for understanding the relationship between exterior surface and interior spaces. In particular a contour interval of 10 cm at 1:50 scale representation provides the best compromise between metric-descriptive density and readability of morphology as contour lines are effective in giving the three-dimensional effect in every orthogonal projection. Sectioned parts are filled with light grey to show also the silhouette of parts that are not directly visible.

Conclusions

The assemblage of the 50 scans reveals the relationship between the carved architectural volumes excavated and allows to individuate the initial core of monastery as formed by the red-decorated environments on the ground floor overlooking the courtyard. Moreover the curvilinear nature of the ground plan stands out as a peculiar feature. All longitudinal developments, whose direct experience and memory would suggest to be more or less regular and straight, instead reveal to follow systematically a curved geometry. The barrel vaults themselves are forms that correspond neither to cylindrical geometry nor to conical one, but to a trend that the longitudinal carving action changes and deform step by step.

It seems hardly acceptable that despite of such a clear organization of the general scheme and a typological identity of single rooms, a careful and aware physical execution of space is missing. We think the mismatch to a regular geometry is due to a precise choice, possibly a coexistence of structural and aesthetic reasons. Empirical knowledge possibly convinced those ancient architects that formal resistance of curved shapes contributes to a better structural behaviour both in walls and ceilings. Moreover curved shape is the most suitable and natural for carved architecture: the process of excavation tends to move on placing the operators at the center of a theoretical sphere and the movement of their arms follows an arch, too, as can be seen in the furrows on the walls.