Title: Architecture for Archeology - identifying new modular and flexible types of shelter adaptable to the diverse needs of archaeological sites

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Summary

With the construction of coverings in the Valle dei Templi of Agrigento, the management of the Park Agency is carrying out an experimental action which can produce innovation in the context of lightweight and temporary structures. The "Architecture X Acheology" workshop explored the state of the art in terms of works protecting archaeological landmarks, with the goal of identifying new modular and flexible structures which are adaptable to the diverse needs of archaeological sites. Parametric and computational strategies are the bases used for the design of the shelters.

The Park, which covers 1,300 hectares, preserves an extraordinary monumental and landscape patrimony. Though visited by millions of tourists, the archaeological sites are not appropriately equipped for tourist use. To better use this enormous cultural resource and to make it an active agent of the regional economy, it is of strategic importance to equip it with new facilities which are appropriate for today. For this purpose, the workshop has seen professors and students of Politecnico di Milano, Palermo University, and of Tokyo University involved in the construction of experimental prototypes for the protection of archaeological finds and excavation sites. The shelters produced during the workshop —other than having a functional and aesthetic value— form the first nucleus of a park of modern architecture within an archaeological park. The paper describe the willingness to systematize the great potential value which the interdisciplinary prospect of integration between architecture, structure and archaeology, offer to the disciplines in terms of research and analysis.

Keywords: Archeology, Architecture, Innovation, Digital Fabrication, Shelter

1. Introduction

"Architecture x Archeology" is a co-joint workshop held at the Parco Archeologico Valle dei Templi di Agrigento, together with Tokyo University, Politecnico di Milano, and University of Palermo, with the aim to design and build three pavilions for covering and safeguarding archeological excavations, and for protecting archeologists from atmospherical agents such as sun and rain.

The workshop offered an up to date study about shelter structures for archeological sites. It aimed at producing modular and flexible structure adjustable to different scenarios and needs. The workshop was divided in to two parts: the first preliminary part -45 days- took place at each respective university of the players involved. The second phase -7 days- took place on site.

The first preliminary part introduced issues relating to the complexity of designing within archeological sites, applications of computational design, structural stability, and practical solutions for quick physical materialization within limited time and budget. The second part explored culture and nature of Akragas (old name for Agrigento) which served as a pretext for further exploring design for archeological sites.

Three teams, each comprised of 6 to 10 members, ultimately produced three full-scale shelters to test out their ideas, methodologies, proposals, and materials. Despite differences in use of software

(Rhinoceros, Grasshopper, BIM, Autocad), principal material (wood, bamboo, stones, micro-perforated polycarbonate), fabrication method (CNC routing, manual sawing), and budget (from 1,000 EUR to 6,000 EUR, including all costs) it was possible to make comparisons and analysis during the process and later in three distinct outcomes.

1.1 Functional Program: Shelters

Due to the complexity of the touristic fruition of Agrigento's archeological site the workshop focused only on shelter for covering and safeguarding archeological excavations.

This theme represents an unsolved issue of many open air archeological sites in Italy. In fact, archeological excavations needs a particular protection against atmospherical events that may bring back the excavations to their original conditions.

Moreover, the shelter theme represents a complex theme because induces a substantial modification of the site aspect. In case of construction -besides technical problems such as anchoring the tructure to the ground- the site will be inescapably changed by the addition of a new volume on the site. In this sense, the team were asked to see their respective project as a shape that merges and connects to the landscape, and not as an opposing element. The three teams tested different technical and material solutions, all respectful of the historical heritage.

The experimented solutions were of two types:

1) Shelter with a light structure easy to move and disassemble.

2) Shelter with a medium-light structure easy to move and disassemble.

2. Archeology and Architecture

According to architect-archeologist Sebastiano Tusa, the relationship between archeology and architecture has always been characterized by several, interlinking factors including historical perspectives, technological aspects, issues relating to restoration and the link with the local territory. No matter how tight this relationship has been, it has not always been linear and calm, both of which are necessary qualities for advancing the state of the art in this area. Differences due to background, epistemological divergences, academic contradictions and reciprocal individualism have produced a fracture between architecture and archeology - not only concerning research and analysis, but also the design of new facilities, restoration, and the transformation of the asset into a more fruitful experience: it seems logical to say that is time for architecture and archeology to start talking to and understanding each other.

2.1 Sicilian Context

Architect Giuseppe Guerrera – former director of a master course on architecture and archeology offered at the University of Palermo – reckons that Sicily is not rich of primary resources, it does not have an industrial reality big enough to sustain the Sicilian economy and, finally, the tertiary sector is not in very good shape, in spite of its strategic position in the middle of the Mediterranean Sea. Thus, maybe the real resource for a concrete economic and social development is not mass tourism, but cultural tourism, a sector on which regions like Tuscany and Umbria have prospered. If Sicily is to become a region capable of supporting a successful tourism industry, it is necessary to design and build adequate structures that are currently lacking: it is mandatory to update our heritage and natural sites for a better fruition.

2.2 Architecture for Archeology

Archeological sites could be one of the most important touristic resources of Sicily. However, archeological sites, even though they are visited by millions of visitors every year, are lacking adequate and up-to-date infrastructures. In addition, this present lack of infrastructure creates obstacles to archeologists and researchers in further excavations. In order to effectively exploit Sicily's cultural and historical heritage, new facilities that respect the historical context yet remain open to the future need to be built. As the first in a series of workshops, the projects designed will form the basis of a catalogue for actual construction, and will contribute to strengthening the collaboration between the academic world and the Archeological Park of Agrigento.

3. The Site and its needs

Covering an area of nearly 1300 hectares, the park preserves an extraordinary monumental and natural heritage that includes the ruins of ancient greek city of Akragas and its surrounding landscape. Listed in 1997 as a Unesco World Heritage, the Valley of Temples is home of one of the largest archeological complex of Mediterranean area, immersed in a outstanding rural landscape punctuated by centuries old olive and almond trees. Agrigento is a major tourist centre due to its extraordinarily rich archaeological legacy.

Though visited by millions of tourists, the archaeological sites are not appropriately equipped for tourist use. To better use this enormous cultural resource and to make it an active agent of the regional economy, it is of strategic importance to equip it with new facilities which are appropriate for today. It is necessary to plan and build adequate structures which are now missing, and to adjust the cultural and environmental assets for better use.

The construction of the shelters—in addition to posing technical problems related to anchoring to uneven ground, and to the dispersion and/or collection of rain water— transforms the site in that it inevitably adds a new element to the archaeological landscape. The projects have been interpreted as a shape to be managed in continuity with the landscape, something which does not conflict with it but rather merges with it. The projects have in part attempted a dialogue with the context—they listened to and answered it—and in part—in the most extreme manner—attempt to merge and cancel themselves in it in order to disappear.

4. Shelters case studies

Two case studies are described in the following sections. Due to the complexity of the site and the limited timescale, the workshop primarily focused on the design of shelters for covering and safeguarding archeological excavations. This particularly composite theme is at the center of many harsh debates in Italy and beyond. This is due to the substantial aesthetic change that they can bring to a site as well as the technical problems.

The workshop witnessed a true debate between the various participating schools, both in the design and in the construction. BIM, parametric software and digital fabrication techniques alternated with handmade sketches and craftsmanship skills pushed to the extreme. The three shelters went from the search for a dematerialized and wooden architecture–in contrast with the solidity of the Greek temples—to the use of materials found within the Valley, from the stripping of river reeds to the collection of rocks used as an integral part of the shelter structure.

The work shows the willingness to systematize the great potential value which the interdisciplinary prospect of integration between architecture and archaeology offer to both disciplines, both in terms of research and analysis and also in terms of how the planning pertains to the execution of avant-garde interventions.

It is on the basis of these considerations, that this complex, fascinating, and contemporary issue, regarding archeological areas and parks, was explored during the workshop. This signaled the beginning of a fruitful collaboration between Parco Paesaggistico e Archeologico della Valle dei Templi, Tokyo University, Milan Poitecnico, and Università di Palermo. The collaboration consisted of both taught sessions throughout the academic year and collaborative work before and during the workshop. Functionaries of the archeological park provided students from Japan and Italy with reference books, technical drawings, aerial photos, and cadastral maps of the site. The preliminary research and design activity conducted co-jointly by professors, tutors, and students was used to achieve a mature design during the workshop. Students were asked to focus on a reciprocal and beneficial dialogue between architectural and archeological issues.

4.1 AkragaShelter, Milan Politecnico

The Polytechnic of Milan has realised a project named AkragaShelter, which sits by a temple built to honour a sacred spring dedicated to Demeter, wife of Zeus. A special and holy place, where architecture and nature combine and unite themselves in an empathetic way.

The small pavilion, about 20 sq.m. was built to protect some portions of the temple, now dismantled and aligned on the ground, waiting for being reassembled. However, this system could serve the Park Valley of the Temples also for other achievements. Due to the sacredness of the place and the

Fig. 1: White corrugated fiberglass covers the shelter giving it a soft atmosphere.

Fig. 2: The shelter sits by a temple dedicated to Demeter, wife of Zeus. Fig. 3: Detail of the roof.

impressive archaeological site, the team opted for a simple design solution which make use of materials such as wood, corrugated fiberglass, and rocks collected on site.

As the design work was shared with the Kengo Kuma Lab –which has, however, developed its own pavilion– the team referred to some aspects of Japanese culture – Zen mysticism– as well as local one – Greek classicism.

The reference to the Greek temples of Agrigento is expressed in the project through the use of massive columns realised in galvanised steel gabions filled with local stones which serve for anchoring the shelter to the ground. This reference is highlighted by the slope of the roof, with an

angle of 22.5°, identical to that of Temple of Concordia. Moreover, the wooden roof evokes the typical gable roof of the Greek temples. Concerning the reference to Japanese culture, the shelter gets inspiration from Ise Shrine, the most important Japanese shrine, made of Inoki wood (cypress). In particular, it looks at the temporality and reversibility of Ise –which is disassembled and reassembled every 20 years– and at the shape of the roof summit, surmounted by a V-shaped ventilation duct for water collection. The roof structure is covered by a white corrugated fiberglass which gives a soft atmosphere to the shelter when lit up at night, with an effect similar to a Japanese lamp made of rice paper.

AkragaSheleter was designed by a parametric and associative model. The shelter –which is is modular and flexible– was conceived as a module that can be built in different areas of the park. Four variables have been taken into consideration for making the model: 1) the variety of sites with ruins in the park, 2) the different orientations of the sites, 3) the different size of the ruins to be covered by the shelter, 4) the uneven level of the ground.

Each variable was considered as a parameter in the digital model. The digital model designed can adapt its global geometry and that of its components to different variables. The height of every pillar is adjusted to ground conditions. The ground was modelled as a cloud of points built by importing data through a laser scanner survey. Length and width of the roof came as a result of the dimensions of the ruins.Every component of the shelter is hierarchically associated to the geometry of other components in a tree of associative relationships.

Once the shelter is digitally modeled, it is possible to simulate real condition of the site and associate i.e. its geometry to a database from which it is consequently possible to extract: amount, dimension and specifications of construction elements. Finally, the team built a small architecture, simple and respectful of the surroundings yet functional and elegant, perfectly integrated in the natural environment of the Valley of the Temples.This experiment shows the possibility in the use of this modelling strategy in a very simple geometry. Here the advantage is in the adaptability of the parametric shelter to different environmental situations.

4.2 Molecular Shelter, Tokyo University

While respecting the local context, the molecular shelter design reinterprets a concept borrowed from Japanese traditional culture. In fact, the shelter takes inspiration from the bracket system “To-Kyou : 斗栱” found in traditional Japanese temple where the roof plays a prominent role.

The bracket system “To-Kyou” derived from Chinese architecture and was reinterpreted innovatively as Japanese style in the medieval era 8^{th}-12^{th} century. It is a kind of stacking structure composed of wood materials and enabled architects to design flexibly plans, structures and compositions of the temples in that era.

The eaves –which extend far beyond the walls, covering verandas– have a practical function because they protect the building carrying by the rain as far as possible from its perimeter. The roof's weight is supported by the simple bracket systems. The shelter meets the requests of the Park Agency that asked for a shelter with a roof as large as possible, designed to carry as far as possible the rain from the excavations, movable from site to site, possible to reset up them in the different locations and to minimize surface area of column base. Columns’ size was checked by professor engineer Jun Sato through structural analysis software to optimize them to the thinnest size possible.

The traditional bracketing system was reinterpreted in the design, yet, it keeps an extremely essential both structurally and esthetically, and present an intrinsic elasticity, which lessens the impact of lateral forces by acting as a shock absorber. the bracket system “To-kyou” can’t change the position of columns after the construction, but our system is possible to change it under the grid ceiling-structure even after the construction. The inclination of the roof is the borrowed from Tempio della Concordia, so to have a direct reference to existing forms in the landscape.

The shelter – being made of multiple units – is light, easy to fabricate and assemble in a reasonably short time, movable, adaptive to the site, and modular. The structure serves also for hanging archeologists’ working tools.

The whole structure of the shelter is made by a joint system of 4 small struts bind both along x-y direction beams with M6 screws. The screws add on resistance against rotational movements due to

horizontal external forces. Being modular, the system allows to extension. If requested by particular site condition, columns can be positioned at different point of the grid. The structure weight around 100 Kg, and can be easily moved by 4 people. The shelter was anchored to the ground by 4 concrete blocks of 20 x 20 cm.

Fig. 4: The shelter integrated in the Valle dei Templi, close to the Temple of Concordia

Fig. 5: Traditional Japanese bracket system and its reinterpretation.

The shelter is made of local pine trees, that was cut and assembled with M6 size screw * 5000. It took five days to assemble it, and the final cost of the pavilion amounted to 1600 euro.

Concerning computational aspects programming was developed with Rhino, Grasshopper, Python. This made possible to organize exchange of informations between Tokyo and Agrigento and optimize the calculation which enables parametrical changes. In particular, the use of parametric software proved to be essential for testing different size and arrays of the grid structure, structure thickness and weight, material length and number of the elements used. As for the fabrication, it was preferred an hand-made easy fabrication system which demanded only simple holes by drilling and screwing instead of sophisticated machine hard to find on because our pavilion should be realized along with local production situation.

4.3 Discussion, Conclusions and Acknowledgements

Conceived and finished in a very condensed period of less than 45 days, both computational design

and digital fabrication enabled the speed and the challenges undertaken in each of the shelter.

The Japanese and Italian students interacted profitably, both with the local authorities and with the park functionaries and architects. The architectural design meeting took advantage of the scientific supervision of Kengo Kuma and Jun Sato as well as the contributions of subject matter experts like Giuseppe Guerrera, former director of a master course about Archeology held at the University of Palermo. The union of these synergies university, public functionaries and craftsmanship represents a unique moment of exchange and growth which opens new paths to explore.

The three shelters produced during "Architecture X Archeology" other than having a functional and aesthetic value and were built only for temporary use form the first nucleus of that which Director Parello imagines to be a park of modern architecture within an archaeological park.

Credits:

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Scientific Advisors: Kengo Kuma, Marco Imperadori, Salvator-John A. Liotta, Jun Sato.
Organization: Laps Architecture, Paris; Atelier 2, Milan.
Contractor: DIPARC- Vito e Michele D'Anna
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