ABSTRACT

This reflection, based on a research carried out at the University of Pavia is intended towards examining the conditions and project results connected with underground architecture, as works that have a meaningful relationship with the context in which they have been inserted.

Constructing below the ground has exigencies linked to the density of the city and lack of space. It also presents an opportunity to protect and conserve the landscape and could point towards architecture optimize the use of underground energy resources on an urban scale. Historically, architecture has many examples of underground cities, Western society, right from the myth of Atlantis and Leonardo da Vinci’s vision of a multi-levelled city has first imagined and then constructed subterranean tracts for infrastructure, public and commercial spaces, service spaces.

Throughout a new ‘alliance’ with the earth and therefore with nature, at the same time, experience takes us back to history through the idea of a stratified city that can handle the complexities and challenges of contemporary living. Parallel to this, sensitisation to ecological themes permits the idea of urban spaces below the ground that is in terms of energy use and landscape, in which the architecture and the water underground systems becomes the medium of this cultural transformation.
I | A new composition approach for new urban environmental and city spaces

The thoughts presented here are part of an ongoing research project at the Department of Landscape and Building Engineering at the University of Pavia, where I am the national coordinator of a program of scientific research. The research work is aimed at investigating the conditions and design results of underground architecture, as works that can have meaningful relationships with the context in which they are introduced. Constructing under the ground is not only a necessity, an answer born out of the problems of density and lack of space in the city, but also an opportunity to conserve the territory and landscape in suburban or dispersed contexts.

The history of architecture gives us multiple examples of underground construction. Western society, starting from the myth of Atlantis and Leonardo da Vinci's vision of a city on many levels first imagined and then realised underground urban tracts consisting of infrastructure, public and commercial spaces and community service areas as extensions of those on the surface. Through a new 'alliance' with the earth/soil and therefore with nature, we go through experiences that take us back to the concept of a layered city that is able to manage the complexities and challenges of contemporary times. At the same time, sensitisation to ecological issues permits us to imagine spaces that are low-impact in terms of energy and landscape, in which architecture becomes a medium of this cultural transformation.

Therefore, on one hand, we have the expansion of the contemporary city that becomes increasingly complex in which (compared to the past) it is difficult to establish a direct relationship between the typology and form of the city; it is also difficult to identify either historically existing features or urban fabric as references or further still, the block as the measuring unit of the architectural design.

As we all know, the present day city is discontinuous, fragmented and heterogeneous. This produces an urban system that becomes territorial, a system with variable geometry and density that spreads out and concentrates without any solutions of continuity in vast areas.

On the other hand, Architecture is unable to establish a relationship with the (almost inexistent) traditional morphological elements of the urban context. It is therefore faced with a situation where it must draw upon the natural landscape, the topography particularly, and the transformation of the terrain, in which the elements of nature, water, earth, trees etc., become new materials of construction. We need to recognise a fundamental change, that is, as Christophe Girot says, a change of nature, that we must face.

Thinking of a new urban environment and new spaces for the city, optimising the available natural resources signifies bringing a possible new state of nature into the research. The challenge therefore, lies in better understanding and respect for what nature has left us, with regard to our urban culture. It is generally recognised in literature that the original state of nature with regard to the city is certainly lost. Therefore, the nature that we can refer to can only be adequate compared to our actual environmental situation. The fundamental reason for this phenomenon could be probably identified if we look back at the incredible transformation that our urban world has been seeing in the last twenty years. Never before in the past has there been such a systematic degradation of our environment. At the same time, the legitimate (but at times irrational) need to restore and give value to the landscape has never been as great as it is today.

As Bruno Pedretti observed, “Landscape was born when we started thinking that the very same nature is designed, even if that thought is not historically separated from the leap of modern technology [...] but with the decline of the physical world to an indifferent willingness, every project has necessarily become dialogical. The concept that the issue of landscape is something more than enlargement of the scale of the architectural work derives from here, as does the idea that the landscape is something different from technological concerns. Architecture is something that goes beyond naturalistic animism and the simple idea of context. Landscape goes back to being a chosen place, a place of intelligence.”

It is but natural to refer to those periods in the past, where a heightened consciousness of the landscape resulted in a perfect relationship. The surrounding territory was designed, yet landscape was not necessarily conceived as an object of design. As in Ancient Greece, the central factor was simply the role of nature as a sacred element, always original and drawn upon. In fact, Greek philosophy always contained an effective fusion of architecture with nature; the disposition of natural spaces was the element on which urban spaces were based, as in the temenos, a natural lawn bounded by a fence, appertaining to a sanctuary.

We must be aware that it is impossible to refer to an original model of nature, since the gradual fragmentation and dispersion of the urban environment caused an irreversible transformation of our traditional cultural references to nature. Western philosophy has always oriented itself in the conviction in the existence of the primordial state of nature – a nature that can reveal its own intrinsic strengths. In our cities, we have tried in vain for a long time to re-establish those lost references to an idyllic nature in our urban culture.

Emilio Ambasz, in a recent editorial writes: “I believe that in the attempt to dominate nature as it has been given to man has created a second nature, with a relationship that is more complicated than with the original. We must re-define architecture as a man-made aspect of nature; but to do this, we must first re-define the contemporary meaning of nature. Maybe we can define it as a sort of Academy. Or we could call it...
In fact, from the first artistic models of Anglo-Saxon culture, at the beginning of the Hygenistic model of the Industrial Revolution, the design of the landscape evolved within a global design culture, firmly based on scientific certainties and frequently expressed with the slogan of sustainability. People did not realise that this culture of designing the landscape (where the search for any kind of connection with natural elements was considered undoubtedly good) remained completely removed from the actual situation.

Starting from the assumption that scientific knowledge with regard to the landscape and its real nature is still incomplete at all levels, that is, as already stated, it is technically impossible to bring back the land to its original properties, we assert that at this point that a new design approach can be introduced by reconciling with the urban environment. As C. Girot wrote, ‘to focus on the questions of nature, without reconciling man with his immediate urban surroundings today seems completely futile and limiting.’

The topography of the landscape can be considered a design approach that takes us to the expression of a new type of environment. New topographical landscapes are becoming widespread in the city; they represent forms very different from those represented in the past.

In many cases, the topographic approach can be taken as a direct expression of the current imbalance between nature and the city. Both in open areas as well as in densely populated and inhabited cities (artificialised cities, in other words), the design approach that re-transforms the morphology of the terrain through its topography becomes very important, even where nothing natural exists anymore. It is apt to specify that the term topography of the landscape is used in a broader sense of the traditional meaning of measuring and representing the terrain. The term is to be understood as the design of new terrain. In this sense, the topography of the terrain can be seen as the creator of a new urban environment, using natural resources optimally.

The topographical approach in architectural and urban composition signifies remodelling the earth to create new ways of using the land and possibly enhancing the value of spaces on the surface, in the new alliance between the land and natural elements. The strength of this approach within cities is directly related to both the urban environment and architecture since the surrounding land is freed and can assume natural characteristics and the architecture with its facades and planes (roofing for example) can become green areas. This leads us towards ecological themes and allows us to conceive spaces with low impact in terms of both energy and landscape; in this way, topography becomes a tool for cultural transformation. Thus modelling the surface of the terrain or the artificial surface of the city becomes fundamental in this approach using the topography of the landscape. This method surely poses structural and technical problems. Yet it opens up great possibilities for future development, starting from the new state of nature previously mentioned, considering the current environmental contingencies like soil pollution, the already existing soil excavation in the city but above all, the soil and the ground water as (still) natural resources that must be respected and with which an effective co-relation must be established.

2 | Historical underground architectures

The discipline of architecture has been continuously engaged in designing under the ground, right from ancient times. Except human settlements found within grottoes or caves, funerary architecture and the theological metaphor represent the first references pertinent to the culture of design. The Pyramids of Egypt that trace routes and chambers and exploit the potential of natural light to the maximum, the Necropolis at Thebes, the Stone Tombs of Mycenaean Society, the Roman Catacombs and the mounds of earth in North America are some of the more significant examples, across cultures and civilisations that are often the focus of rehabilitation and archaeological value addition.

During ancient times, there are numerous examples of settlements, and include those of a residential character: the subterranean cities in the Anatolian Peninsula, Derquyu among them, completely excavated in tufo stone and the underground habitations in Southern Tunisia, with chambers facing and underground court, which partly date back to Roman times represent some of the more celebrated attempts at subterranean living by trying to find a balance between environmental conditions, safety, typological and morphological conditions of collective and residential spaces.

Routes, spaces, both private and collective have thus progressively characterised the history and construction of many European cities (Naples, Orvieto etc.) that stand apart due to the simultaneous presence of settlements both under and above ground. The multi level city conceptualised by Leonardo da Vinci in the 1500s was first designed and realised during the Machine Age in the 1800s. Means of collective transport and the diverse types of transport allowed the
conceptualisation of a mirrored use of subterranean space, providing for both collective spaces and commercial activities. For example, De Finetti planned the Strada Lombarda in Milan, a continuous route, flanked by collective spaces, where glass fronted shops are located 6 metres below the level of the road and a system of collective transport plies in between. Piazza Fontana was another project by De Finetti, designed as a large underground public space opening into an open court, connected to a wider system of public spaces located at various levels.

After the Second World War, the Technological civilisation, aided by development, tried to conceive ways of living in environments that were quite different in character from those usually destined for human living. In the 60s, alongside the Utopian Plug-in City and the survival cell, the subterranean cities were planned, at times imagined to be possible settlements in outer space (the Lunar city) or to counter risks of nuclear proliferation like the underground city by Abramovitz and the Atomic City by Esquire.

Submerged cities, ideally represented by the myth of Atlantis, represent a different area of research that has important theoretical and design analogies with underground cities. Here, the element of earth is substituted by water. In France, as a guest editor of an edition of L'architecture D'aujourd'hui in 1975 devoted to “Habiter La Mer”, the French architect Jacques Rougerie presented designs for a number of underwater and marine based projects.

Some recent experiments, focused towards technical and technological innovations are trying different underground architectural typologies. This is also thanks to the propensity to partially renounce the use of natural light like in Museums, Hotels, Research Centres, Hospital laboratories, Inter modal Changes, Commercial Centres and even in actual portions of the city.
3 | Composition strategies for contemporary underground architecture

The history of architecture and exigencies of contemporary cites point towards the utilisation of underground space for different motives - the lack of space in the city in general that requires solutions that are specific and innovative, along with the need to increment the area and reconfigure the existing morphology of architecture and complexes. The use of subterranean space allows us to refrain from intervening on the existing architecture to a great extent.

So we find some notorious examples, as: grat hall of Galfetti in Lugano, hospital of Basilea by Vacchini, De Carlo in Salsburg and Albini in Genova, National Galerie in Berlin by Mies Van de Rohe, Lingotto Center in Turin by Renzo Piano.

Some recent projects seem to prefigure possible compatible solutions with the specific context and landscape: the Louvre expansion by Pei demonstrates the possibility of exploiting underground spaces by redistributing functions and accesses to the existing complex of monuments. The relationship between the new and existing seems to be clearly articulated in this way; the bike race track by Perrault at Berlin with its clear morphology shows the potential of inserting into the existing landscape large volumes that do not require space on the surface and natural light; the auditorium of Ravello by Neimeyer shows the use of accommodating service and support activities of the main spaces. This maintains the expressive character and compositional relationship with the surroundings.

A thorough evaluation of the real exigencies and the answers that can be provided by contemporary architecture is needed in the case of linear infrastructure where progressive re-structuring often takes place with an unjustified consumption of territory. The goal of protecting the landscape can therefore be effectively approached with underground architecture, where the visual ‘impact’ is cancelled.

Techniques and composition strategies can be seen in other types of underground or undersea structures. Felix Candela has designed an entrance to an underwater path as a series of light concrete vaults that are illuminated wither directly from the water or from other specific points and accesses.

4 | Conclusions

In spite of the fact that the research is in progress it is evident that the potential for further investigation mentioned up to now can expand into new fields of investigation and inspire new ideas and areas of study. This obviously depends on the fact that the elements that come into play are once again development of urban culture in relation to natural resources like earth and water. In a period of significant climatic changes the topic of transformation of the landscape in the most diversified parts of the territory requires an ever increasing awareness of the need to conserve ‘Soil,’ ‘Water,’ ‘Energy (sun and wind)’ by developing sustainable technologies and proposing eco-compatible designs.

The aim of protecting the landscape can therefore effectively be paired with the idea of underground architecture, whose visual ‘impact’ is annulled.

Underground architecture requires techniques and technology that are more expensive than the equivalent solutions on the surface but these costs seem to be justified in certain cases: particularly dense contexts, places where the existing landscape is or particular relevance, extreme environments like areas that are becoming arid. On the contrary, these increased costs are also justified in vulnerable areas where...
the aquatic ambience does not allow borders to be defined, or in places where land and water meet, imposing a different way of using resources and finally, places in which the emergency of climatic and natural events require a risk evaluation as an integral part of the architectural design.

We therefore intend to enhance the value of those functional and landscape elements, for an architecture that does not become an object in itself but instead gives rise to connections and relationships.

Moreover, in terms of energy consumption and more generally, in terms of environmental ‘impact’ and ‘sustainability’, underground architecture can boast of favourable microclimatic conditions, thanks to the presence of water under the ground. This generates a positive influence in terms of the underground temperature and inertia.

In conclusion, we emphasise that the most evident aspect is the urgent need to recognise the profound changes in nature that determine the climatic changes taking place; for this, we have to assume the responsibility to use the existing natural resources wisely. Thus, we can explore new possibilities and create new landscapes and new forms of living that try and integrate architecture and the city with nature.

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