Towards an Understanding of Shapes and Types in Architecture

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Abstract. Architects deal with shapes all the time in a variety of ways. Shapes in architectural practice are understood as an interesting blend of abstract geometrical forms and their possible or actual material realisations. These entities can even be identified with a real place, a place where people live, which then acquires this mixed nature as well. Thus, architectural shapes and places are not abstract entities nor can be confused with material realisations (the constructed objects) since humans perceive them well beyond their material aspects: enclosed and open places are perceived via their material as well as their idealised forms. In this paper we make some initial step in the study of this characteristic of architecture and its understanding of shapes and places. In particular, we focus on the perspective that architectural types offer to read shapes.

Keywords. architecture, shape, type, design, ontology

1. Introduction

Architecture presents an original mix of distinct efforts going from contemplation to action. The other visual arts represent and interpret reality according to some point of view and within the constraints of a certain medium. Action in these arts is often limited to the "translation" (perhaps in terms of an interaction) of the chosen view into the given medium. Architecture, while embedding this goal, goes beyond by aiming to contemplate, understand and recreate reality via its very transformation. This activity requires to balance two forces. On the one hand, the desire to exploit the physical realm with its natural laws, the properties of known material, and the intrinsic nature of the portion of space under consideration (natural or previously altered by human activities). On the other hand, the need to understand and control the effects that the foreseen alterations of reality, perhaps just in terms of spatial arrangements, have on the perception of the space itself and on how humans, in particular the users, experience it. Across the historical periods, the architects have been struggling to find an equilibrium between these two tensions within the constraints of their cultural environment and the limitatinos of the clients' needs.

We plan to shed some light into this particular aspect of architecture by focusing on the way architects see and use shape. Our plan is to apply ontological analysis to high-

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light and coherently separate the key elements in the architectural creative processes. Our general goal is quite challenging and requires a long study. In this paper we make some progress, in terms of hopefully interesting observations, about the potential hybridisation in the architect's mind between architectural types and their realisations as well as between their 'universal' and 'local' properties.

2. Layers in Architecturet

Architecture develops on a complex and various set of knowledge that could be divided into a number of layers. From the discussion in the introduction, two important layers to distinguish are those of conception and realisation, respectively. The architect's activity is a process comprising a series of steps which start with the initial act of conception of the architectural design, an act that at the beginning might not have a design goal. Architecture often starts as an act of art. We can thus split the conception layer in two further layers: conceiving as a spontaneous act, that is, an act of art, and conceiving as a task-oriented act, that is, the answering to the needs of the client.

Usually shapes are presented as static entities characterised by static properties [Casati2013]. During the architect's creative phase, she recalls and recombines the accumulated knowledge that form her background. In this effort to image and rethink the object she is creating, how it could be realised and how it matches possible design goals, shapes intrinsically evolve like they were flexible entities in a mental representation of space. This mental space keeps changing under the stimuli of new intuitions and developing ideas. In this cognitive process objects do not really exist beyond their shapes (often just vaguely understood), and these seem to lack the geometrical rigidities we usually take for granted: their forms can be adapted and their positions change with respect to each other; yet they are stable enough to anchor their identity, their identification 'signs' and their roles in the overall project.

3. Knowledge of Space in Memory-based Creativity

An architect, in the effort to balance critical aspects like locality (the material and cultural specificity of the region of space under consideration), functionality and creativity, has to satisfy basic social needs in a given physical and cultural layout and, at the same time, to break the rules to offer surprise and innovation into the built spaces as well as new modalities for an aesthetic fruition of them.

While we recognise the complexity of this scenario, we posit as working assumption that the form of creativity realised in architectural design is a manifestation of memory-based creativity. The underlying conceptual approach, that we hope an ontological analysis can make explicit, should clarify and manage the complexity of references, constraints, functional goals, and designer's ambition across the cognitively centered design process. The process is externally constrained by the objects to become (including their need to be material beings) and internally by the personal memories of the designer.

Creative aspects in architectural design are based on both expert knowledge and experiential knowledge. The latter includes also knowledge of lived space. Complex spatial forms and relations have been already clarified, at least at the mereological,

topological and geometrical levels, via ontological studies of space and related notions [Bhatt2012,Borgo2009,Borgo2010]. These provide a first framework to understand the deep meaning of space for the designer.

Since knowledge about space, spatial action and organisation of space contributes significantly to the creative process, we have been looking at architects' memories of design, space, architecture and memos in their autobiographies. This literature suggests that space memory strongly and primarily affects work approaches and creativity [Petruccioli2007,Rossi66]. Since technology has been permeating architecture, spatial memories today should be studied with a larger perspective by looking at the manifestation of technological memory [Borri2006].

4. Architectural Types

Architects have tried to understand the specificity and complexity of their area over the centuries, and have even attempted to systematise the key elements that are at the core of their work. These efforts are important to compare the different views and historical approaches as well as to highlight important regularities. We are particularly interested in the notion of architectural type, which since Vitruvius [VitruvioIBC] has been exploited by many architects in discussing their domain. Types in architecture have been listed, explained and discussed over time in the attempt to introduce and specialise notions like form and function in architecture. The introduction of architectural types seems to answer a need to instantiate and analyse some natural classifications of architectural works, classifications amounting to so-called archetypal distinctions.

Since the work of Durand in the 18th century [Durand1799], architectural types have been exploited to distinguish and classify architectonic objects: from houses to temples, from public buildings to squares and so on. In the literature these types are fairly stable but are discussed at different levels of generality and interpreted under different views or cultural scenarios. One may focus on the relationship between the architectural object and its surrounding space as seems natural for churches or malls; another on the comprehensive form of an architectural object like the Villa Capra (Palladio) or the Guggenheim museum (Gehry); another on the object's functionality contrasting a museum and a library; another on the interactions (leaving aside functionality) among the object and the users and so on. The perspectives that are associated to these different aspects are hard to unify under a single framework, even their comparison seems to be challenging.

The result is that over the years authors discussing and theorising architecture have proposed different ways to interpret types, essentially relying on different mixes of the aspects listed above. Unfortunately, most of the time the very reasons behind the introduction of a new perspective or of a new architectural classification of types are not given. One could elicit, from the background within which these perspectives are adopted, the motivations for the need to rethink previous definitions. This analysis is complex but can reveal the implicit motivations for a specific choice of architectural types in some historical period or even architect.

From the initial results of such a study, we can claim that types are reinterpreted depending on the view of what architecture, as an activity, should be about and of what it should aim to. This observation explains why over the years architectural types have not

been as homogenous as one would expect. This core notion of type is reinterpreted in the different periods because it seems to provide a simple and comprehensive organisation of what architecture creates. At the same time, since the conceptual tools on which it relies are constrained by contextual, cultural and social views, the notion of type needs to be continuously readjusted leading to rethink what architectural types are as well.

5. Architectural Types in the Literature

The evolution of the theory and practice of architecture and, in particular, the increasing specialisation of buildings in relation to their function have influenced the introduction of new ways to conceptualise forms and functions. We thus have interesting varieties from the milestones of the XVI-XVII century by Palladio, through the XVIII-XIX century refinements and increasing specialisation by Durand, to finish with the development of the form-function conceptualisation in the current paradigms of type and typology.

Already in the preface of [Palladio1570] there is a neat distinction of buildings by type and functions. Private homes are contrasted to public buildings and within public buildings a list of city parts' types are collected: roads, bridges, squares, monumental arches, aqueducts, fortifications of cities, ports and public buildings aiming to accommodate social functions like prisons, churches, courts, arcades, gyms; and again temples, theatres, amphitheaters, baths.

Durand [Durand1799] looks at the city from a different point of view individuating which parts constitute the city, the distinction between inside and outside, and even the decorations of city's streets. He directs his attention to what has to stay outside the city walls, like burial monuments (monumental tombs) and hospitals, and the characteristics of what has to be inside. The walls themselves, in their role of separators, form an architectonic type with their specificities like the entrance doors opening to the inside streets. The types resulting from this view include streets, triumphal arches, bridges, public squares, public buildings, temples - churches, palaces, courthouses, colleges, libraries, museums, observatories, markets, lighthouses, building grants, customs trade fairs, theatres, and hospitals.

The notion of type used in architecture reminds the categorial notions on which ontological analysis rests, that is, the rigid distinction of entities in homogeneous classes that fix some of their properties as primary or essential. Yet, one should not confuse ontological types and architectural types since the double nature of architecture, described in the introduction, brings an epistemological component into the picture, and this is crucial to understand the particular role that types end up playing in this domain.

This point is clearly made by Martìs Arís when claiming that an architectural type is a statement that describes a 'logical scheme', a formal structure [MartìArís1990]. To understand this view we need to think of types as abstractions built not just from the analysis of its (real and/or possible) instances, but from the complex system of relationships among the context of architectural activity, the design that it produces, and the building that it realises.

Note that a definition of architectural type must be able to distinguish types from the modern concept of standard. A standard refers to a (possibly rich) pattern. Patterns, even when adaptable, are ultimately independent from the spatial location where they are applied, and are therefore easy to reuse. A type, although capturing some regularities across time and space, is still anchored in the experience of the constructed object and thus is continuously modified or reinterpreted both in time and across locations.

Many architects and much literature have dealt with the definition of architectural type across different views as proposed, for instance, in philosophy and history of art. Giani [Giani2010] collected a large amount of "definitions", distinguished according to their background domain and position in the history of architecture. These statements are not comparable to anything resembling a modern form of definition since they have an implicit rhetoric and moral taste, but the variety of meanings that these cover is interesting. Even dictionaries and encyclopaedias present types as a 'character', a rule. These, however, are at most a medium and do not lay at the core of the architectural type notion.

Grandinetti [Grandinetti] concentrates on the architectural types in the ancient Greece showing how these types were structured over time, how they entered the roman architecture, how they became part of the structure of urban morphology. In this analysis, he focuses on temples, thelestherion, boulotherion, stoà, and gyms. This shows that types are attraction points of structural regulations and formal milestones with a large number of varieties in their instantiations. They identify the parts that, according to their level of shape similarity, characterise the urban morphology: something that connects the ancient greco gym type to the monastery we know today. Monasteries that, in turn, later may have become schools, hospital, and so on.

6. Towards an Ontological Analysis of Architectural Types

In the previous section we have listed some historical views on architectural types. As said, there are many similarities across the periods and authors but also important dissimilarities which, apparently, make hopeless any attempt to isolate a unifying and stable perspective of this notion.

We already listed the types used by Palladio. Palladio [Palladio1570] discriminates buildings based on their functionalities. He starts with private homes, then lists public buildings. Among the public buildings, he puts types that are not properly types of buildings but connecting parts of the city. These parts of the city are roads, bridges, squares, monumental arches, aqueducts, fortifications of cities and ports. Finally, Palladio adds the public buildings that isolate a space dedicated to some function: prisons, churches, courts, arcades, gyms; and again, temples, theatres, amphitheaters, baths.

Similarly Durand [Durand1799] distinguishes the main parts of the city - the edges of the city - (and discusses how to decorate the city streets). According to his view, burial monuments (monumental tombs) and hospitals must stay outside the walls or, if inside the walls, must have their own enclosure: entrance doors, entrances to the streets - triumphal arches, the streets, bridges, public squares, public buildings. He then lists

temples - churches (for use) and then: palaces, courthouses, colleges, libraries, museums, observatories, markets, lighthouses, building grants, customs trade fairs, theatres...

Instead of attempting to identify one particular notion, perhaps among those discussed in the literature, as the true and general notion of type that can subsume all the others, we discuss the elements that can be taken as unifying across the different views. Our goal, then, is to set the basis for a view on architectural types that distinguishes the possible dimensions of interest and that can be later organised into a motivated (and possibly stable) classification. One advantage of this work on architectural types is the development of a tool that help to read the structure and dynamics of architecture in a multi-scale prospective from building to cities and territories in a cascade of generation and evolution of spatial primitives. This, hopefully, will allow us to study the unusual notion of shape as recurring in architects' practical activities.

Resuming the twofold nature of architecture as an art and a science, it should be clear that the notion of type in this domain comprises elements from different ontological perspectives. Types, as already detected by Vitruvius [VitruvioIBC] (even if he does not use this term as we know it), are ways to identify architectural entities and are characterised by the relationships of these entities to space. First of all, this means shape as well as the complex spatial relationship of the entity with its surrounding environment. Another dimension traditionally explored is functionality, in particular in the sense that the entity contributes (and perhaps even forces) a new organisation of space towards the achievement of some goal like the separation of an inside and an outside (city walls, buildings) or the performance of some social activity (gyms, squares). The 'living style' (that an architectonic entity introduces or modifies) at the social level is another central aspect that characterises the identity of the entity itself, while the redefinition of the environment and of the affordances provided to the observer are characteristics that take into account the perspective of the agent. Space, spatial relationships and the realm of possibilities that these offer to the user are variables in just one dimension.

As we have seen, architecture has also an artistic nature that cannot be explained without referring to notions like intentionality, creativity and memory. We embrace the view that design, and thus the architectural outcome, is the expression of a critical conscience somehow detached from reality. It derives from the special personal universe of the architect and her inventive memory –which is exportable and non-contextualised– and not from the specific social context of the area addressed by the architect's design. Creative aspects of architectural design are hard to pinpoint. As said, they are based on complex expert and experiential knowledge, almost a remarkable result of a memory/knowledge-association process [Weisberg1993,Gero1996,Mallgrave2011, Borri2014]. This may explain why still today the creativity element is only marginally present in the discussion of architectural types, and perhaps mostly limited to highlight schema variations more than type characterisation. Another interesting factor in architectural types is the different uses of abstraction which, especially via typology, is needed to understand and reinterpret the structures of the architectural entities. Following this observation, even the path from primitive (or basic) to complex types may significantly draw upon creativity, and in particular upon the cognitive ability of associating memories and structures.

There is also a kind of common core in all this activity and creativity. The very first origin of any building type dates back to the construction of a place to live, a place of protection. It arises by marking the separation of what is in and what is out (e.g. via a fence) and by covering it to obtain a 'liveable' space: these two actions persist in any innovation and constantly change [MartìArís1990]. After all, any architectural realisation is a process of instantiation: the common and general features time by time become individual, unique and unrepeatable, distinguished in space and time [Strappa1995]. A basic step yet still today hardly recognisable in standard discussions on types.

7. Conclusions

We started from the nature of shape, as understood in architects' practice, and at its unusual properties. Via a discussion of architectural creation as a memory-based activity, we were led to consider a fundamental notion like that of architectural type. Our analysis of this latter notion, based on the literature and admittedly preliminary, led to show the advantages of extending the set of parameters still today adopted to discuss types in architecture. In particular, we have suggested to directly introduce intentional aspects into the discussion. This line of research is particularly complex due to the need to work and mix the cognitive level of the designer and the social level of the design among others. In this regards, we have proposed some (hopefully promising) directions. For instance, we suggested that some types are constant across time and cultures simply because heavily related to objective dimensions like space, spatial relationships and functionality, while others may remain unclear because we still lack the ontological and cognitive framework to model them correctly. This notion of type seems to point to the right direction in the analysis of shapes (and their role) in the complex processes of architecture.

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