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MODELLING EDUTAINMENT

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A b s t r a c t

The paper elaborates on a certain way of describing an architectural space by means of a physical model, along with a project exercise realized as a part of the course in Descriptive Geometry which is an element of the program of the first year of studies in the Faculty of Architecture. The intent is to incorporate a component of entertainment to break out of the "rigid" and "dry" way of teaching this subject.

Keywords: Didactic Solutions, Designing Task, Physical Model

S t r e s z c z e n i e

Artykuł prezentuje sposób opisu przestrzeni architektonicznej, jakim jest model fizyczny w powiązaniu z wybranym ćwiczeniem projektowym realizowanym w ramach przedmiotu Geometria wykreślna prowadzonego podczas pierwszego semestru studiów na Wydziale Architektury. Ćwiczenie to jest próbą wprowadzenia elementu zabawy strukturą dla przełamania „sztywnego" programu nauczania przedmiotu.

Słowa kluczowe: dydaktyka, ćwiczenie projektowe, model fizyczny

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1. Introduction

The fundamental ways of capturing an architectural idea are concerned with the media used to communicate between the designer and the user. All of them are used to explain a certain mental model, which is subsequently realized in an architectural construct.

As a matter of fact, there are six ways of capturing any design concept. The first one aims to describe the assumptions of the project and the underlying idea. The next is a planar drawing displaying an organization of the space of the object, which is composed of projections and sections (orthogonal projection). There is also a spatial drawing which comprises axonometry and perspective (parallel and central projection) using which we display the organization of internal and external space in relationships with the environment as well as the scale of the human. One can refer here to [6, p. 265]: "These ways of portraying the space assure that the architectural representation becomes more tangible through some theoretical background reflecting upon the physical reality of the construct. These are some forms of *mimesis* – a graphic mimicking the existing entity and expressions, a rigorous way of describing information about a shape or dimension of the object…". One could mention here description in the form of a movie – in this case the space is augmented by the factor of time. The next mode of description is a digital model in which the form is generated with the aid of suitable algorithms. Finally, we encounter a physical model which demonstrates yet another aspect than those discussed so far, namely a way of building the construct.

Undoubtedly, to assure a broad perception and understanding of the project, it is beneficial to engage in several methods of describing the architectural space. Their mutual intertwining and supplementing impacts the quality of the architect's design activities and the quality of the artefacts produced.

2. Education

In the realm of the course of Descriptive Geometry offered by the Faculty of Architecture, instructors are often faced with the problem of how to approach the problem of space – its formation and mapping. It is crucial to identify an appropriate and suitable way of realizing this task in the context of innovative visualization techniques. We remain convinced that while retaining the traditional ways of building objects, we have to stress the aspect of forming models which is of particular usefulness in the context of the existing tendency to form design concepts based upon an approximate structural model.

Constructing architectural models entails a number of advantages – a better understanding of spatial structures, and the ideas, functions, and forms of the objects. It realizes the highest objective of students' mental development, which is the compact coordination of various tasks – construction-based, composition-oriented, and those related to aesthetic aspects.

In the education process of future architects at Polish universities, the use of physical models treated as development tools is marginal in comparison with the role that is identified for their virtual equivalents. We tend to overlook the benefits of working with models. Of course, they play an essential role as being associated with architectural projects; however, their introduction into courses such as Statics of Buildings or Descriptive Geometry offers indispensable advantages. "The difficult art of building mock-ups does not entail exclusively a reduction of reality. This art is subject to its own rules while a presentation of building objects serves only as a mere pretext" [3, p. 89].

3. Representation

Models – miniatures – have been an information medium in contacts between designers and investors or potential clients for centuries. Professionals in the building industry can skilfully move around in the world of two-dimensional representations of a three-dimensional spaces, while individuals outside this sphere might encounter some difficulty in aggregating projections, views and sections in a single form of the object. A three-dimensional physical model, reflecting the aspect of model building, is understood by all. It exhibits a number of features that are common with the real object, and this is helpful in realizing a reliable verification and assessment of the proposed solution – it becomes a game in space. It is well known that what is possible to model is also possible to build. Therefore, we can conclude that the model is a certain prototype of the physical construct.

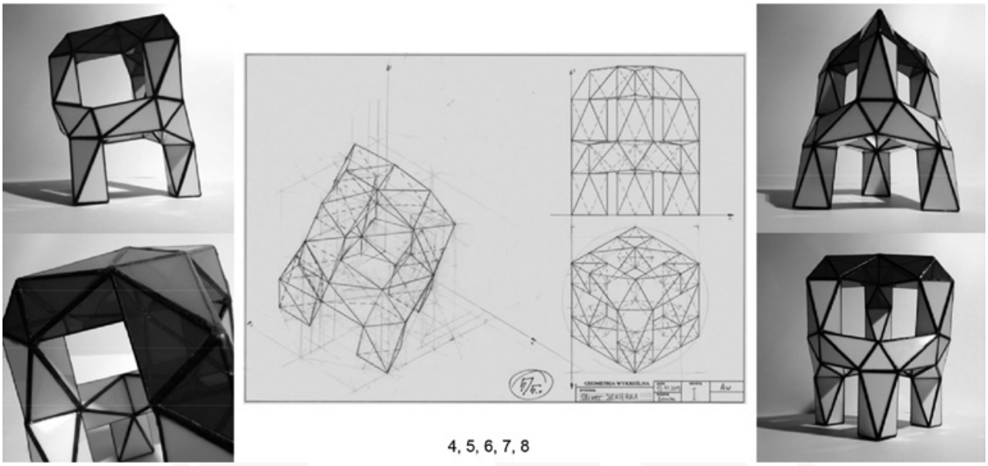
Today, model-based design is more frequently encountered in architecture. Two-dimensional or three-dimensional constructs built electronically are continuously verified with the aid of physical models. A model, viewed as a synonym of the original at a certain scale, can be tested in various ways, say in acoustic chambers or wind tunnels. The Austrian designer Copp Himmelb(l)au has often used a movie-photographic atelier to complete analyses of reduction models in successive design phases. By confronting the work completed in parallel in the 2d and 3d format, an additional value is offered when coming up with the final architectural construct. Owing to this, we should be aware that with the aid of a simple model (a rapid working template) we are in a position to augment the project by considering some aspects that have not been considered before.

In the last phase of design, we may encounter sensory model design. In this phase we consider a model completed using the anticipated material and at a real scale to assess its material and aesthetic aspects with regard to the existing context.

An undisputable value of the model is that we become aware of the material that is going to be used. The model as a reflection of the future object implies our need to touch it, look at the structure and shape. It is likely that a product that faithfully reflects reality becomes attractive, and engages the observer, investor and user because it is far better understood than the 2d or 3d description completed in the electronic version. The physical model always constitutes an attractive alternative to connect with the client and as such it enjoys interest. As a summary of the project, it could be a useful element of the promotion process.

4. Triangulation

As a result of the technological revolution initiated in the 1950s, the computer has become a tool of everyday usage. Everybody has seen computer graphics, either in games animation or animated movies, which are, in essence, a realization of 3d space in a 2d space. Computer graphics constitutes one of the possible uses of a new branch of geometry, namely algorithmic geometry, which is referred to as computational geometry. There are numerous complicated geometric figures which have to be handled. In other words, there is a need to



4, 5, 6, 7, 8

Ill. 1. Al Bahr Towers – Aedas, 2013, Abu Dabi, United Arab Emirates [13]
Ill. 2. New Trade Fair – Fuksas 2005, Milano, Italy [11]
Ill. 3. Starhill Gallery – David Rockwell, Kuala Lumpur, Malaysia [11]
Ill. 4.–8. Orthogonal and Axonometric Projections with Model – designing tasks carried within the subject Descriptive Geometry for the first semester of studies at the Faculty of Architecture

establish a suitable technology that helps solve these problems. In this regard, triangulation forms a certain system which is responsible for the current situation. This technique helps split complex objects (regions) with the exception of the circle, into a collection of triangles (in the 3d case of rectangles). Furthermore it is a technique that helps describe complex geometry with the aid of a certain mesh as computer-generated imagery. It helps solve numerous problems such as region filling and determining points of intersection. The objects formed through meshes (used in 3dMax, Maya, Blender) are ready to superimpose texture and complete rendering processes. In addition they may be subject to various modifications and deformations.

Triangulation is often associated with computer graphics; however, it could be applied to other disciplines such as geodesy, astronomy, mathematics, sensor technology, psychology, and sociology.

In designing complex nonlinear surfaces, triangulation is tessellation. It helps decompose a surface into flat regions which are easy to process with the use of CNC. Examples here would be the roofs in the Great Court of the British Museum (1997–2000) designed by Foster & Partners and the building of the DG Bank (1996–2001) located at Parizer Platz and designed by Frank Gehry.

An excellent example demonstrating the use of two-curve surfaces realized by tessallation is the freely formed ribbon or veil of roof of the central pavement of the New Milan Trade Fair (2005). M. Fuksas accommodated this structure to fit into the natural landscape by spanning it on adjacent buildings dramatically bringing it down to the ground level. A Polish roof completed in a similar way is the Zlote Tarasy complex in Warsaw (2002–2007) designed by Jerde Partnership with substantial design support from the Polish division of Ove Arup.

In all such cases, the system of precisely formed flat components that differ with regard to their size and adjusted to the costs and production scenarios has been possible thanks to digital fabrication.

5. Creation

The objective of the design exercise realized as homework was to construct orthogonal projections – Monge's projections, parallel projection – axonometry, and to realize a mockup of the structure of the object generated by the triangulation method. The project can constitute various architectural components such as elevation forms, roof of the object, site-specific installations or a part of the solution such as a structural elevation plane. Given the time constraints, and in order to match the problem to the actual abilities of first-term students, the solutions were narrowed down to triangulation issues.

The issue itself was pre-empted by a lecture presenting the idea of triangulation in various areas of science and technology, with a focus on architectural designs and solutions.

In my opinion, this formulation of the problem stems from the fact that contrasting real models with a 2d space representation delivers obvious advantages because of the full understanding of the structure of the object. The problem becomes interesting from the perspective of representing triangulation as data structures fully comprehended and easily processed by computers. There is also an effective realization of geometric manipulation of the objects formed in this way.

In addition, the physical model offers a potential contractor (student) an ability to assess the shape, proportions and form of the objects. The technology for its realization, which is completed when using materials exhibiting specific physical properties, is reflective of the laws of statics impacting the construct. Obviously, this material (balsa, cardboard, plexiglas, styrodur etc.) has different properties than the material used in the project. Nevertheless the project completed for some tangible material teaches the students responsibility for making a decision on choosing a suitable material to realize the project.

6. Conclusion

- The method of architectural representation of the developed project impacts the final result.
- Drawing, being a manual way of transforming concepts of the designer onto paper, serves as a communication vehicle between the designer and the environment.
- Models serve as an "information medium" thanks to which the architecture becomes fully understood and perceived by investors. They are also a "project medium" in the process of forming structures (including also 3D scanners) and as a "cognitive medium".
- A working mock-up being a realization of the creator-architect's vision and concept to be presented to investors and receivers at all phases of design is useful to the author himself by facilitating a comparative analysis of successive design phases and overall thought process.
- Constructing models invokes some creative emotions helping in the discovery of other variants of the architectural solutions.
- A physical model enables an interaction with a real mapping in its genuine shape with all proportions being retained.
- A model – mock-up of an object supplies complete freedom with regard to any selection of any fragment of the object under development and a direction of viewing.
- Making use of sketches and physical mock-ups results in full engagement in the perception of the architectural construct.
- A combination of studies on the project in the form of drawings and models serves not only to represent the form of the building, but is useful to illustrate a function and check its statics.
- Despite the tremendous technological achievements in the development of virtual models, manual creation (analogue) still enjoys an undisputable role in architecture and art owing to the abilities to offer a direct interaction with the material world.
- Education in the realm of individual disciplines always promotes abilities of rational problem-solving with the use of knowledge of laws and rules present in the discipline.

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