Digital Czech Cubism

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Abstract. Cubism is one of the great phenomena of Czech architecture and the use of digital technology opens up a new aspect of its significance. Digital models of both realised and unrealised buildings are becoming an important aid for research into the history of architecture and the teaching of this subject. The very process of the creation of the models enables deeper understanding of the principles of Cubist architecture.

Keywords. 3d modelling; Virtual architecture; history research

Introduction

The project of digital Czech Cubism is part of the research subject Model Methods of Design, Model and Presentation Techniques in Architecture at the CTU in Prague, supported by grant MSM 210000028 . The research intention is aimed both at the classical methods of designing and presenting architecture and at the new digital approaches.

The aim of the postgraduate project is the creation of a database of Cubist buildings (both realised and unrealised), consideration of the possibilities of a digital model as an instrument for research into the history of architecture (critical reflections of the individual buildings and the style as a whole) and the proposal and testing of new methods of creating digital models (work procedures, structure of models, presentation of results).

Cubism in Czech architecture

Cubism is, alongside Supreme Gothic, dynamic Baroque and Functionalism, one of the great phenomena of Czech architecture. It is, however, also unique in this list. Cubist architecture, inspired by the art trend of the analytical Cubism of Pablo Picasso and Georges Braque, came into being only in Bohemia. Even though its development was only very brief, it has its period of preparation in 1910, climax in 1911-1912 and breaking-point in 1913, up to 1922 a mere thirty or so buildings were constructed. At the birth of Cubism in architecture stood four young archi-

Figure 1. Black Madonna House in Prague.

tects: Pavel Janak, Josef Gocar, Vlastislav Hofman and Josef Chochol, who tried to define themselves as a generation in the face of the too severe rational architecture of the representatives of the modern trend.

The chief theorist of this style was Pavel Janak, who in his articles (the key article was entitled Prism and Pyramid) upheld the opinion that the spirit turns the material into the abstract. His concept of architecture as pure geometric forms comes very close to Neo-Platonic philosophy. He considers the oblique to be the victory of the spirit over the materialist symbols of the horizontal and the vertical. Janák found the forerunners of Cubist architecture, who emerged through the struggle between spirit and matter – the reduction of matter in the Gothic, dynamic Baroque and Baroque Gothic of J.B. Santini.

In the first projects in Jicin (1911) and later in Neklanova street in Prague the authors tried to implement the new procedures not only in the shaping of the facades (where they applied openwork surfaces and pyramid shapes), but also in polygonal layouts. But for the entire period the Cubists did not manage to acquire such orders as would enable them to implement the new procedures spatially as well. This is the reason for the statement that the Cubist architects were unable to free themselves from the tradition of the facade architecture of the nineteenth century.

In 1913 there was a split between the Prague architects and those from outside Prague. Further architects joined the original four founders. In their work they tried to react to the latest stimuli of synthetic Cubism. Differences began to appear in the work of the individual architects – Janak began to use not only diagonals but also sectors of a circle in his designs, Gocar included a reinforced concrete frame, Hofman conceived of matter as something living (he used the terminology of power curves and organism), and Chochol fought emphatically against ornamentation.

After 1920 Cubism moved into the period of "Rondocubism", characteristic of which are relief hemispheres, circles intersected by a rectangle

Figure 2. Villa in Prague.

and sectors of rings with the implementation of emphatic use of colours. The style was designated as national and was to a certain extent opposed to the Cubism of the pre-war years. After 1923 Cubism survived only in details.

In relation to the surrounding countries the Cubist architects did not catch on in Paris, the cradle of Cubism, but they did have some influence on Dutch Neoplasticism and on the German Expressionists (Bruno Taut, Hans Poelzig), as is documented by their mutual contacts in the twenties.

The evaluation of the importance of Cubist architecture changed in the course of the past century from rejection to uncritical acclaim. The important questions as formulated by Rostislav Svacha remain: Was Cubism a "national" Czech architectural style or an import from Paris? How was it inspired by the example of Picasso? Was it provincial or part of a wider pan-European movement? Was it rather innovative or traditionalist? Were its aims restricted to the new decoration of facades or a more profound transformation of the basic principles of architecture?

The digital model as a tool

Cubist architecture offers us a number of opportunities for the use of digital technology for its description, recognition and interpretation. In the process of modelling it is important to remember that the model is always only a certain simplification of reality. Within the framework of the project there is no creation of precise copies of buildings – with all the deviations from the original documentation which occurred in the course of construction or the changes made as a result of decay. The aim here is first and foremost the geometrical perception of the building – its pure crystalline form.

Development of the design of the building

In the constructed projects we usually only know the result of a long process and there are also necessary compromises reflected here (with the authorities concerned, with the investor, with the building firm). An example of this is the design of the first Cubist building (Jicin), where the design to begin with is dynamically shaped, although the final building is considerably more modest (for both economic and technical reasons). The digital approach enables us to capture the development of the design from the initial sketches to the final realisation.

Development of the building in the context of locality

Digital technology, as opposed to the classical modelling and depicting methods, is able to capture the elements of time and change. We understand the architectural work in its context, but the environment of buildings often changes fundamentally in the course of the years and the Cubist buildings themselves alter (reconstruction, additions), which means that our present view is other than the view at the time of construction. A special case are the buildings which are part of a larger series, such as the spa complex in Bohdanec, so that understanding of past development and the present situation is important for its further development and protection.

Unfinished and demolished buildings

In the collection of buildings there are also models of projects which were not completed, where only their visualisation and animation gives a true picture of the overall target.

The virtual reconstruction of vanished or demolished buildings (and towns) is today a method which is used very frequently and from the Cubist period it applies mainly to the Hofman Crematorium in Ostrava. In this case the virtual model is a reconstruction of a vanished building just as it was built, according to the basic material preserved.

Unrealised projects

Due to the small number of realised Cubist buildings it is important to have the modelling and presentation of projects which remained only in the form of plans and sketches. It is in these proj-

Figure 3. Pavillions at the entrance to the graveyard in Prague.

Figure 4. Spa House in Bohdanec in 1913.

ects that we can verify and demonstrate that Cubism was not only the formal shaping of facades, but an entire spatial conception which also encroached on the sphere of urban planning (the proposal for the buildings of the Prague Vysehrad citadel by Vlastislav Hofman).

Possible development of style

The hypothetical question is how Cubism might have further developed, variations of its designs are created and the continuation of spatial principles tested within the framework of exercises in composition.

Basic material

The source of data for the digital models are building plans from the authorities, new survay in the case of reconstruction, period photographs, professional publications, articles and periodicals. For two Prague buildings it was impossible to obtain sufficient documentation and here the method of photogrammetry comes into its own. Most important, however, is the vast quantity of material in the depositories of the Czech Technical Museum, where the heritages of a number of Czech architects are stored. The archive material was, however, partly damaged by the flooding in the summer of 2002 and some is unfortunately also temporarily inaccessible. In this light the consistent and rapid digitisation of all the preserved archive material becomes even more urgent. The basic material used varies in accuracy, it has been processed by various people using various methods at various times, and very often these are mutually incompatible or directly at variance, but what is important is their correct systemisation, differentiation and acknowledgement of validity.

Figure 5. Sketch of interior.

The digital model - technology

The main modelling software is MicroStation, which enables work with the dwg format, and for the presentation and visual control it has integrated instruments for animation and visualisation (Ray Trace, Radiosity). Within the framework of the research other software for modelling is also tested (ArchiCAD, 3D Studio and Rhino). Working directly in the dwg format facilitates the transfer of the data created without loss of information to further platforms, for instance platforms specialising in realistic visualisation (3D Studio). The structure and organisation of the data in the model is very important, the differentiation of the individual parts takes place on the basis of several criteria. The basic division is according to the time of origin/change, construction parts and material (for later categorisation of appropriate textures). The suitable selection of structure should enable the widest possible use and presentation of the model. Also differentiated, in the case of missing documentation, are those parts completed by the author of the model. The models are created for the consideration of the composition and geometric principles of Cubist architecture and the detail selected corresponds to

Figure 6. Vlla in Jicin (first design - 1911).

this (the models do not, for instance, include fittings and detailed profiling). A number of models are made up of the reference files of the individual parts, which enables eventual further refinement of detail. Also part of the project is the following presentation. From the 3D model are prepared visualisation, animation and VRML models. At the close of the project there will be created a systematic databank of buildings with all the collected basic material and resulting work and the database will be presented through the Internet.

Figure 7. Black Madonna House in Prague (physical model).

The physical model

The collected and digitalised basic material does not serve only as a virtual collection of Cubist architecture, but is also used for the creation of physical models with what is known as computer support. This offers the opportunity to compare the classical physical model with its digital counterpart as instruments for research and education.

A new possibility of the presentation of digital models of Cubist buildings at the Department of Architectural Modelling is its materialisation by means of the technique of rapid prototyping in the Dimension instrument.

Summary

Although this project is still developing, it is already possible to state that the creation of the digital models of Cubist buildings brings us a more precise view of the development of the individual buildings and of the style as a whole. In particular the models of the unrealised designs present the existence of new architectural principles and demonstrate that Cubist architecture is not the mere formal creation of facades. The actual process of digital modelling has an important influence also on the understanding of the method of Cubist design, the understanding of the laws of its composition, the shaping of space and the criteria of the buildings.

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