Object oriented Thinking for Technical Architecture Modelling

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Abstract. Today it is increasingly important to focus the efforts of research on thinking about the great innovation introduced by digital 3D modelling in the housing sector, not only in the merits but also in the methods of the designing conception. Thinking of an object-orientated constructive 3D model does not only mean to represent it, but to conceive it, by generating it within an existing although virtual space. This encourages one to focus not only on the formal and compositive side, but also on the technical and technological side of the future building, whose constructive components are brought in, arranged and above all connected within the virtual building, as will happen in the practice of building, according to the building rules.

Keywords. Virtual Architecture, 3D Model, Object Oriented, Project Thinking

Technical architectural design.

The new technology is dramatically changing our approach to design; it also allows us to work with a vector geometry which marks the end of the rule of the Euclidean geometry. This breaking off involves as much our conceptual and designing potentials as their implementation.

We could say that, somehow, this also increases our designing abstraction skills. A new conception of the form and the architectural space was born.

But the contribution to the design of the "technical side" of architecture – that today is based on object-oriented and parametric working approaches – even if less conspicuous has equally important potentials.

The connection with building tradition.

It is above all the method, that is now becoming more and more important for the consistency of such contribution, that has to prove how computer innovation is not antithetic to the past, but can actually recover some essential constituents of the designing and building tradition.

One of the ways of research is to promote not only a mere application of computer technology to architectural and building design (which can appear, however, still essentially "juxtaposed") but rather to experiment with the possibilities of their becoming second nature to it: from being simple tools for the implementation of working methods to affecting the genesis of a potential transformation of the designing conception and practice.

To overcome the computerization of processes, it is important to make continuity explicit through the suggestions of tradition: this relation can be found connected with some basic con-

cepts of design: such as that of the “verification of designing conception" and that of the “model”.

Design as "verified conception".

In addition, design has always played a key role: that of being a “verified conception”. In the past, a conception was implicitly verified as one designed and built to the professional standards that had been developed by tradition over the centuries.

Nowadays, the designing conception is verified before the building is erected through the modeling of its structural features, through an interaction among the different disciplines involved and an iteration between the time of conception and the time of its verification: the aec technology perfectly fits in this dimension.

3D building model.

The development of models has always gone hand in hand with the designing activity; in the Renaissance Leon Battista Alberti wrote (“De Re edificatoria" Libro IX, Cap. III): Si facciano altresì dei modelli in scala dell'opera, sulla base dei quali è consigliabile riesaminare ogni parte dell'edificio da costruirsi…Per mezzo dei modelli dunque si dovranno progettare gli edifici” (Also make scale models of the work, and use them to check every single part of the building to be erected … Buildings shall therefore be designed with the aid of models”).

In the contribution given by aec software to the development of structural models for technical design, one can find not just a simple modernization of a method: the possibility of making a model, but much more than that: a reflection on the introduction of factors that could not be assumed in the past

Research and education.

In the course of research the significance of this method in terms of its contributions to learning has been explored. At the end of the first seminar held at the local Faculty of Engineering regarding the topic of projects and technology aec, approximately twenty students in their final year of studies in Civil Engineering, (some students were about to graduate) have been invited to do a digital model of a single family villa.

Contrary to what they were used to do, beginning with the design of a map, prospects, and sections, they were asked to use a tri-dimensional approach, trying to translate in construction of a virtual model, the operational model that would have characterized the construction of a building.

For example, they were invited to do for constructive component object oriented, first the structure, the roof, and then the envelop, the internal walls, the fixtures…

At the end they were asked to write a report of the work they conducted.

Very positive comments were given to this experience and the normal procedures of the project (even though if it was only a learning experience), the most frequent comments phrases expressed some precise concepts.

- "To have a different way of reasoning": the fact of being invited to conceptualise the project from a tri-dimensional perspective in the student’s minds and then as a virtual model, had a direct effect in terms of understanding "the building object", like they had never experimented before. This notion lead the students to understand the different parts of the building in a concrete manner: initially like a system an subsystem and then as constructive elements.

- "To understand all in clear and total way": they experimented how this procedure had the benefit of leading them to think how to immediately solve the relationship between constructive

elements to avoid leaving unsolved and incomplete many aspects of the building, like in the case of using simple bi-dimensional designs.

I would like to emphasise how these results have been exposed by students that were familiar the topic of the design of a building of this type: however, the students have indicated a rediscovery of the practice not only at a project level but also constructive of the future building

What comes to the fore in all its strength is a syncretistic approach to the construction of the model and then to its verification. After all, syncretistic is just a specific mode of the computer technology insofar as this concept implies the concept of relation, i.e. of hyperspace.

The digital environment can therefore be defined as the hyperspace of design just because of the nature of the operating platform.

Transformation of the meaning of the structural model.

"The data" included in the electronic images of a project are not more rigid (like in the traditional model of Renaissance), but they are easily modified.

The digital tri-dimensional model permits to obtain in an unicum, not only the possibility to present a project, to study the different phases of construction, to produce explanatory graphics for the building yard, to explore the object in movement, to simulate the light and the shadow , the thermic loss or the structures, but allows to generate all these elements in a combined manner.

The meaning of digital models changes from that of a virtual plastic to the more scientific one of an operating scheme, also theoretical. The implementation of structural models can even go so far as to guide the designing practice itself.

Regarding professional practice, it offers the advantage the on-going process of a project in independent steps, allowing the recovery of its meaning as an expression of a single and simultaneous concept of all the aspects involved. In fact to make the most of the possibility to develop an integrated virtual model, the design concept needs to be integrated since an early stage.

I think that is possible to make a prevision regarding the supply of structural products for design. Like a puzzle is composed of different pieces, an organism is made of cells , a system is made of subsuystems, in this manner the virtual model of a building will always be constructed with 3D elements provided by the Production Companies. The structural elements could be transmitted by their three-dimensional digital catalogue, by turning into real “executables”: the 3D element supplied by the companies will be “intelligent”: when retrieved, it shows its own features and establishes relations, in the virtual construction of the designer, with other elements, by mutually recognizing them and settling any conflicts. Like two chemical elements interact with each other when added to a specific solution and producing a new composition, we can hypothesise that specific constructs interarract with each other when they are inserted in a virtual environment construction.

Regarding the problem of the semantics of design, by promoting the possibility to draw information right from the three-dimensional model, by displaying it synthetically, thus simplifying the heavy production of paper documents.

An approach to reading in which the main characteristics are: speed, synthesis, dynamics of interaction. The reference to the transformation of information into a perceivable form, as normally happens with scientific visualization, comes naturally; and even the flow of data, information, movements, which currently seems to be the hallmark of the smooth, non-Euclidean ‘digital architecture’ (for example the Selfridges Store in Birmingham, by Future System, Figure 1).

Figure 1.Fut. System, Selfridges Store, Birmingham.

Figure 2. The ancien castle of the case of study

A case study about the past.

Thinking, for instance, of the potentials of virtual navigation within the designed spaces, one can see that this increases, improves the process of knowledge and design to such extent as to allow the cognitive processes themselves to move from a symbolic-reconstructive value to a perceptive-motor value.

We have experimented this method about the restrucuture plan of a castle (Figure 2).

The method chosen was to synthesise both the historical reconstruction and the on-spot survey into a 3D digital model (for the moment, a geometrical one) that could also be used as a basis for outlining the potential work plan (to be therefore completed by adding constructive components). The virtual decomposition and re-composition of the fortified construction highlighted constructive problems that could be open to uncertain readings.

The progress of the extensions and alterations that have taken place over the centuries and therefore the room occupied by the castle as it extended over time was examined through a 3D model which blended these two dimensions into a virtual dimension: this resulted at first in a chronological journey that was used, later on, to simulate a contemporaneity of moments that are remote in time: from the past to today and beyond, through to the future work plans. Information turns time into a spatial parameter. Once able to move, space and time become inseparable. This directly affected the possibility to get an insight of the construction, its liveability, its "ambience". Through the dynamic method, we could experiment with constructive conditions that are typical of the building process and which otherwise would have been purely imaginable, thereby reconstructing the accessibility and usability that would have been reconsidered at the design stage.

The design of the works, based on utmost feasibility and compatibility criteria, even in the choice of materials, had to be prefigured in the way they would fit in with the context.

Conclusion

The topics are suggested as an oppotunity to assess vitual modelling techniques, as a factor to develop thecnical and cultural conception. This approach offers a new powerful ognitive paradigm, on scientific bases, which has to be developed as a new dimension to study and verify civil and architectural design, for the present and for the past.

The research, aimed at filling the gap between the design and the model and at the same time

between the model and the building, can eventually provide an important contribution to the future development of digital designing techniques, that will allow this type of modelling to be more and more substantially used in building engineering.

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