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New key factors in drawing up a building

Innovative methods in architectural design

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Abstract

When we draw up a building we are using our personal way of approach to architecture. We are interpreting the building. We must do a detailed study of the object: construction, structure, ...

Drawing by computer is widely used in the architect community, more and more the architects' studio and ateliers demand the professional who collaborates in the tasks of production and drawing of the architectonic planes, with more knowledge in the computer drawing. Lately the introduction of the presentations in three dimensions and multimedia causes the professional to get knowledge on these means and their use.

Nevertheless, the virtual pads introduce a fundamental concept in drawing up plans or plan survey. But a problem exists, to access to the virtual graphical representation without the necessary maturity in the field of the Architectonic Presentation.

We must think that independently of the used technique it is very important to know the aim a priori that is wanted to obtain, since this one is the only mean to obtain it. For that reason, a constructive understanding of the architectonic work is advisable, before realising any representation of it, and based on it, we will choose the more suitable technique of representation.

It is for that reason that seems so important to us to make an analysis of the drawing up a building and its problems.

From the Madrid Politecnic University, we must begin to stimulate the new forms to express the architecture, imaginary or constructed, and to express with a clear and concise language our work, so that we pruned to show from different points of view our finished work or process of creation.

Consequently, we must try to balance the feeling of using such a powerful means for designing as those based on computing techniques with the intrinsic value of the graphic means based on the traditional manual ones. We consider it is the best approach for using the new technologies.

1 Introduction

Men are being able to learn and use the acquired knowledge, to transform their natural and social surroundings by means of the technology. The history of the men is the History of the ups and downs of a long process of learning and its consequences in all the orders. Our objective is to share opinions and experiences. Foolproof systems or methodologies in the plan surveying in the Construction do not exist. We want to create a debate forum to interchange opinions on the matter. Nowadays, drawing a building without CAD cannot be conceived. The society demands it and the professional who is not trained in this field, will be outside the professional context. The professional who know his profession, does not recycle itself, does not update itself, will be forgotten or reduced to a simple collaborator, but not a decision-maker. The professional who works in the field of the graphical expression must dominate all the representation systems that help the best presentation of a building.

2 Objectives

Our objective is the analysis of the instruments that at this moment are being used in the Surveying. We will display the different methods of representation used in the Construction. They would be analyzed, the basic tools of computer aided drawing programs, and later to see its used in the computer graphic design of different architectural works. We will see the results obtained in the different applications, and will give an idea, about the rules that we believe are possible to be followed. Understanding that a unique method does not exist, but diverse methods that properly interrelated can take to us to obtain the proposed aim. This aim is not other that

getting a coherent graphical communications in the field of the Architecture.

We try to show, the utility of the programs of virtual simulation and its application in the study of the architectural work of the great architects. For that reason, we are going to set out the experiences obtained in the development of a course of postgraduate realised in the school. In this course, it was tried to teach to the student the basic tools of computer aid design programs, to apply them in the computer graphic work development other than architecture.

3 Exposition

Today the contents and matters increase, at the same time, the ways in learning and teaching are being changed and widen The use of the new technologies has not only become an instrument of formal analysis, but a tool without which many of the actions, that the society demands, cannot be realised. The society, more and more introduced in the graphical languages through the TV, demands the graphical vision of the elements.

The corporations that order a work want to see the end results, as real as possible They wish to see the impact in the surroundings. And all of this is not possible without virtual simulations, without strolls through the building, without this constructing and all this only can be realised by computer graphic applications.

4 Method

If we undertook the study in depth of any work we must documented it as much as possible about its architectonic and constructive characteristics, of its author and its time. We will have to carry out diachronic and synchronous studies on it, to catalogue it, to analyze its technical and formal aspects. In the final concerning conceptual study, we will interpret its content as well as to comment the relation that it has with the circumstances of the author and its time. We see the steps to be taken in the previous study to the surveying.

4.1 Genius loci

· Situation and Location
· Relation with its surroundings
· Accesses
· Characteristics of the enclave

4.2 Study of the building

4.2.1 Historical context

· Author. Different schools or variants from the architecture of that time.
· Time of construction and style. Characteristics of the time.
· Building typology and its characteristics.
· Economic aspects.
· Social aspects. People or groups to whom it was adressed and the social consideration that the artist receives at that time.
· Political aspects.
· Cultural aspects. Relation to the function for which the building is constructed.

4.2.2 Sociological analysis

· Person, institution or group that ordered the work
· Relation with the architect or constructor of economic or professional type
· Time of accomplishment the project
· Style to which it belongs
· Date of construction
· School or variant of that style
· Rehabilitations
· Changes of use

4.2.3 Formal Analysis of the Building

· Geometric
· Formal
· Symbolic

4.2.4 Constructive System

· Constructive types
· Materials used
· The relation of the materials with the parts of the building

4.2.5 Structural System

· Structural elements
· Orders, types
· Types of structure: walls, pillars, etc.
· Other subtenant elements: right foot, abutments.

4.2.6 Closing System

· Walls of closing
· Geometric analysis of façade hollows: windows and doors
· Lintels or arcs
· Intermediate elements: drum, modillon, squinch, pendentive, etc.
· Roof: flat (architraved), curve (vaulted), pitch, etc.
· Analyses of the closing elements: materials and systems

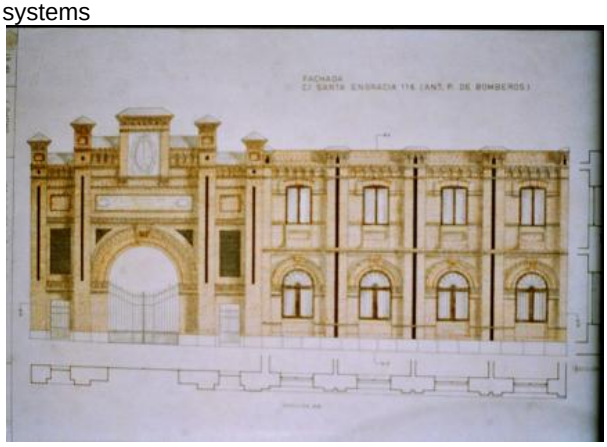

Fig. 1: Building elevation in Madrid

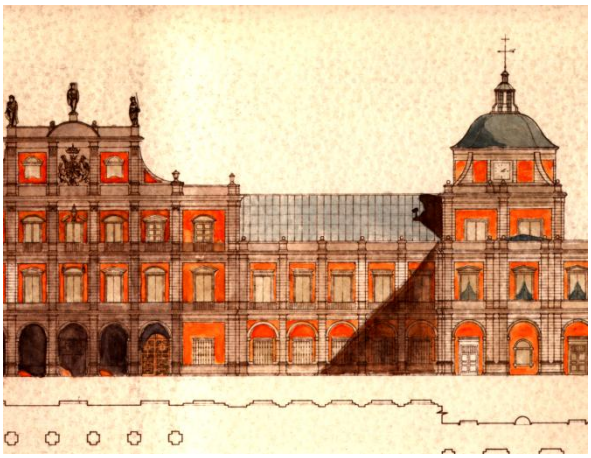

Fig. 2: Building elevation in Madrid

4.2.7 Ornamental Elements

· Decorative elements: carved, painted or in construction equipments
· Decorative rate
· Details of the hollows and ornamental elements
· Doors and windows studies

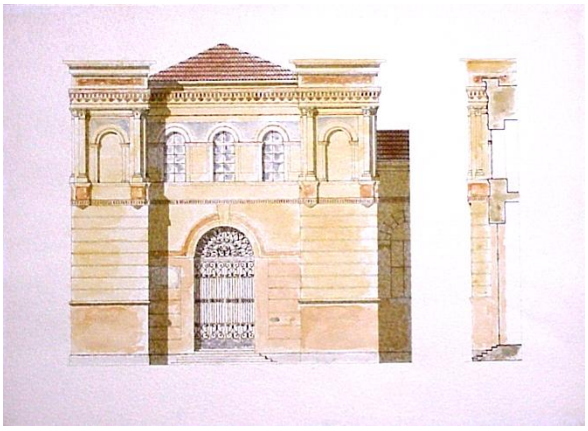

Fig. 3: Decorative elements

Fig. 4: Detail of hollows and ornamental elements

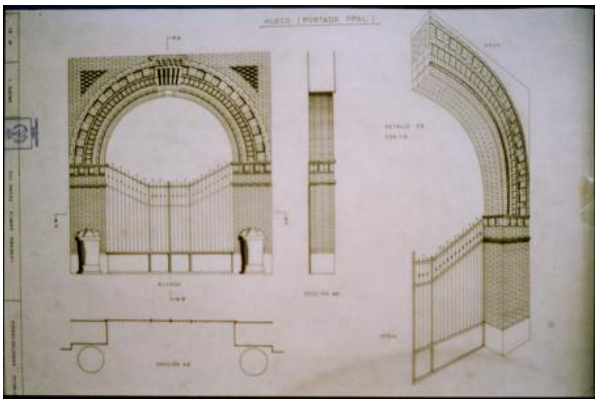

Fig. 5: Door study

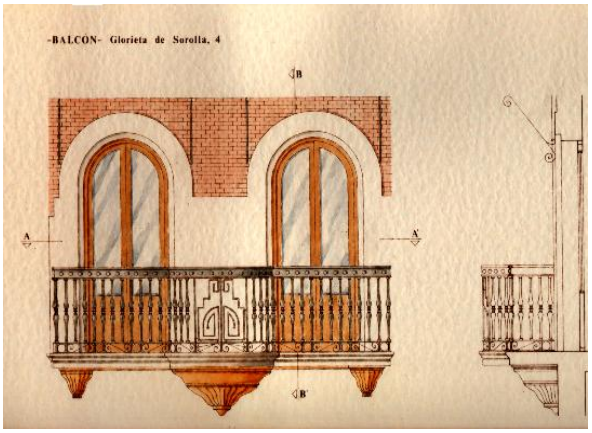

Fig. 6: Window study

4.2.8 Fixtures

· Analysis of the fixture systems
· Water, light, electricity, gas, cleaning, etc.
· Natural or artificial illumination / ventilation

5 Development of the Work

Once analyzed the building, we try to analyze its plans and sections and later to represent them correctly. In Bruno Zevi's opinion, it would be essential to spend a time on looking around the building for its understanding, what is known as the fourth dimension of the architecture. Nevertheless, when we do a study of the history of the different cultures, we must be satisfied to the graphical representation of the buildings before the impossibility "to walk around" at least most representative of every time. Besides the photography or slides from different positions of the buildings, graphical representations are an essential complement that we needed to know the whole building (form, geometry, structure, constructive elements, etc.).

The representation of an architectonic, volumetric object, on a surface must overcome an important departure problem: the dimensional reduction. The architecture is three-dimensional, nevertheless at the time of drawing it in a paper, can only be used the two dimensions. This process receives the name of representation system, and implies a complex operation, as much technical as conceptually.

The election of the system will depend on the aim for which we want to represent (the phase of design of a building, the construction of the building, the presentation, etc).

5.1 Croquis

The architectonical sketch graphical language demands a level of the detail and abstraction greater than other drawings in architecture. Its purpose could be: documentary, designing or didactic.

Documentary function ("in situ" information):
· Building surveying.
· Typological diagrams.
· Constructive study.
· Conservation study.

Designing function (study and analysis in cabinet):
· Constructive study.
· Decoration study.
· Industrial design.

Didactic function (communication in the building construction):
· Work organization.
· Constructive detail.

5.2 Floor Plan (plan view)

The floor plan view is a graphical representation of an orthogonal projection system on a horizontal plane of a horizontal section at certain height (J.R. Paniagua). It a horizontal section, seen from a point above floor (in perpendicular) to which some elements have been eliminate and the raising forms from ground are displayed.

If we analyzed the plans, we would have:
· Form
· Function
· Meaning
· Structure of uses
· Routes
· Furniture

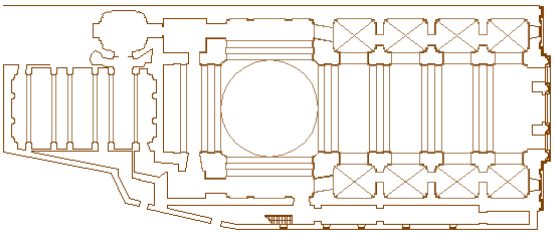

Fig. 7: Floor plan of San Ildefonso's Church in Toledo

5.3 Elevation

Design of a building taking care of its vertical planes, without representation or projection in perspective (J.R. Paniagua).

Seeing the elevation, we will study
· Proportion
· Study of bays and hollows
· Study of proportions
· Formal study, geometric study
· Materials
· Ornamental elements

Fig. 8: Palace elevation in Madrid

Fig. 9: Building elevation and ornamental details

5.4 Section

The section or cross-section is a representation from a building to which a part has been taken off him so that it is possible to be contemplated its outside view and part of the interior.

The section could us to analyze:
· Accesses
· "Promenades"
· Measure

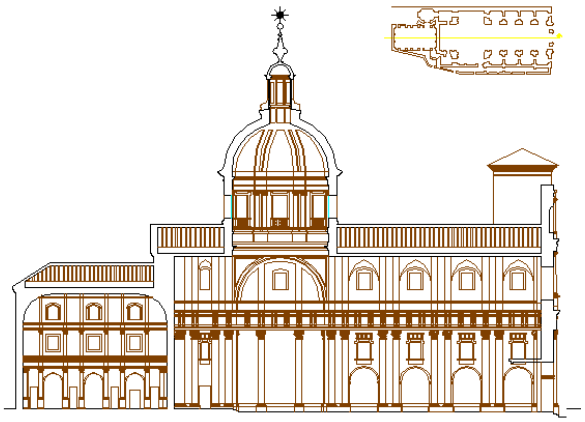

Fig. 10: Cross-Section of San Ildefonso's Church in Toledo

5.5 Perspective Projection

Perspectives show an image of an object as viewed from a skew direction in order to reveal three directions (axes) of space in one picture.

Perspective projection of a building gives us a more realistic view. As it is seen and how it is shown will go in function of the chosen point of view:

· The type of the building to be represented
· The information that is wanted to be provided
· The intention that is desired to transmit

Computer aided drawings can help this type of representation and its accomplishment by computer graphics will help us to go towards the reality.

The type of perspective projections depends on the election of the representation system:

· Cylindrical o parallel projection (axonometric system)
· Conic projection (conic system)

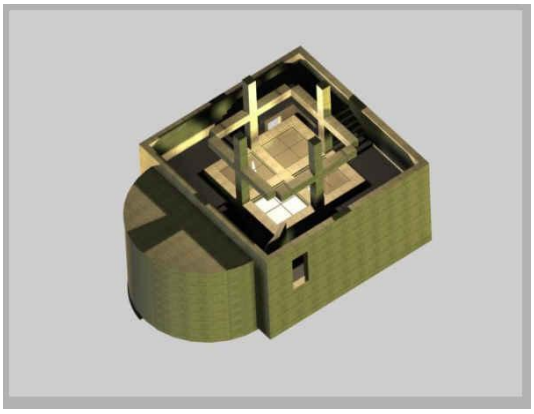

Fig. 11: Axonometric sectioned perspective

Fig. 12: Conic perspective

Axonometric projection is commonly understood the representation in which the plant of the building is placed with certain inclination angle, having maintained the values of its angles and meeting its metric correspondence, raising from them the heights vertically (J.R. Paniagua).

Conic perspective is a type of projection where three dimensional objects are not projected along parallel lines, but along lines emerging from a single point. This has the effect that distant objects appear smaller than nearer objects. It also means that lines which are parallel in nature appear to intersect in the projected image, for example if railways are pictured with perspective projection, they appear to converge towards a single point, called vanishing point. Photographic lenses and the human eye work in the same way, therefore perspective projection looks most realistic.

The normal convention is architectural perspective is to use two-point perspective, with all the verticals drawn as verticals on the page.

Three-point perspective gives a casual, photographic snapshot effect. In professional architectural photography, conversely, a view camera or a perspective control lens is used to eliminate the third vanishing point, so that all the verticals are vertical on the photograph, as with the perspective convention. This can also be done by digital manipulation of a photograph taken with a normal camera.

By means of the use of the conical perspective it allows to be able to draw the plants and elevation of a building from photography (perspective restitution). This way of working has great utilities in the constructed architecture as well as in the insertion of a project within an existing image.

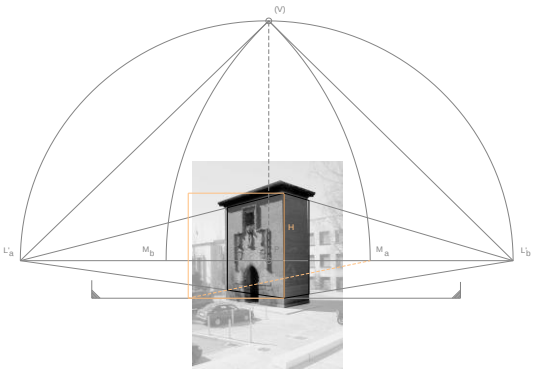

Fig. 13: Perspective restitution

6 The computer as a tool of graphical expression in drawing up a building

A constructed architectonic fact is not conceived, without sketch. Nevertheless this sketch must be passed to a scale, and it is necessary to modify it to present alternatives, and the better tool for doing all of this is the computer.

The arrival of computer in the seventies meant a technological disruption in the domain of the architectonic design. The world of the architect, like other type of professionals related to computer graphic sketch activities, has been changing according to innovating jumps and it has been closely linked to the denominated culture of the image, being useful the communication facilities that suppose the use of this new tool. Nowadays, the incorporation of the computers to the architecture practice is an undeniable fact that it includes from modest individual offices to network connected multisites of the largest architecture companies.

From the University, we must begin to stimulate the new forms to express the architecture, imaginary or constructed, and to express with a clear and concise language our work, so that we pruned to show from different points of view our finished work or process of creation. CAD programs are more and more being used in the architecture studies to generate architectonic images in any stage of the project. The infographic works, as it helps to the creative process or with commercial purpose, is an unstoppable fact. The creation and manipulation of digital images with the help of a computer are one of the most significant advances realised in the field of the image management from the invention of the photography.

By using computers, we are able to make changes in our drawing, display different alternatives, different solutions, with a minimum effort. We are able to see, with virtual simulations, as it is integrated in the surroundings and with a virtual walk around, we can introduce ourselves in the building.

Computer animation is essentially a digital successor to the art of stop motion animation of 3D models and frame-by-frame animation of 2D illustrations. To create the illusion of movement, an image is displayed on the computer screen and repeatedly replaced by a new image that is similar to the previous image, but advanced slightly in the time domain (usually at a rate of 24 or 30 frames/second). This technique is identical to how the illusion of movement is achieved with television and motion pictures.

The use of computer science programs of design in 3D, which means we generated images of a project or building from drawings in cutting projections, is today a reality.

The exercise of the architectonic design is in process of massive transformation. With the appearance of new and more and more powerful and versatile computer science tools, the architect has initiated a way that supposes the transformation of habits, tools and methods of design.

Nevertheless, the most important thing is what it is wanted to be transmitted, at is wanted to express, in this way we will be able to choose the more suitable graphical technique to our aim. We do not have to forget that the computer is means to secure an aim.

Infographic works about Tadao Ando's buildings

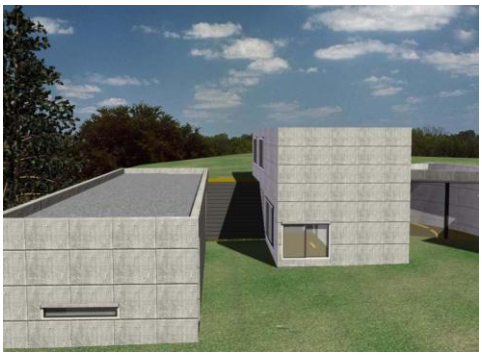

Fig. 14: Koshino house, Hyog (Tadao Ando) 1981/1984

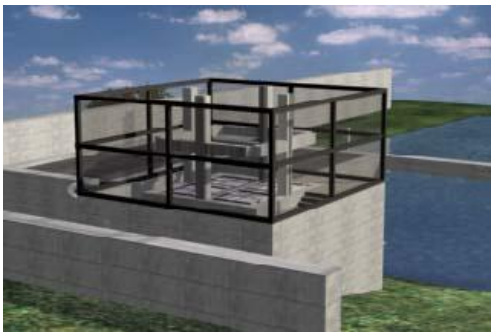

Fig. 15: Water Chapel, Hokkaido (Tadao Ando) 1985/1988

Fig. 16: Koshino house, Hyogo (Tadao Ando)1981/1984

Fig. 17: Water Chapel, Hokkaido (Tadao Ando) 1985/1988

7 Advantages and Disadvantages of this system of work

The drawing by computer has a great diffusion between professionals. More and more the studies and cabinets of work demand that the professional who collaborates in the tasks of reproduction and drawing of the architectonic planes, has more knowledge in the computer science field.

More frequently the architectonic presentations as a photography, videos, CD and strolls flood the market and the execution facility causes that we are due to retrain with the means that the computer provides to us. The example of the simulation of a virtual stroll introduces a fundamental concept for the compression of this new technology.

The majority of these graphical systems are designed to be able to talk with them. When a created image is observed or when is being created an image, the system allows you simultaneously to consult and to correct others views or images. This type of graphic applications simulating the reality has an inherent risk that it is the distance that these systems put between the operator and the real world. When improving the view at the expense of the tact, we can get to break away from enemy with the reality. These active systems give to passage to the systems liabilities, like the figures of this communication, are virtual parts of videos or strolls that have gone to the paper with a good resolution. This allows us to analyze them with more detail.

An advantage of the graphical systems liabilities is that all the computer power can be used in achieving a better quality of the graphical material. Not only the images can be reproduced very quickly, but also they are possible to be manipulated, and getting a high rendering quality, that could not be imitated by a graphical artist or a good sketcher, just using conventional means.

The main advantages of the computer, applied to the graphical tasks, are the speed of production, the saving, the great impact and the flexibility that they provide. Another one of the advantages is to provide the user of dynamic, fast, precise, reciprocal surroundings, a graphical simulation can show before being constructed the generating surroundings by the building that we are going to construct or by remodelling that we are going to realise.

A potential area for technology focus is to introduce optimization techniques in the design model. Objectives such as cost, quality, maintainability, energy efficiency, …, would be introduced to the appropriate level in accordance with the customer requirements. Data regarding those factors would be provided in the drawing database for each relevant drawing element. The optimization tool would be executed having into account a set of rules previously defined producing the final result on each objective (over or under). Modifying the design could improve those objectives not being met, so that on several iterations the architect could reach the better design. It could mean a valuable mechanism in order to assist the architect in the design decisions.

8 Conclusion

We cannot leave these break troughs aside, but they must be introduced in so far as they are necessary. . The lately introduction of the presentations multimedia causes that the professional must know these means and their use.

More and more the new advances in computer science cause that constantly we are innovating in our systems of representation of the buildings. But a problem exists, to access to the virtual graphical representation without the necessary maturity in the field of the architectonic presentation.

Another problem that involves these new techniques consists on replacing the own reality by an artificial reality. Whereas the creation manual of images, by means of the drawing and the painting, recreated the world in agreement with the language of the representation and whereas the cinema, the photography and the television register tracks of the real world, the computer allows us to simulate the reality.

It is a power that can be abused easily. It would be possible to make a television newscast, with news that has never taken place. Because is very easy to manipulated our society. There is a way to draw to raise a building and is only the natural way. It does not have anything to do with the technique; it does not have to do with art, or the conception.

It is convenient to offset the illusion of a technological power, with the respect by the average graphs of manuals representations. Thus we will only use of effective way the technology that we have to our reach.

We must think that independently of the used technique, the most important thing is to know the aim a priori that is wanted to obtain, since this one is the only mean to obtain it. For that reason, a constructive understanding of the architectonic work is advisable, before realising any representation of the same, and based on it, we will choose the more suitable technique of representation.

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