

SHAPE STUDIES: REMODELING BILBAO MUSEUM

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Abstract. This paper is a study of shape, attempting to understand the effect of computer-aided architectural drafting and design on the geometry of form. This study also is a part of larger question: When the tools of presentation change, does form generation necessarily change as well? The study is in two parts: Remodeling Bilbao Museum and Editing a Cube.

1. Introduction

Why do forms become more complex? How does the architect use tools to obtain additional complexity? What computer-aided architectural design programs allow the architect to be more complex? In other words, for the architect himself, is the motivation to demonstrate a set of 3D geometric operation sufficient to generate complex assemblies, and is the other possible operations needed?

2. Remodeling Bilbao Museum

2.1. GEHRY METHODOLOGY

Frank Gehry began by building a physical model, and used a 3D laser scanner which transferred the 3D objects to a digital model. From that digital model, using the computer graphics software as a tool, he created 2D drawings to finish the construction drawings and successfully build the project.

2.2. PAPER METHODOLOGY

The paper begins where Gehry ended: obtaining the 2D drawings and using computer graphics as a tool to build the 3D models of the project.

2.3. STARTING THE WORK

Analysis of plans and division of each plan from the objects' point of view (exterior only).



Figure 1. Analysis of four level floor plan.

Rebuild these layers with the correct height.

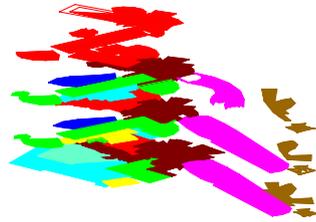


Figure 2. Building in layers.

Divide the building into 10 main objects and construct each object separately. Then connect them and build any remaining linking structures.

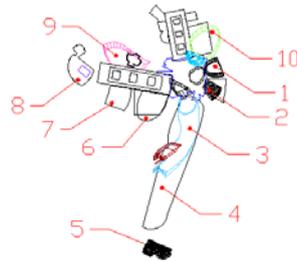


Figure 3. Objects selected to be built separately.

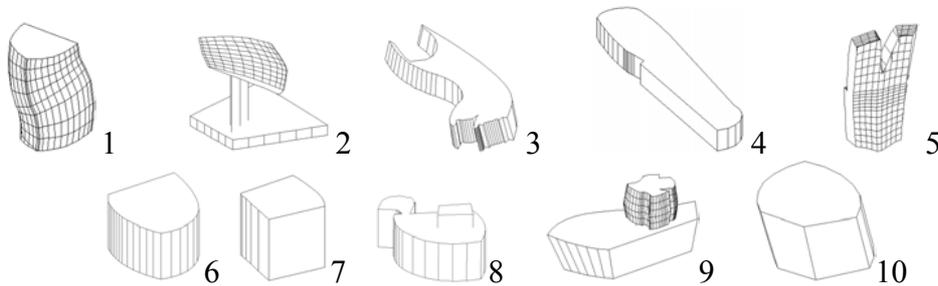


Figure 4. Objects built separately.

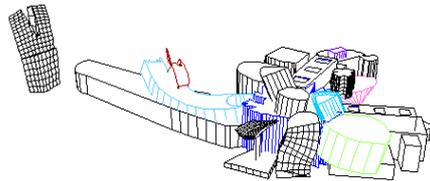


Figure 5. Complete model.

The main questions to be asked after this experiment:

- With such irregular shapes, how accurate is the building itself compared to both the physical and digital model? If it is not 100% accurate, does it negatively affect the visual experience and message of the building?
- If Gehry has the tool of computer skills at his disposal, does he need to create a physical model in order to progress to a digital one?

3. Computer Editing of Simple Forms

How can one go from simple forms to complicated forms, from recognizable form to irregular shape? How does one interpret the beginning and final outputs from the 2D and the 3D images?

Starting with a simple cube, build a matrix containing this cube and apply different types of computer editing – subtraction, bending, tapering and skewing, the same commands used to create the above model. Then experiment with the combination of edit commands: two at a time, then three, and so on, until the whole sequence of edits is represented in one cube. From

this final form, the 2D plan and elevations are redrawn to see if the form can be understood from a single perspective, and if a model can be built.

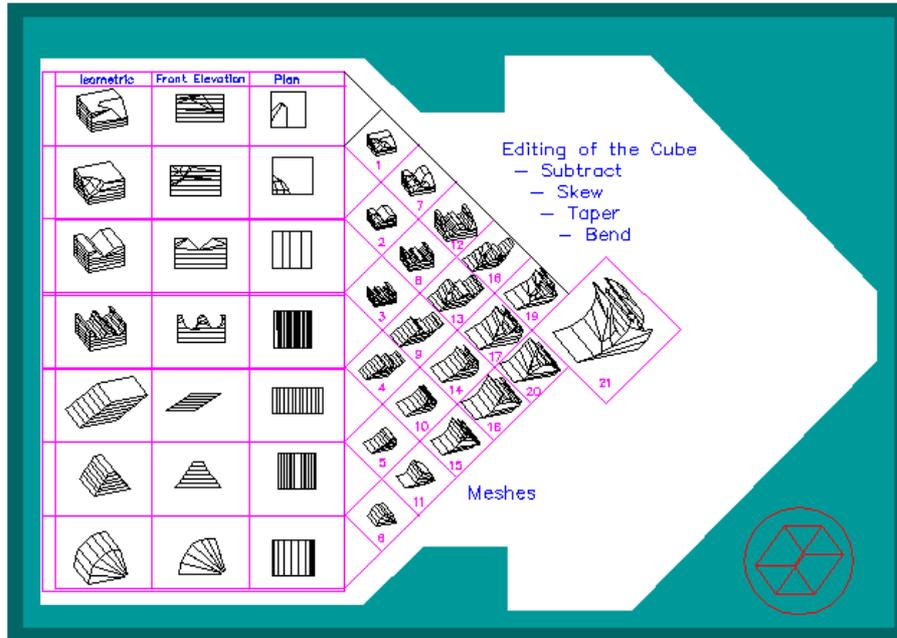


Figure 6. Editing matrix

What happens if this experiment is extended to other shapes? If that methodology is applied to other shapes and those shapes are then combined, would we have another Bilbao?

4. Conclusion

When architects learn how to use a tool, it can be used to create new shapes. How can we shift between traditional and new tools? Do new tools make the traditional tools obsolete, or can we continue to use them and transform to the digital era by using intermediate techniques (as with Frank Gehry and Peter Eisenman, who design by traditional methods and use the laser scanning to transform the model to computer)?

Form becomes more complex with the use of tools which allow better generation and understanding of the form imagined by architects and designers.

There is no limitation upon architectural ideas with the use of the computer. The only limitation is how we can understand and use the tool. As Gehry said, "I just did not like the images of the computer, but as soon as I found a way to use it to build, then I connected."

Virtual reality and holograms will mark another shift in the future of architecture and its ability to develop a new image of the interior and the exterior of a building. We will have to learn and study these new techniques, as well as existing manual and digital tools.

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