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QUALITATIVE CONTRIBUTION OF A VR-SYSTEM TO ARCHITECTURAL DESIGN: WHY WE FAILED?

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Abstract: the paper exposes the development of a Virtual-Reality system for modeling timber structures, and evaluations with students about its contribution to the architectural project.

1. Departure

Computers have reached mainly an utilitarian role in architectural work, focused on the quantitative production of plans and images, and not related to the quality of design, as argues Flanagan (1999). They are used more at the end of the process, than at the beginning, when the design is conceived. However, new virtual-reality systems shows stimulating possibilities in architectural creation, according to Kruijfft (1998), although these experimental initiatives are yet targeted to general issues and operational challenges. Then, in order to explore a qualitative contribution of computers to architecture, we proposed to set-up a VR-system for the initial creativity in a specific subject of design. A computer application that combines perceptual and cognitive techniques (spatial representation, library of elements and constructive programming), devoted to model major timber structures (beams, trusses, portals and arcs), that has building constrains and architectural variety (Poblete and Hempel, 1995).

2. Path

The system was set-up in PC with the software VRT-5.6 from Superscape Corp., developing a 3D-library of 50 different shapes of timber pieces showed in technical handbooks like Nevado (1999), and programming the architectural modeling of a structure with four variables; span, height, pitch and separation of elements. The ranges and sizes were based on the effective conditions of fabrication, transportation and construction in our country. It also included six possibilities of arrangements; linear, diagonal, curve, open radial, close radial and square, but without options of layout. The variables allows coarse measurements (spans every 5 m. or separations every 1 m.), because the system was focused to a quick review of the spatial configuration, and after the design can be detailed in another software. In any case, the combination of shapes, variables and arrangements can produce more than 40.000 different models.

The application can be used with a free-browser (Visualiser) in a regular monitor. We implemented immersive visualization with Sony Glasstron glasses and Intersense tracker. The manage of the system was concentrated on the mouse to have a fixed reference, controlling a pedestrian displacement (go-ahead and back, turn right-left), supplemented with the head movements to look around. After testing a user-interaction with internal 3D-elements, it was preferred to use dialog windows with the options of shapes and measurements, for to have an easier functionality and a clean virtual environment. The models are created into a natural landscape that includes the representation of a walking person to see the proportion of space.

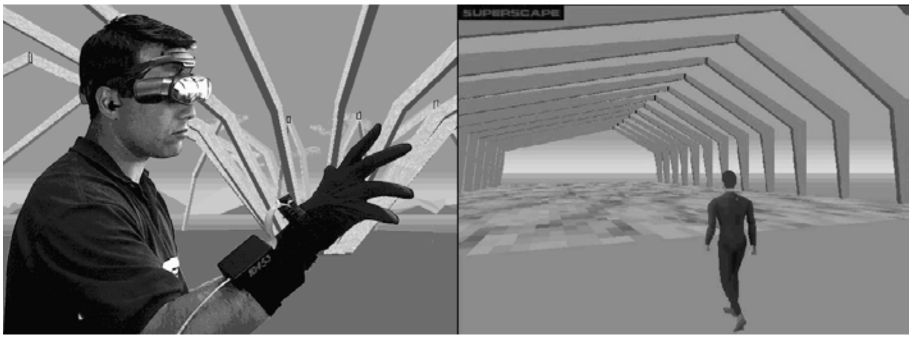

Figure 1. VR-System for architectural design of timber structures

In order to review the contribution of the system to the architectural process, two evaluations were carried out with last-year students of architecture; one in our University and another in a different institution located in another city (Universidad de Santiago). In both cases the students developed a short exercise of 3-4 days for the rough design of an exhibition centre in timber. In each institution they were divided in two groups of around 15 students each, one group used the system, and the other did not use it. By the end of the activity, each student presented a sheet, identified with a numeric code, containing a plan, elevation and a perspective of the design proposed. In the two evaluations a board of professors ranked all the projects in a blind-comparison, and the students answered a questionnaire about the system.

3. Arrival

In both institutions the assessments of the designs revealed similar marks between the two groups. In fact, the average marks of the projects made with the VR-system were slightly inferior to the projects made without it (inside the statistical deviation). In one evaluation the jury was also requested to rank separately construction and creativity of designs, and a review with assistants was also carried on, however, these results matched with the overall marks.

A general look at the projects showed morphological differences between the groups, particularly more diversity and complexity of the designs made with the VR-system. In order to measure that observation, a geometrical analysis of all the projects was carried out. The designs were synthesized in schematic plans and elevations in order to count the number of spatial volumes, segments of perimeters, and the difference with others designs in the group. In both institutions those values were higher in the experimental group, but without statistical relation to the marks.

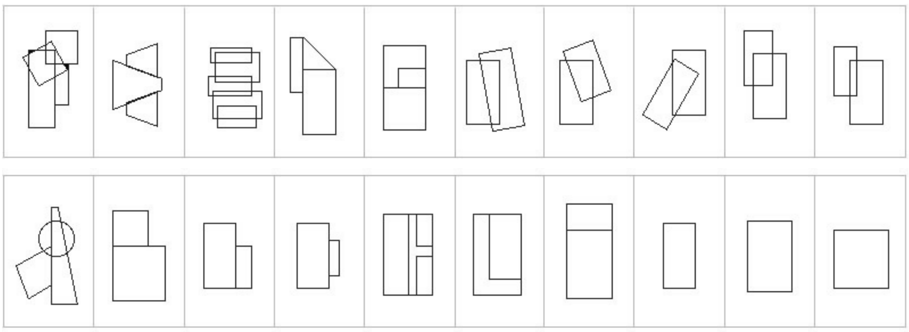

Figure 2. Schematic plans (up: designs with VR-systems, down: control designs)

In the questionnaires, the students recognized a good functionality of the system, and more use at the beginning of design process to search possibilities, than at the end to define the proposal. They made some operational recommendations, such as to combine models and to show constructive details of pieces, which we are including in the final refinement of the system. The students, like architects who have known this work, appreciates the 3D-visualization and the variety of models, so we plan to distribute this computer application without cost between professional practices in order to encourage timber building and the use of VR-systems in architectural design.

4. Traces

The small influence of the system on the marks of projects represented a defeat to our intention of qualitative contribution. Although the experiences developed are reduced for the aims proposed, their results confirmed the secondary role of computers in design. This conclusion is supported by the similarity of the two exercises, but also both of them show a morphological incidence not expressed in the assessments of the exercises. Probably the indifference of the jury to formal influences of computers was due to the traditional integrity of architectural quality, argued by Alberti (s. XV) like the "concinnitas" or coherence of building, which prevents new factors. Also, we must to recognize that the research did not clarify properly its objectives of quality and creativity. Besides it must refine the methodological application of these creative tools in the design, due to the personal autonomy of the process, claimed by Einsenman (1999) as the predominance of a "rationalizing vision" in the architectural conception.

In spite of all the hype around use of computers in architecture, there are not too many evaluations. One recent work of Ataman (2000) exposes positive results, with also more complexes and diverse designs. This influence of digital tools corresponds to a divergent creativity (De La Torre, 1993), which could produce a more sophisticated spatial sensibility.

Then, this experience suggests that computers do not have a qualitative incidence on design according to traditional terms. But they introduce new characteristics that probably will participate on the cultural evolution of architecture, changing concepts instead of improving traditional values. In that sense, it seems better to target new media to develop new architectural solutions, than to promote design conventions.

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