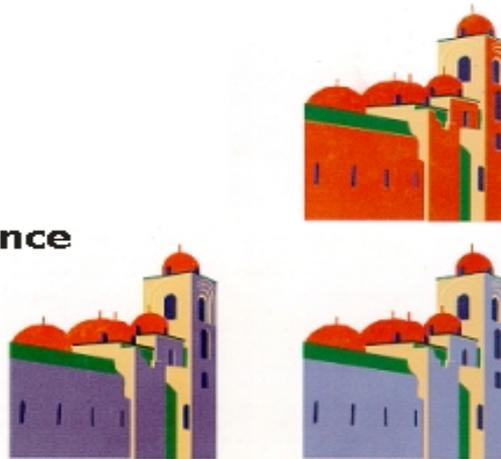


*Javier
Monedero and
Ernest
Redondo*

Multimedia and Architectural Disciplines

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Departamento
de Expresion
Grafica
Arquitectonica
I,
ETSAB
(Escola
Tecnica
Superior de
Arquitectura
de Barcelona),
UPC
(Universitat
Politecnica de
Catalunya) -
Barcelona,
Spain

Abstract

The paper presented. is based on a work, developed by the authors, which concluded with an exhibition that was inaugurated in Barcelona on the 23th of april, 1995 and will proceed to other places the next year. The work consisted in the organization of an exhibition and the development and visual simulation of 14 projects aimed to promote ways to rescue the Besos river that crosses the north side of Barcelona and is probably one of the most degraded rivers of Europe. Our task was to select and suggest ways of acting on the landscape that could be easily understood and assimilated by the layman so that a public consciousness of the problem could be incorporated to a program that implied a complex and long term task From the technical point of view the job implied particular aspects that are also discussed in the paper.

Introduction

In the last years, the metropolitan area of Barcelona has gone through one of the most important urban transformations that is remembered in Europe in the second half of this century. The opening of the city to the sea; the new urban settlements on the littoral front, the modifications of streets and public squares and the construction of cultural equipments, recovering historical losses, have transformed Barcelona in a new focus of interest in the mediterranean area. However, after this urban actions were consolidated, there remain several contrasting issues. Among them, one of the most important ones is the need to recover and qualify the areas around the two rivers that run at both sides of the city, "el Llobregat" and "el Besos". This rivers, together with the

near mountains ("la serra de Coliserola") and the seashore, surround the urban area and conform the physical limits of the city of Barcelona.

The area covered by this two rivers is bigger in extension than the Eixample; a block of houses could be inserted in the bed of whatever of the above mentioned rivers. It is an enormous reserve of space, and its integration on the free space's system could provoke a radical change of AMB's (Area Metropolitana de Barcelona) urban high density. It isn't surprising that, while the initial objectives in the recent urban development of Barcelona have been successful, some public institutions have begun working on the problems related with these two rivers which are, both of them, in a very bad state. The situation of the Llobregat is less severe; the rearrangement works of Llobregat's bed are quite advanced because of the extension of Barcelona's harbour to the south.

The other river, "el Besos", is in general a group of affluents ("Caldes", "Tenes", "Congost", "Mogent", etc.) that get together a few kilometres before the delta. The situation, as the river approaches the seashore, becomes more and more serious. During the last twenty years, the last kilometres of the river on its way to the sea, have become an open sewer underneath the sky, stinking, and bordered by highways and huge electrical towers. In short, an inhuman and polluted landscape that will take years and a strong social and political impulse to recover.

To this can be added that the erosion and the defloration of it's bed and the high level of occupation of it's shore have caused historical high velocities in the Besos' hidraulic system occasionating in the last 100 years some natural catastrophes. The worse ones were the floods of 1962 which finished with a balance of more than 1000 victims.

The comission

On december, 1994, the Diputacion of Barcelona commissioned our Laboratory to carry out a double job. First, to organize an exhibition that would present the magnitud of the problem together with some ideas to confront it, to the general public. Second, to produce a collection of images that would illustrate this ideas. The work we have carried out at the LTGA (Laboratorio de Técnicas Graficas Arquitectoniques de la ETS de Arquitectura de Barcelona) in relation with this second part of the job has consisted in the visual simulation of 14 projects to recover the Besos' bed at different point on its journey from the steeped catalonian mountains to the sea.

These works were intended to evaluate the environmental impact but, mainly, to promote public consciousness on a serious and difficult problem. The problem comes mainly from the pollution created by industry and the lack of attention to the river. But it is agravated by the particular characteristics of a tipical mediterranean river with long dry seasons followed by fast floods. Because of the complexity of the problem and the huge investments implied in it, there were clear political implications and so the administrations involved tried to explain their ideas to the public before giving the final concession. It was considered a necessity to ask and stirr the potencial users and to know their opinion about the transformation of the degraded and in danger of flood zones into public places. The inhabitants of the riverside, near the seashore, still remember tragic events caused by the river running out of control and they regard with suspicion the idea of reusing part of the rivershore for public use. In the rest of the country there are no examples of this kind of proposals, excepting some channelings resolved with concrete walls or some places arranged as pseudogardens with no exit because these things have nor resisted the attack of the water.

Apart from the mos costly interventions on the urban side, there were many others on the country side. They were intended to recover the idea of a river as a place which should be well known, customly enjoyed and seriously protected; this would be the only real and consistent action to be taked in order to prevent pollution by industry. With this objective in view, future actions of different kinds have been evaluated. They were mainly little projects on the fluvial margin in the Besos' affluents. These little projects consisted, for instance, in the opening of pedestrian or bicycle paths that would allow people to approach and use these areas. Some of these projects were carried out in places like Llinars, Castellar del Vallés, Caldes de Montbui, etc., small towns that are some 30 to 60 kilometres away from Barcelona. Another kind of evaluated projects were more complex operations based on advanced management studies of natural resources to create wet areas. Some of these

projects were carried out in places like la Roca del Vallés, Mollet o Montcada; again small towns situated near Barcelona.

There were also large scale proposals like the substitution of the airy electric network systems and the huge electrical towers in the bed of Besos river. Should this ideas be realized they woul be among the most important changes that had been done in Catalonia as they imply, among other things, the modification of the free section of the channeling that imply complex hidraulic calculations as we can see in the images of Sta Coloma de Gramanet and St Adria del Besos.

The projects

The projects themselves have been done by several teams grouping architects, engineers and biologists. None of them had worked with computer based environmental technics before our collaboration. With this new techniques some projects have been modified as we have been able to see them from another perspective.

Sometimes, the preliminary images have showed that some apparently well founded ideas provoke undesirable environmental impacts. On the other hand, environmental education campaigns addressed to the general public, promoted by local institutions, based on small and discret intervention and characterized by the maximum respect for the ambient, prove to be much more effective. It is with these kind of interventions that we think the river can be saved.

The computer has become in this way a powerful techonological instrument that can be used against the misuse of other powerful technological instruments. In the particular case of environmental projects that were proposing different ways of viewing the landscape has proved to be, once more, an invaluable tool and, as it has been unanimously agreed by the teams that elaborated the first projects it has helped decisiveley to complete them and to present them in a effective way to the public.

The exhibition as multimedia

The last objective of this team labour has been, as was mentioned above, the realisation of an itinerary exhibition that could be also considered as a popular plebiscit. The exhibition was conceived using several systems, panelled images, automatic slide projectors, dioramas, pannelled texts, models of the river, games for school activities.

The exhibition was propitiated by several institutions, from little town councils grouped in the "consell comarcal", to an autonomous organism who takes care of residual water's management ("Consorti del Besos") or other organisms with a wider more institutional character like "la diputacio de Barcelona" or the AMB.

It has been visited by a lot of public. It was located underneath a big carp in the middle of Sta Coloma de Gramnanet, one of the most emblematic towns arround Barcelona, notorious by its social activism and ecological claims. Afterwards it was installed in Barcelona and soon it will be translated to several other councils along the river.

The general idea which has promoted this exhibition has been the need to transmit to the public the message that is possible to act upon the river if we act with decision and solidary from all the ambits of the society. This ideas have been launched, now the challenge is for the public in general, who will have to make them their own and translate their claim to their representatives.

As it happens often, multimedia is a branch new word that appears to be deeply rooted in good old words as soon as we focus our attention on what it is meant to mean. We discover that when we found ourselves suddenly moved from our current work as professors and researchers in architectural computer graphics, to comissioners of a rather complex exhibition. We had to arrange texts, posters, images, automatic video runs, automatic slide runs, dioramas and ocassionaly speeches into a well organized walk through that had to preserve the sense of the exhibition. How would you call that but *multimedia*?

There is the possibility of putting most of the items that have conformed this exhibition in a CDRom and we have started already to consider this possibility. As it happens in this cases it will depend on the budget available to be acomplished. But on the first instance we have the intention to follow the spirit of this rather modest exhibition to organise our material. It is said quite often that new media

should try to discover which are their essential characteristics instead of trying to mimic the old media characteristics. It is not less truth that one of the best ways to understand new media is to look at them from some stable position. If this is not so we run the risk of having none; neither a reconverted strategy nor a new one. This is a criticism that, we are afraid, could be applied to many recent productions on CDRoms.

Technical aspects. Image resolution

From the pure technical point of view this exhibition meant a radical depart from other experiences that we have had the occasion to show in some previous ECAADE conferences, particularly in Barcelona, 1992. Until this moment, we had produced images whose final output were meant to be slides. In this case, we had to produce 28 images that were going to be printed on a 900 x 600 cms panel, and that were intended to be shown to hundreds of people used to color photography in the form of public advertisements.

This was really a challenge because our equipment (an i486/66 board with 16 mb at the beginning of the job, a pentium 90 board with 32 mb at the end, both equipped with a matrox graphics board, 1024/24 bpp) does not reach the capabilities of a top professional equipment for graphics work. Neither do we think that we had to be equipped with a Silicon graphics workstation to complete a job that is intended to be, among other things, a reference for our students and for common architectural studios.

So we had to study very carefully the figures that had to direct or quantify, the quality of our images. This prove to be very valuable and we include here a resume that may useful to others.

The power of resolution of the human eye depends on physiological and neurological factors. From the physiological point of view, resolution can be related directly to anatomical data. Firstable, the cones, the retinal receptors in the fovea (the area of the retina on which we automatically focus objects around us and that covers 5° aproximately) are about 0.002 mm wide. On the other hand, the distance between the centre of focus of the eye at the cristaline and the surface of the retina is about 17 mm for distant objects and about 14 mm for near objects. This means that the real width α of a near object placed at distance d from our eye becomes a projected width of $14 \alpha / d$. For instance, the dot of a monitor, 0.28 mm wide, looked at from 500 mm will produce a retinal image of 0.008 mm ($14 * 0.28 / 500$) that is, will cover aproximately 4 retinal receptors.

It must be taken into account that the power of resolution of the human eye depends on a complex variety of factors. Among them we can quote: conditions of adaptation to lightness, contrast between figure and background, the part of the retina on which the image is projected, the subjective expectations of reconaissance, the particular capacity or visual acuity of the subject that varies from one individual to another and changes with the age. But, if we accept "normal" conditions of observation, experimental data and anatomical data provide us with similar results. Everybody, in good conditions of illumination are unable to resolve, i.e. to distinguish, black and white lines presented to the eye at an angle of about 0.40 min of arc which is aproximately the same ang that is subtended by a cone. In general, it is accepted that 5 lines per mm (5 lpm or 127 dpi) observed from what is called the standard distance of visual observation D_v , equal to 250 mm, are indistinguishable to most people.

This means that a photograph as wide as a sheet of paper, let us say 25x17 cms wide (9.8 x 6.7 inches) observed from a distance more or less equal to its bigger dimensions, let us say 25 cms to simplify the matter (we should considered the diagonal) at 127 dpi of resolution should become an image of 1245x850 pixels (9.8x127 and 6.7x127) in order to present us a collection of pixels that should no longer be recognizable as such but as a continuous surface. If we have 3 rgb chanel, 1 byte each, this means (1245x850x3) a 3 Mb image.

But this are minima values that will prevent the points to be seen as such points. The sharpness of a photograph still depends on other factors. One of this is what is known as Vernier acuity that is about 1/4 of standard acuity. Another is what is known as Mach bands. Both depend on neurological explanations. Vernier acuity allow us to distinguish whether a line is straight or not, despite the fat that we are not able to phisically distinguish their points; our eye/brain is able to compute the

contextual data that tell us that that line "should" be straight. Band Machs is a phenomenon that allow us to distinguish whether a fade of intensity is continuous, beyond the fact that two rectangular patches of the same gray that appear to us as fading away in intensity, will look the same to us if presented as two rectangular patches, side by side.

To summarize, we have found that, for optimum conditions of image quality, we should multiply the resolution mentioned before, twice by 4. This means that our 3 mb image should become a 48 mb image (3x16) in ideal conditions and for optimal conditions of observation. For an exhibition panel, the figures should be the following: 35 dpi as equivalent minimum resolution for an observation distance of 90 cms; 1240x826 pixels for an 90 cms panel (35 inches x 35 dpi pixels on its wider side) ; 3 mb as the minimum size of the image; 48 (3 x 16) as the optimal size of the image. For technical reasons ("ram" reasons) we worked with less than half this figure, around 20 mb images. It did come out quite well if we have to believe the comments of the public.

Technical aspects. Color

Although the resulting images have received nice comments from the public that attained the exhibition it is here, on color, where we would have liked to count on better hardware and software equipment. And more time. Firstable, our prime material, color photographs taken on site were, too often, either too much or too little contrasted; too colourful or too pale; had too much shadow or looked flat. Working on the basis of colour photographs has some advantages but many disadvantages; the main one is that reality refuses stubbornly to follow our clever suggestions. Another one is that one should, ideally, wait for the right day at the right time; this is nearly impossible for this kind of jobs. As a consequence to all this, the original images are corrected to balance color. But there is a limit to what can be done processing images before manipulating them. On the second hand, our new scanner (a flat bed HP ScanJet IIC) proved to behave in practice as we feared it will do in theory; dark areas become messy, as flat bed scanners of medium price lack penetration power and subsequent discrimination capacity on dark areas. A good drum scanner is, concerning black backgrounds, as a Rembrandt portrait is to a second class painter's portrait; it provides a feeling of depth based on nuances that cannot be seen from some distance but can be felt intuitively.

On the third place, there is the complex issue of output devices. Here, as anybody who has entered this field should know, we are, all, at the mercy of elements. There is not a standard of output control. RGB does not mean anything that makes real sense for a printing device. CMYK implies a 4th channel (32 bpp) and, worst, an exact specification of the output device that will translate digital values into specific ink weights. Colors that were carefully adjusted on a gamma corrected monitor get an unexpected green, blue, yellow or red cast on print. It becomes a hazard game. Sometimes, we were fortunate and must recognize that the output was different, but not worst, than our monitor image. Other times, things were a bit worst; seasons moved misteriously from springtime to autumn or summer. Still, we hope to be able in the future to control color in a more efficient way and explain to you how we have managed to do it.

Conclusions

Bit map processing, as a direct way of generating new images on the basis of photographs, is a well known technique in computer graphics. What, perhaps, has not been fully assimilated, is its tremendous creative power and its effectiveness as a mean of communication in the case of landscape projects where the original quality of the site must be integrated in the proposal and cannot be modelled by any geometrical, procedural or fractal modeller.

One of the reasons why it arrives to the architectural area so slowly is that, to use it, one must be at the same time, in a way, an artist (must be able to *paint* a landscape, either with a mouse or with a pencil) and, in a way, a scientist (must be able to understand theoretical issues to be able to deal with many collateral problems that come on the way). It is rare to find somebody with this two characteristics; we know what we are talking about because we have had to reject some jobs due to

lack of assistance.

But although the technique is well developed in other fields (like advertising) there are, in general, many questions that deserve further development and also, in particular, that need to be adapted to particular cases that one encounters in the case of architectural and landscape projects. We have presented some of these questions in the context of a very interesting job: the exhibition that we had to carry out to promote ideas to save the Besos river.

Perhaps this last part will be considered too technical and far away from the usual scope of interests of an architect. But if one thinks about it, the process is not different from the process that should be followed in the case of the real construction of a virtual project. Color control, in the case of the **impression** of the particular aspect of a real material that is intended to contribute to the recovering of a landscape visual quality, should be less strict than color control in the case of the **construction** that is supposed to culminate the process?

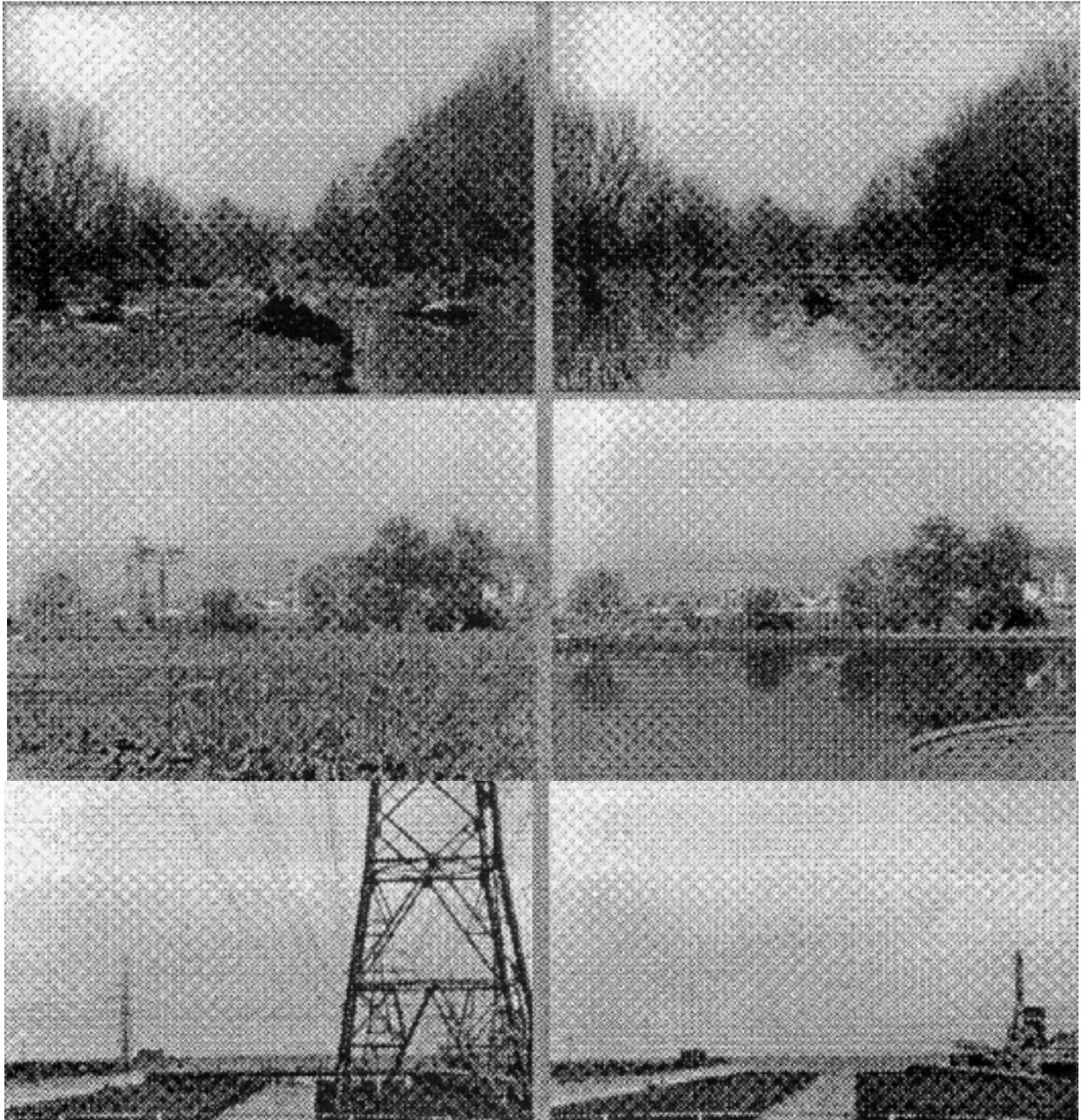


Fig. 1 - Views of three projects for the Besos river. Left: actual state. Right: project state
Top to bottom: a) La Roca, b) Mollet, c) Barcelona