Computer generated architectural images in practice: what kind and when?

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Abstract

The production of near-photorealistic images of buildings is becoming increasingly common. The software to produce reasonably sophisticated images being available at affordable prices and the increasing power of generally affordable computers have contributed to this trend. It is also probably the case that the run-of-the-mill architectural practice sees the competition producing this kind of image with a superficially beguiling quality and follow suit. What we ask in this paper is whether we should be more thoughtful about the kind of image used? Should the kind of image chosen to suit the stage of the design that it applies to and the nature of the human agents viewing the image? Of course, in posing the question we imply our answer, that it should. What we do in this paper is to illustrate why we feel it should and what the consequences are for the education of architects who are about to join the world of practice.

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Start Point

The principal use of computers in architectural practice is the production of 2D drawings or, in other words, the use of the computer an as electronic drawing board (Richens, 1994). However, over the past few years, there has been a noticeable increase in the use of CAD facilities for visualisation, post-processing and representation. Sanders (1996), for instance, illustrates twelve common post processing (what he refers to as image editing) techniques that are available in standard packages and Bartlett et.al. (1996) show the practicing architect what is possible in architectural rendering with a single package. Sanders also shows how the computer can be used in more inventive ways (to produce, for instance, multilayer artwork) than simply driving it in the routine fashion suggested by training manuals. What we want to do is to go a stage further and not only be inventive but also make the image respond to user and circumstance.

During the design process it is recognised that different stages can be identified such as sketches, drawings for developing ideas and images for presenting design intentions (Brown and Horton, 1991; Edwards, 1993). Historically the tendency has been to present drawings and other associated images in different ways in accordance to the purpose of the stage itself. This means using a certain technique to present the building in a certain stage may not be appropriate to be used in presenting the building in another stage.

The introduction of CAAD facilities has changed that state of affairs to some extent. Practices tend to use a limited range of software and thus are limited to the range of presentation styles embodied in the package. It is this fact that we wish to pursue and to follow by asking ”what kind of image should we be producing at a particular stage and for a particular audience?”

Intersection

A central role of CAAD is its function in communicating and presenting design ideas. Here we are concerned with the accurate communication of architectural intention about a buildings. In particular we are interested to establish what kind of image it is appropriate to use in response to different design stages and different predisposition’s of the human viewer.

Our starting points are previous research by other workers in the field dating back over 30 years. One of the mistakes which we tend to make in CAAD research is to overlook research work which is anything other than contemporary (Maver, 1995). In response to the observations made by Maver we have as one of the core start points for our work some studies undertaken around thirty years ago which investigate the different interpretations of architecture observed in different groups of people (Hershberger, 1965). In fact there are three research investigations which are the main start points for our work. An outline of each and the relevance to our research is given below.

Tangent

In chronological terms the work undertaken by Hershberger is the first of those that we refer to, but it is probably more instructive as an introduction to look initially at the technique developed, initially by accident, by Van Bakergem and Obata (1991) at Washington University. The technique produces computer drawings with a free-hand drawings character. creating the illusion that they are hand drawn sketches. The way that the images are produced is simply to use pens and pencils which do not quite fit into the holders of a pen plotter. Using a variety of pen and paper types and different degrees of looseness of fit the quality of the plotted line can be varied from the conventional hard-edged plot to very free and ”wobbly” (see Figure 1). A similar look and feel to rendered CAAD images was developed later by Schofield (1994) through software rather than hardware. In both cases though the computer is being made to generate deliberately non-photorealistic images.

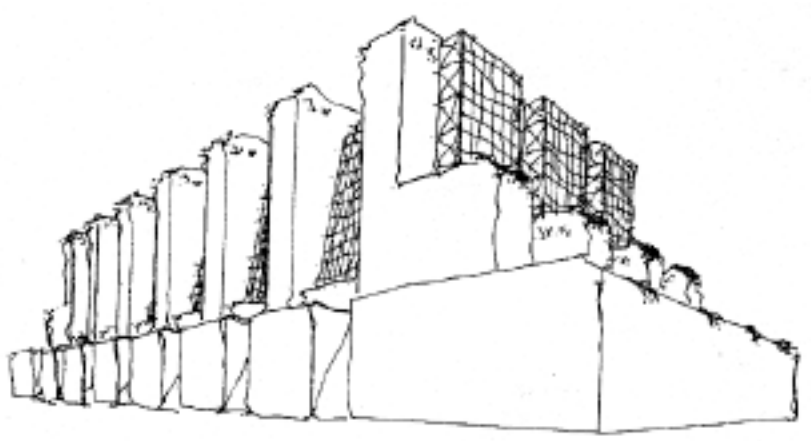

Figure 1. Typical ‘wobbly’ plot (after Van Bakergem and Obata): this one is of Mendelsohn’s Labor Hall.

In their study Van Bakergem and Obata (1991) compared the reaction of architects to these drawings and also the perception of members of the school of architecture to the same drawings. The study involved two images of building designs not known to the participants in the survey, each a computer generated drawing: one was a ”wobbly pen plot” and the other produced by a laser plotter.

The results were very interesting. Most participants (the participants did not know that all the drawing that they were looking at were generated by computer) in general found the wobbly pen plots very interesting and used words to describe these images such as these:

”expressive, unfinished, sketchy, rich, free, soft, simples, messy, organic, flexible, loose, freehand trace overlay, in progress”.

This contrasts markedly with the laser plots which the respondents generally regarded as uninspiring and boring, though complete.

Possibly the differences in perception were caused by a perception that (the obviously) computer generated images were held to be unimaginative or because the incomplete quality of the wobbly plots suggested more complexity and therefore held more attention and interest than an image which is understood quickly. A technique like this could be very appropriate in the early stage of the design as the design is emerging in its premature stages, when both the architect and the client can discuss their ideas in a more open way. But the same techniques might not have a potential role were decisions are made. Here we will be looking into another technique approach and a need appears to distinguish different approach to present the image.

Clearly we are generally used to regarding hard-edged, mechanical drawings as the device for communicating a completed design to those involved with the construction of the building. The computer generated image produced for this purpose is therefore an information document and not a design document in the sense that the term design is used in architectural design. It may be that the architectural community reacts badly to a hard edged drawing because of the perceived role of this type of drawing. This is a matter for further investigation.

Schofield (Schofield, 1994) developed the technique of van Bakergem by turning the physical effects of a wobbly plot into a software technique for creating an image which was non photorealistic (Figure 2).

Figure 2: Schofield’s software driven technique can produce apparently hand rendered images like this one.

Schofield's investigations with architects and designers to discuss the integration of non-photorealistic rendering (the prototype) within art and design practice led him to a conclusion that this will help in repositioning the role of CAD and computer graphics in architecture in several positive ways.

The technique developed by Paul Haeberli is similar to that of Schofield's. It takes a conventional simple rendering and reprocesses it with the use of different kinds of marks to replace continuous lines and colours. The marks used by the post-renderer can be, for example, a hatch line or a brush stroke and it can have internal variability in its width, length, colour and transparency. In this way we can manipulate an image to a great degree by applying a wide variety of rendering options.

Parallel

In the study conducted by Hershberger (1965) the aim was to examine whether there are differences in the way architects, non-architects and architectural students interpret the same architectural image. The images used in the study were conveyed using 35mm slides and were of buildings known by some or many of the participants.

Hershberger found there was a clear difference in the way that architects and non-architects perceived the same buildings (when presented in this way). The forms found to be appealing to architects were often regarded as unappealing by laymen. One group of the respondents would judge a building to be ”good, exciting, unique, pleasing”, another would judge it to be ”bad, boring, common and annoying”. This suggests two problems in itself. The first is that people differ in their assessment of architecture depending whether they do or do not have an

architectural background, and the second is the problem of communication. In both cases, it is the architects concern to convey the right message to the viewer.

As a response to his own work Hershberger recommended that if architects want to use their media to communicate their intentions to laymen, they must either re-orient architectural education and broaden the architectural education or makes greater effort to educate laymen to see and appreciate architecture the same way as architects. We believe that these conclusions need reinvestigating, with the additional layer of complexity added by the computer-generated image, but what is significant is that there does appear to be significant differences in perception of architectural images by viewers from different backgrounds.

In his study, Hershberger used only one technique to present the architectural images. What might the result be in the case of using different media in presenting architecture? Could this affect the result that Hershberger obtained from his study; if the answer is yes then there are clearly implications for the computer generated image?

End Point

When we talk of lay people we are talking of the client and the user. One of the important aims of the computer in practice is (increasingly) to help to communicate to the non-architect what the building will be like. But what the investigations referred to above show is that we may be taking too much for granted when we convey the architectural image using the computer. Do the other viewers see what we see? It might be that VR could make a significant contribution to the answer (Richens, 94). It is just as likely that the differences in perception between the architect and non-architect are magnified by VR.

When we think about presenting architecture, we need to think first about the factors that influence the mass of a building which vary between its location, the way it addresses it neighbours, the landscape, its planning, detailing. So our aim in presenting these images now is to convey as much information about the building in order to minimise the surprise when entering the real building, but how can this be achieved? Good buildings exceed our expectations while poor ones look worse in real life. What is the best technique that we can use to help us all in experiencing architecture and presenting it?

We need to understand the factors affecting human visual cognition in order to present architectural images to be interpreted as we intend (Solso, 1994), and in particular we need to understand the effect of different presentation techniques on the perceiving of architecture. This implies the need to consider three stages of the problem and the need to emphasise on both the second and the third to examine their role on perception:

- first, visual cognition (seeing and understanding)
- second, how can the primitive information be organised into fundamental forms.

• third, how can the fundamental forms give meaning through association with previous knowledge of the world stored in long term memory (LTM).

West (1993) notes to the importance of the visual learning on visual thinking and communicating ideas:

> *We may find it preferable learning experience rather than from lectures, a facility with visual content and modes of analysis instead of mainly verbal fluency, a habit of innovation through making connections among many fields, An ability to progress through many developments and mental models with 3D CAD.*

Next

We have shown that the work undertaken by Hershberger suggests that groups of humans from different backgrounds perceive architecture in different ways. The later studies undertaken by van Bakergem and Obata's work indicate that 'traditional', hard-edged (in both 2D and 3D) computer generated images are received badly by architects whereas (despite the fact that the CAAD model data is identical) loose images are received well by architects. But do non-architects respond to the images so produced in a similarly favourable way?. Finally, the research by Schofield (and others) shows that we can control the nature of the output image to give the kind of effect that produces the most appropriate response.

But what is the appropriate image and what image gets what kind of response from a particular group of humans? These are the kind of questions which need to be answered in order to best use this powerful communicator of architectural design intentions that we have at our fingertips.

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