Computer Generated Architectural Images: a comparative study

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This work is part of a long term research programme (Brown and Horton, 1992; Brown and Nahab, 1996; Bassanino, 1999) in which tests and studies have been carried out on various groups of people to investigate their reaction to, and interpretation of different forms of architectural representation. In the work described here a range of architectural schemes were presented using particular representational techniques and media. An experiment was then undertaken on two different groups; architects and lay people. They were presented with a number of schemes displayed using the various techniques and media. The responses are summarised and some comments are made on the effect of computers on perceiving architecture and on communicating architectural ideas arising from an analysis of the responses.

Keywords*: subject, image type, presentation technique, medium, SD scales, factors.*

Introduction

The relationship between architectural representation and its intended product- a building has undergone a profound transformation over the centuries. The age of computer aided-design has brought another dimension to architectural representation. With the rapid recent development of computer hardware and software, images of various kinds of representation techniques are now available to the architect.

In computational terms, when we work with the digital image, what we generate is data which is interpreted and relayed back to our eyes in a form that is governed by both the hardware and the software that sits between the hand and the eye. The digital image regardless of the various techniques used to represent it, has a physical quality and what is significant here is the cognitive interpretation of the digital image.

Although there are many parties involved in the design process, it is primarily the architect's role to covey the appropriate message to the client. Thus, the broad objective of this research is to study the graphic presentation of architecture and its use in communicating design ideas and information and to investigate whether differences appear in the perception of architectural images by viewers from different backgrounds (Brown and Nahab, 1996). In this paper we focus on the difference between two particular groups; architects and lay people. Other groups included in the broader study reported elsewhere (Bassanino, 1999) include other construction industry professionals and teachers of Art and Design.

Setting the Experiment

Each of the study groups was composed of about 50 respondents. The members of the architects group demonstrated different experience in using computers;

most of them had used computers for 2D drawings, CAD modelling as well as for visualisation techniques. Although the group consisted of both genders, it displayed a bias towards the male gender.

The lay people had no direct experience of architectural design and less experience in using computers than the architects group. The lay people group contained a more balanced mix of genders. Both groups of architects and lay people had a similar distribution of age between 20 and 59.

Each subject group was split into two halves (groups A and B) and the presented images were also divided into two sets. Subjects in group A were presented with the first set of architectural images while subjects in group B were presented with the second set of architectural images.

Subjects [A] in each group were presented with ten architectural schemes (various types of proposed buildings). Each one of these schemes was represented with a number of image type [B]. All the images for each scheme were displayed to the subjects within a certain presentation technique [C]. In other words, by the end of the experiment, all subjects in a particular subject group saw the same images for the same set of schemes. The other subject group would see the same schemes as the first group, but represented by presentation techniques different to those used in the first subject group.

Schemes were represented to the subjects by a range of techniques which can be characterised as one or more of the following:

 Coloured and *monochrome Photorealistic*, *Photosurrealistic*, *Mechanical*, *Simulated hand drawn*, *Post Processed* and *Reinforced (enhanced) edges*.

Images were displayed with three types of media; as hard copy, on a CRT monitor (72 pixels/inch) or projected as a large image onto a wall (1.5 by 1.5 m).

Each scheme was represented by a mix of images of both two and three-dimensional drawings: a plan, section, elevation, perspective, all presented using the same technique and by the same medium. Each scheme was represented by two to four images.

The questionnaire was the principal measuring technique used to collect data in this research in which the Semantic Differential (SD) scales was the measuring device that formed the main part of the questionnaire. Subjects rated each building on 25 bipolar adjectives of seven steps scales. Scales were grouped into five factors [D] of *Quality*, *Friendliness*, *Coherence*, *Character* and *Activity*. The list of SD scales was formed in two stages. First, relevant scales were studied and selected from other studies (Canter, 1969, Hershberger, 1969, Osgood, 1975). Secondly, a pilot study took place when the list of scales was discussed and refined by testing with the CAAD Research Group at the Liverpool School of Architecture and Building Engineering.

To investigate whether there are differences in perceiving architectural images between the two groups, architects and lay people, comparative studies took place as the following:

1. A comparative study of the schemes represented as (a) *Mechanical* and (b) *Simulated hand drawn* images to see if lay people value Mechanical drawings differently to architects.
2. A comparative study to investigate the rating of images represented with (a) *Photorealsitic* and (b) *Post Processed* techniques.

Evaluation of the Influence of Computer Generated Architectural Images on Perceiving Architectural Images

The first comparative study between the two groups of architects and lay people was to investigate whether lay people value *Mechanical* drawings higher than architects. To do so, one of the schemes, which was represented as *Mechanical* drawings displayed on paper for both groups has been chosen to illustrate the kind of difference that is suggested.

Analysis of the test results indicated that although both groups of architects and lay people had a positive response in rating scheme 3, it is apparent that the
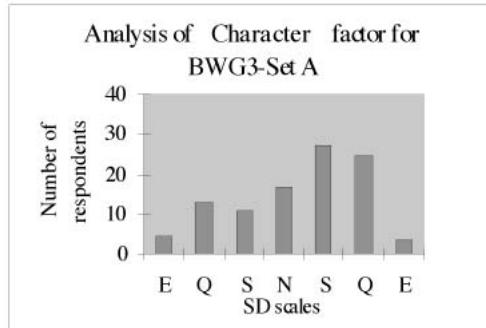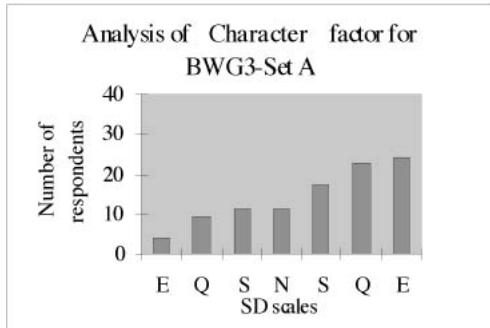
Analysis of Character factor for BWG3-Set A

Number of respondents

E Q S N S Q E
SD scales

Analysis of Character factor for BWG3-Set A

Number of respondents

E Q S N S Q E
SD scales

Analysis of Friendliness factor for BWG4-Set A

Number of respondents

E Q S N S Q E
SD scales

Analysis of Friendliness factor for BWG4-Set A

Number of respondents

E Q S N S Q E
SD scales

Figure1 (top left). Rating BWG3- Set A displayed as Mechanical drawings on paper on the Character factor by a) Lay people group b) Architects group
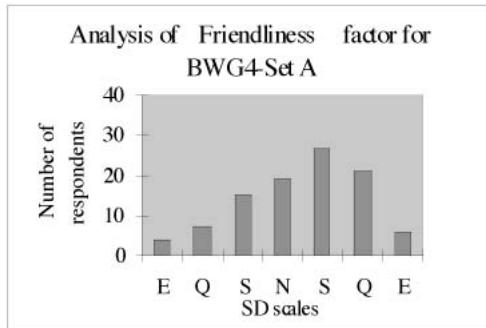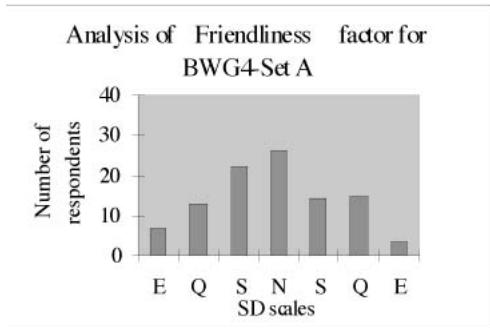
Figure 2 (bottom left). Rating BWG4- Set A displayed as Simulated hand drawn images on paper on the Friendliness factor by a) lay people group b) architects group

lay people group had a stronger preference towards the *Mechanical* drawing by placing higher scores on the positive side of the neutral point of the SD scales. This phenomenon applied in particular while rating on the *Character* factor (figure 1).

Results from rating the above scheme when it was represented as *Simulated hand drawn* images displayed on paper in set B for the two groups of lay people and architects indicated that although the two groups rated the scheme positively, but it is worth mentioning that the architects group felt stronger (positively) towards the scheme for placing higher figures on both *Quality* and *Coherence* factors than the lay people group.

The next scheme taken to illustrate a point is BWG4 in set A which was represented as *Simulated hand drawn* images displayed on paper for both groups. Results indicated that the lay people group rated this scheme negatively on the *Friendliness* factor

(figure 2) while results were found to lie towards the positive side of the SD scales on all factors when the scheme was evaluated by the architects group.
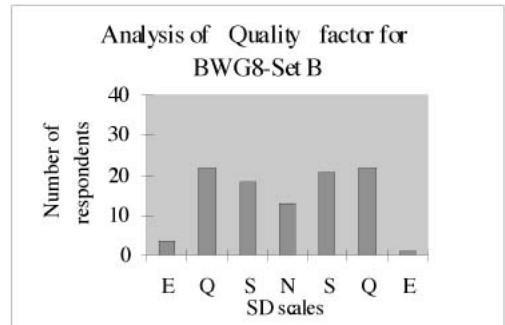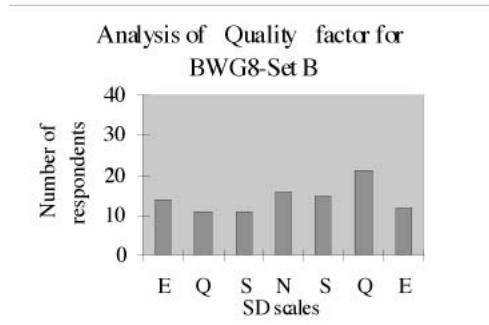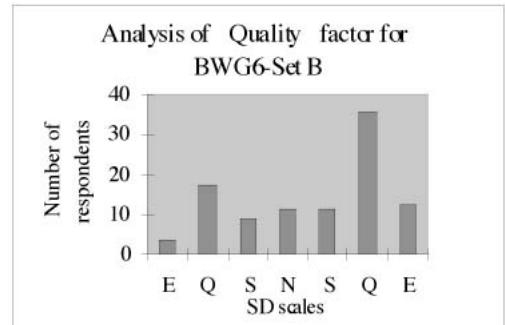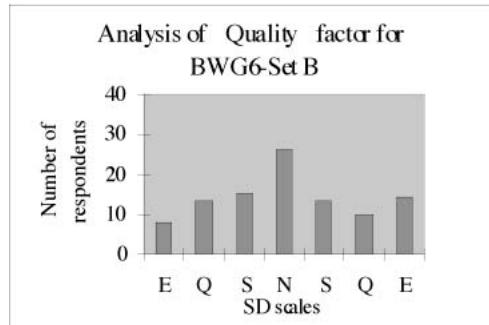
BWG4 in set B was the next scheme selected to analyse which was represented as *Mechanical* drawings displayed on paper for both groups of architects and lay people.

Analysis indicated that both groups rated this scheme to a similar degree towards the positive side of the neutral point of SD scales. However, it is worth mentioning here that the lay people group felt more positive towards the scheme by placing higher figures on *Quality*, *Character* and *Activity* factors.

The second set of comparative studies between the two groups of architects and lay people was to establish the responses to *Photorealsitic* and *Post Processed* representational techniques. From analysing data on all factors for all representational techniques, it was found that differences between the

Figure 3 (top right). Rating BWG6- Set B displayed as Post processed and projected as large image on the Quality factor by a) Lay people group b) Architects group

Figure 4 (bottom right). Rating BWG8- Set B displayed as Photorealistic on paper on the Quality factor by a) Lay people group b) Architects group

Analysis of Quality factor for BWG6-Set B

Analysis of Quality factor for BWG6-Set B

Analysis of Quality factor for BWG8-Set B

Analysis of Quality factor for BWG8-Set B

above two groups were most marked when schemes were represented with *Post processed* images.

Moreover, the data indicated that the schemes displayed as *Photorealistic* images generated less difference between the two groups of architects and lay people (both groups rated the *Photorealistic* images towards the positive side of the neutral point of the SD scales).

By examining figure 4 again, it is apparent that architects exhibited a stronger view (in terms of *Quality*) towards the scheme and were more decisive about their ratings unlike the lay people group. As mentioned by Tweed (1999) architects tend to see and infer more in drawings than other people do and this would explain why they were more extreme than the lay people group in their evaluation of particular types of architectural image.

The following points summarise the significant results from analysing the above comparative studies

(between the two groups of architects and lay people):

1. The comparative studies of the *Mechanicaly represented* schemes indicated that the lay people group was more positive than the architects group towards *Mechanical* drawn images. On the other hand, architects felt stronger (positively) towards the *Simulated hand drawn* images (Nahab, 1998) than the lay people group for having a preference towards *Simulated hand drawn* images than the lay people group. This finding supports the findings of others, and particularly, in this context, Van Bakergem and Obata (1991).

2. The results above indicated that although differences were found in perceiving architectural images between the two groups of architects and lay people was mainly on the *Quality* factor when the two groups were

represented with the same images, it might be possible to reduce the gap between these two groups by representing the scheme with an appropriate presentation technique (Bassanino, 1999). As indicated from the above examples, presenting a scheme with *Photorealsitic* images would probably generate less difference between architects and their clients rather than presenting the same scheme with *Post processed* images for example.

Conclusion

The main objective of this work was to offer an approach to help understanding the process of communication between the architect and clients during the design process. It is not surprising to find out that architects interpret architectural images differently to lay people (as well as to other groups in the building design team). This has been referred to in a number of previous studies (Canter, 1969; Hershberger, 1969, Tweed, 1999). It is apparent that architects look at representations of designs (drawings and other related images) differently to their clients, and other agents in the design team. But what is worth considering here, is that those differences should be made explicit, understood, and taken into account by the architect where appropriate.

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Notes

[A] Subject: The persons in each group i.e. the subjects of the experiment

[B] Image type: The image could be presented as site plan, plan, section, elevation, isometric or perspective.

[C] Presentation technique: The technique used to render the image in a particular way Photorealistically, Photosurrealistically, as a post processed image, as a loose edged computer generated image, or as a mechanically drawn image.

[D] The collection of scales to test a certain concept are referred to as Factors in Semantic Differential testing.

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