DRAWING THE MAP
ABOUT THE WAY FREEHAND DRAWINGS LOOK IN COMPUTER MODELS
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Abstract
The use of 3D-software in architecture has several advantages: architects and clients are better able to comprehend the design, test variants and take and confirm decisions. On the other hand, architects warn against the presentation of computer images at too early a stage because these images give the impression of conclusiveness. Hand-drawn illustrations, by contrast, have the loose character of a sketch and leave things open to the imagination. This has advantages, especially in the initial stages of a design.

This paper is a survey of our current research and teaching work, showing especially the combination of freehand drawing and computer model and the effects and possibilities of this form of abstraction in order to facilitate a correct interpretation of the proposed ideas.

Introduction
During the previous D-11 exercise in computer visualisation, students were asked to design a small building meant to show one 'piece of art', also to be designed by the students. As result, they had to produce at least eight renderings of the whole setting: four exterior and four interior pictures. This process was carried out directly on the computer during three weekly afternoon meetings. On the first day, during the initial couple of hours, they learnt the basics of the software program before they began designing directly on the computer. These exercises produced good impressions of their ideas, describing forms and spaces and also colour and textures.

The architectural practice requires, of course, another process where decisions are taken in a different way and tempo.
Like As Allen (page 149) points out, computers offer ease on generating perspectives and using colour, but "More significantly, these techniques of visualisation ignore what has traditionally given architectural representation its particular power of conceptualisation - that is to say, its necessary degree of abstraction, the distance interposed between the thing and its representation. Design does not operate on the basis of resemblance, but on the basis of abstract codes and a complex instrumentality. Architecture presumes a transformation of reality, but an architect attempting to work directly with that reality will be paralysed."
Besides, "The image is not the architecture, it's the message.... An image can show aspects that would not be noticed in the real building". On the other hand, „In a realistically rendered picture,
feelings that are evoked in a room, may not be perceived” (Engeli, page 42).

As we said at the previous EAEA conference (Giró, Kegel, page 36): the experience of various media techniques gained in the studies Assignment and simulation (Overdracht en simulatie) and The imag(in)ing (De verbeelding) also supported several statements. Hand-drawn freehand illustrations have a personal touch and are generally intended to give an impression of the subject. In particular, the loose character of a sketch, when supplementing factual images, leaves a lot open to the imagination. This has advantages in the initial stages of a design.

Computer images are based on precisely-defined 3-D models: with too little detail they appear dead, while too much detail in the early stages of a design project quickly gives the impression of a finished design. On the other hand, computers offer the ease with which variations can be tested and the opportunity to accommodate different viewpoints. These features make it attractive to combine these two visualisation techniques. The question is, how and to what advantage?

What could be a kind of third way became then worth to be considered: using 3D-computer modelling but applying the abstraction of hand freehand drawings: a 2D/3D tool for modelling.

This also makes it necessary to study the effects of reduction and abstraction used in the traditional freehand drawing techniques when applied on to the computer models. This way of working generates new abstractions and new ways of looking at the traditional ones, while at the same time new ways of interpretation are also being required.

Objective of the study

When simulating the environment, plans and sections are not enough to visualize expressed ideas and proposals; 3D simulations – like perspectives and animations at eye level – are necessary to give a correct idea of the design and a more understandable impression of it to most people. Considering trees, for example, apart from size and position, we can then also show aspects like form, structure, transparency and colour.

As we announced at the last conference in Essen (2001), one of the objectives of the study is the exploration of 3-D models of (green) - compositional design features and the application of 3-D (combined freehand and computer) visualisation tools. The study we presented explored the spatial visualisation of the district of Pendrecht and described it in terms of its “green” compositional elements (Giró, Kegel).

In this second study, R. Kegel and I limit ourselves to freehand illustrations in computer models and explore their significance and the opportunities for combining them. We examine the application of these techniques, especially in an early phase of the design process. The advantages of both techniques can be exploited from the very beginning during design and communication sessions. These results are published in the form of a CD-Rom to be used during our visualisation courses.

One of the main items we considered was the question: Which is the communicative value of an image and to what degree is this related to the way the image has been drawn?

In addition, which are, within the standard software available for students at our faculty, the possibilities to combine hand freehand drawings and 3D computer models?

One of the main objectives, perhaps the most important, is then to encourage designers and, specially, future designers, to develop their own freehand drawing and handwriting skills in order to be able to create and transmit ideas better to others and mainly to themselves.
Freehand drawings and computer visualisations

Some examples made by students show different ways of combining these techniques. Hidden-line perspectives rendered by hand were initially the only way to combine freehand drawing and computer modelling.

In addition, we can combine these techniques by means of texture mapping:

A student designed a complete urban site and wished to give an idea of scale, type of building, colours, etc. She drew the facades in different colours and used these freehand drawings as a texture map in the computer model. The rendering of the stills describes the atmosphere and qualities of buildings and spaces without establishing their specific materialisation.

By using pen and tablet it is now also possible to apply mapping by drawing directly within the computer model: what is drawn on the 2D panel can be seen in real time on the perspective view.

In freehand drawings, however, objects can be represented only by their silhouette, like parts of the trees shown below. This kind of flat, layered, 2D abstraction is not so useful when applied into a 3D computer model.
Depending on the message to be transmitted or on the phase of the design process, the following examples by Gordon Cullen (1914-1994) - quick impressions and more detailed, time consuming, images - show us how to select and apply materials and techniques (Waterside new town Marlow, 1950 - left; Isle of Dogs, 1982 - centre; Pimlico Squares, 1952 - right).

When drawing a tree, we can show – more or less easily, depending on our skills, its structure and details.

A detailed 3D-computer model of a tree needs some more attention. There are some additional aspects to be considered: software, time needed for construction and the size of the files. There is software, like Maya Paint Effects, which offers a library of plants and trees. A complete tree can be then placed into the model according to pre-established definitions. These parameters can be modified to suit specific needs.

The standard trees offered are not always “natural” enough and often you would not find the local tree species. It also takes time to get acquainted with the software, while the size of the files can become very big: depending on the computer performance and the 3D-model, working with these files becomes slow or practically impossible.

Nevertheless, you are able to construct complete 3D-sites, including grass, plants and trees and can achieve amazing results by animating them when simulating, for example, the effects of the wind.

Texture Mapping

As shown by some examples, earlier in this paper, texture mapping is a technique widely used to represent materials. Its advantage consists of suggesting different kinds of information or atmospheres without significantly increasing the size of the model and in particular, spending little of time and effort. Texture mapping is particularly appropriate for showing trees in a computer model.

By playing around with the flat images, drawings, in the 3-D computer model, it is possible to compile a sufficient number of suitable trees, certainly for the drawing phase of a building or complex of buildings, where only an impression of the environmental features is desirable.

You need to create a “material” by applying a bitmap to it. In this case the bitmap is the scanned freehand drawing. The 3D model of the tree consists of a star – two or three (in this case) vertical planes – upon which these images have been mapped. The combination of these three planes gives
the illusion of a solid tree. The practically upright trunk in the flat drawing of the tree is important so that the combination of sketches gives the illusion of a tree with one trunk. When combining three similar images it is advisable to draw an asymmetrical tree to reduce pseudo-symmetry to a minimum.

It is also advisable by placing the trees in a row or a group to arbitrarily turn the star on the map, which produces a livelier spatial image. The trees, regardless of the technique used in the computer model, can be given a certain degree of transparency, if required.

To apply this technique you also need to create a mask. This is normally a black-and-white version of the drawing, which supplies transparency – or opacity – to the texture map. In this way, we render only the tree itself while the surface (white paper) on which it has been drawn becomes invisible. When drawing the tree and for this purpose, surfaces must not be left empty, in other words, outline drawings, as often sketched on paper, will, in principle, become transparent.

We noticed that when using the same drawing as a mask, instead of the black-and-white version, transparency is attached also to the tree itself: the lighter the tone, the greater the transparency. This feature offers the possibility, for example, to show more of the architecture hidden behind trees or to simulate the difference between trees in spring and summer time.

Besides using freehand-drawn trees, you can combine freehand drawings and paint software, such as hand drawn trunks and computer painted foliage.
As we have shown above, software like Maya Paint Effects also makes it possible to paint into the 3D model itself, directly upon the planes. In this way, you can see the results of your painting in the perspective view in real time.

How trees are represented
The trees used have the following characteristics:
Types: street trees and some stylised trees.
Seasons: summer and winter.
Colour and black-and-white.
Coarse and fine: The distinction lies in the choice of drawing equipment.
Finely drawn trees are not drawn so that the shape of the leaves is recognisable. It is still just a sketch (in the sketch plan of a built-up area).
Drawing equipment: pen, fine liner, (coloured) markers, (coloured) chalk.
In accordance with the aim of this study, focus is given to experience gained in using freehand-drawn trees in computer visualisations. These experiences lead to recommendations regarding illustration and manipulation techniques.

Spatiality
In order to achieve a spatial impression of the tree, we used a star formed by three instead of two planes. When copied, and in order to improve variation, the star is rotated to different angles. The choice of drawing techniques or points of view for rendering should not influence the images in a negative way. A point of view coincident with the production of one of the planes should be avoided.

In addition, drawing lines or stripes to indicate different tones can result in an unwelcome flat, "fish-bone" pattern.
Variation can also be achieved by drawing the trees asymmetrically. To achieve the illusion of a single trunk, this follows practically a straight line: its central longitudinal line coincides with the intersection line of the planes. Taking this into account and to prevent (pseudo) symmetry it is possible to combine three different freehand drawings to form one single tree. In this way, we also achieve a greater spatial variation.

When using this technique and rendering the model from the top view or bird's-eye perspective, the trees would not look acceptable. By adding a fourth, horizontal, plane we can easily solve this problem. On this plane, which lies more or less perpendicular to the others, we map a freehand-drawn top view of the tree or we compose this image digitally by combining parts of the drawings we already have.

Transparency  
In principle, all "holes" left empty when drawing the tree will become transparent. As we mentioned above, transparency or pseudo transparency can be obtained by applying the same drawing also as mask. In this case, colours become transparent and we see that the lighter the tone, the greater the transparency. This could become a choice when showing buildings behind "solid" types of trees, or when suggesting trees in springtime.
Depth and Contrast

Depth is related to spatiality and concerns the form of expression we use to visualize the tree itself as well as the place it occupies in the composition. Trees must be drawn applying enough contrast in either colour or tones. Contrast in tones suggests and strengthens depth and spatiality. To illustrate this, we mapped photographs of trees on the models.

![Photographs of trees](image)

Markers offer a wide range of tone; chalk does too, but only when we vary the pressure we apply. The drawing technique then has a positive spatial effect on the computer model.

![Markers on trees](image)

Visualizing shadows, both internal and external, is also necessary and contributes further to suggest depth. When arranging the composition the correct light direction must also be considered.

![Visualizing shadows](image)

Depending on the distance to objects within the computer model, the drawing technique we choose will also affect the visualisation: trees situated far away can become a dark spot. With regard to distance, a decrease in brightness can also be obtained by arranging the distance and atmospheric options when rendering.

The Sketch

When visualizing trees, and taking into account that a lot variations can be applied, we have to consider the graphic and communicative qualities of the image. The initial phase of a design suits a non-realistic form of representation. What are the minimum requirements for a computer model? We can illustrate this by means of two drawings by Gordon Cullen. The first drawing shows black stripes representing boughs and hatch indicating foliage. The drawing itself is already rather “flat” and so it looks in the computer model. The “fish-bone” pattern becomes annoying too.

![Two drawings by Gordon Cullen](image)
The second drawing shows more spatiality due to the colour nuances inherent in chalk surfaces. Without a trunk, the tree would become almost unrecognisable but its computer model expresses the tree in a nonchalant, very useful way.

**Communication**
When designing the environment, ideas are developed and communicated through draft sketches and models. Trees are described in an indicative way, also within the computer model, but already have an indication of size, form, transparency and other spatial properties. In this way we lay down its significance within the built or planned environment. The moment sketches and models are better defined, tree visualisation is expressed in a more realistic way.

**Reduction**
Reducing implies not only simplifying a realistic image but also indicating the nuances. These are based on considerations concerning the desired kind and degree of information to be transmitted. The extent of reduction depends on the significance the image will have in the visualisation. The appropriate degree of reduction depends on the wish to both communicate information and create a pleasant image. In addition, an excess of information makes the image become a puzzle picture.

**Graphic Significance**
Images provide not only information but should, at the same time, remain and appeal to people. The way we render the graphic image we produce is then also important. Both composing the image and choosing techniques and materials play an important role when drawing and working up the trees.

**Pen**
The pen is an elementary instrument used to express form by means of lines. The pen or fine liner, except when combined with markers, is less adequate for drawing quick, rough sketches. When
more time is dedicated to drawing for receiving a more detailed sketch, the pen offers possibilities for showing line and tone nuances.

Open (silhouette) drawings, generally not useful in computer models, can give, easily and quickly, an impression of the subject.

**Marker**

Markers, applying points, lines and surfaces, are very useful for drawing trees. By means of a "pointillist" use of a marker, you can easily suggest leaves. Many colours can be chosen and superimposed and this suggests more spatiality. Marker surfaces are transparent.

**Chalk**

When using chalk you can quickly describe the type of tree by applying dot, line or surface patterns. Dots are reminiscent of marker dots, but they are rougher. This suggests texture in a better way.

In renderings of the computer model, lines can show, as we said, unwelcome patterns. When applied lying on its side, chalk can provide "spatial" surfaces. Colours can easily be mixed and drawings can be produced in a quick, illusory way.

**References**

- S. Allen; Practice – architecture, technique, representation; G+B Arts, Amsterdam, 2000
- T. G. Cullen; The concise townscape; The Architectural Press, London, 1976
- J. van der Does, A. van Haaffen, R. Kegel, R. Vrins; Overdracht en simulatie – onderzoek naar waarde en betekenis van media-toepassing bij architectonische simulaties; DUP, Delft, 1990
- J. van der Does, A. van Haaffen, R. Kegel; Presentatieltechnieken; Publikatieburo Bouwkunde, Delft, 1994
- J. van der Does, H. Giró; Imag(in)ing, a fresh look at design, presentation and communication; Delft, 1999
- M. Engeli; Digital stories – the poetics of communication; Birkhäuser, Basel, 2000
- H. Giró, R. Kegel; The score of Pendrecht; digital/analogue Environmental Simulation – new impulses in planning processes; 5th EAEA conference september 2001, University of Essen (Germany), published 2002, p.36-49
- D. Gosling; Gordon Cullen – visions of urban design; Academy Editions, London, 1996
- N. L. Prak; De bouwkundige presentatieltechniek – vademecum visuele overdrachts technieken; TU-Delft.