

# A Case for Computer assisted Creativity through Clarity

## Project 12 CAD and beyond...

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### Abstract

*A paper exploring the opportunities of different Design Media for the benefit of Architectural and Urban Composition. It is argued that during the design process, the designer develops Models for a projected end result, which are visualised in the form of Images using traditional media. The Computer affords the possibility of creating (virtual) models from which images can be taken. Current types of Computer Interface still form an obstacle for creative computer assisted design, comparable to Sketching. It is argued that the Clarity of the medium will need to be enhanced, if it is to become an Instrument for truly creative design. Using the example of an educational, practical Cad exercise, the case for Clarity for the benefit of creative computing is put forward.*

### Design, Composition and Media

Designing is essentially an act of *Composition*. In architectural design this activity, which can be regarded as a form of creative *organisation*, takes place on different levels (for instance on functional, structural, material and aesthetic levels, regarding the overall concept and in detail) - often simultaneously. The designer strives (or should strive) towards a result which is more than a sum of separate parts, but which in combining a range of different aspects and components, creates something new: a *Synthesis*. In the search for appropriate design solutions the designer needs feed-back, something to respond to, to be made aware of relevant *choices* in order to be able to make *decisions* (Breen,1995).

When creating compositions for new environments, designers make use of a range of media which assist in shaping and communicating their ideas. One important characteristic of this kind of spatial design - architectural or urban in scale - is that the designer does not create an *end product* in the way that for instance an artist or musician may do.

The designer is involved in creating *Models and Images for thought and communication* through which the intentions of a design concept may be captured and transmitted in such a way that they may be understood, evaluated, discussed, altered and eventually 'realised' in the form of a new or altered spatial surroundings which are subsequently perceived as *reality*.

In order to get this far a great deal of thought has to be invested into the development of something which cannot as yet be envisaged. During the design process, many attempts are made to overcome this problem. This is essentially done by creating *visual information* which can give an understanding of where a plan is heading. This information has to be 'read' to be understood, and the reading of architectural notation has to be learnt. Some such information may be relatively accessible, both to designers and non-professionals, but a lot of it is abstract and difficult to imagine. This applies for non-professionals but also very often is the case for the designers themselves. As such design activity is essentially a process of creative *imaging* as

Zeissel has indicated (Zeissel,1984). Images are used to lay down ideas and this information can then be shared or be communicated to others. However they are also a form of communication with oneself (or with other partners in a design team), a way of questioning or verifying the merits of design ideas, of testing their viability and of developing new options and strategies.

The process of imaging can be effective in channelling inspiration, the designer thinking while doing and reacting directly to intermediate results as they are visualised, reflecting, eliminating and refining... and subsequently making decisions and documenting these.

This process is *iterative*, it is not linear in its progression but tends to take place in design loops, in which the state of the design at a certain point is evaluated and judged in relation to previous steps and developed further. The process is not predictable, the designer 'hunts' for solutions which sometimes come easily but more often are difficult to grasp. Unforeseen developments and outside influences may frustrate progress and cause setbacks. Although there may be some evidence for certain specific types of working styles in architectural practice (van Bakel,1995), design generally does not follow a clear pattern except that there is an overall development from a primary, more or less 'approximate' type of visual information in the early phases to more precise, systematic and 'exact' information towards the end.<sup>1</sup>

As the emphasis shifts during the process from conceptual to rational, so different design media may be of specific benefit in different phases of design development.

The best known of design media is the **Drawing** and it is used throughout the progression of the design, from the first idea sketch (supposedly on the back of something or other) to technical drawings, traditionally drawn to scale along rulers on drawing tables. The most familiar drawing is the **Floor plan**, originally probably carved straight into the ground 'in situ'. Despite the fact that a plan is an abstraction in so far as it shows an overview of different spaces simultaneously - whilst our perception of spaces in reality is serial - it is a scheme that is reasonably well understood by non-professionals. Reading a plan is comparable to reading a map.

**Elevations** are projections of facades which are read graphically, but in reality are experienced quite differently through motion (Breen, 1996). **Cross sections** are an other matter, a building has been seemingly sawed through and - similar to the way in which we can apparently look into several spaces within a plan - we see different spatial entities simultaneously - but without a 'realistic' spatial impression. Using these basic drawing types side by side the designer is (or should be) able to mentally construct images of how the design would be perceived spatially were it to be built in this form.

Le Corbusier, addressing students has stated:

"Now that I have appealed to your sense of honesty, I should like to inculcate in you, and in all students of architecture, a hatred of 'drawing board stylism', which is merely covering a sheet with alluring pictures, 'styles' or 'orders' - these are fashions. But architecture is space, breadth, depth, and height, volume and circulation. Architecture is a conception of the mind. It must be conceived in your head, with your eyes shut. Only in this way can you really visualise your design. Paper is only the means for setting down the idea, and transmitting it to the client or contractor. Everything is in the plan and section. When you have achieved through plans and sections a working entity, the elevations will follow, and if you have any power of design, your elevations will be beautiful. Say, by all means that houses are for living in, but you will be a good architect only when your elevations succeed. Proportion is enough, but you need plenty of imagination as well, and the more modest the problem, the more imagination you need.

Architecture is organisation. *You are an organiser, not a drawing-board stylist.*"<sup>2</sup>

In this case Le Corbusier follows the classic idea in which the '**Model**' of the design resides solely in the mind and imagination of the designer, this is then skilfully translated to paper.

Of course it is not necessary to approach such the imaginative tasks of design 'with closed eyes'. Other design media can help create insights into how complex spatial compositions work.

**Perspective drawings, isometric and axonometric** projections are notable examples of drawing types that offer a three dimensional suggestion, and as such can be seen as models which can give insight into the concept as a whole, or into specific aspects of the design.

Another medium which is often used for the benefit of both to design thought and design communication is the three dimensional **Scale Model**. Here the concept is 'realised' in reduced form, both in scale and in level of detailing. The scale model can for instance give insight into the overall impression, the spatial qualities or the structural organisation of a plan, aspects which are often difficult to extract from drawings. In addition the activity of actually planning and making a model - as a condensed building process - often is an impulse to focusing on aspects such as proportion, material expression, detailing and assemblage, as is demonstrated in education.<sup>3</sup> From models such as these, images can be made in the form of photographs or by simulating eyelevel perception using optical **Endoscopes**.

The techniques mentioned above can be used for **Presenting** finished ideas in a bid to convince other 'actors' influencing the possible realisation of a design, but they can also - and this is probably more interesting - be used as media for **Inquiry**. The strength of compositional design sketching is the directness of expression, the swiftness with which a skilful designer can note down options, reflect on them, jot down notes, make small detours and 'polish' a concept by re-drawing while introducing subtle variations.

## **Computers and Clarity**

Initially Computers were used in architectural practice primarily for **Drafting**, not for design. The perspective option was originally a sideline to technical drawing, and used as an 'underlayer' for the construction of hand drawn perspectives. The potential of working in three dimensions, has however led to new opportunities that have far reaching consequences for the design practice.

Through Computer Technology it has become possible not just to make separate drawings of a plan but to construct **Models** which may be tested and altered, which can be viewed in different ways, and from which different **Images** can be taken.

Some **Advantages** of the computer are their *precision* (in principle one works scale 1 : 1 and chooses a scale for presentation), the possibility of working with *components* (which may be repeated, varied and altered relatively easily, and can contain 'nested' sub-components), the opportunities of working and storing information in separate *layers* (which be viewed and presented in different configurations) , the ease of generating *three dimensional* images and the possibility of working *simultaneously* in 3D an 2D formats (floor plan, section and elevations combined with for instance an isometric model projection), the use of *colour*, the relative simplicity of making *alterations* and *storing* information and their tireless *energy*.

Of course there are also still a number of **Disadvantages**. To name a few: the relative lack of 'presence' and visual clarity caused by the interaction taking place via a *screen* and through a system of *commands* (which still gives a certain distance to the content of a drawing compared to the way one can get immersed in a hand sketch), the lack of *overview* and limited *sense of scale* by essentially looking at selected formats through a frame surrounded by all kinds of

handy options, the seductive appeal of computer *images* as such (often leading to a total lack of criticism concerning the actual qualities of the perceived image (or animation) through the knowledge of the difficulties involved and the sheer feat of being able to get it out of the computer at all), the '*hardness*' of technical drawings, the emphasis on (often infantile) *graphics* and easy *surrealism* plus the seemingly endless *unpleasant surprises* (which sometimes makes it seem as if the computer has a simple but stubborn mind of its own) and although much improved: the speed (or slowness) of computing relative to the thinking speed of the impatient user.

The computer is bound to influence the practice and through this the theoretical background of designing, in much the same way that other, relatively simple innovations (pencil and eraser, graphic paper, transparent paper) have affected designers in the past. An important difference is that the design is not set down by guiding separate lines over a paper but by positioning preconceived elements in a virtual spatial framework, which leads to the necessity to anticipate and work systematically (Bridges,1993), and might in the hands of uninspired designers lead to easy repetition. At the same time the computer has made it possible to describe forms which were recently considered impossible to draw, let alone build, and this has led to a new wave of architectural and structural experimentation and expression.

There is considerable and growing evidence that the computer has changed our perception of the possibilities of design (Coyne,1992, Mitchell and Mc Cullough,1991).

How should we see computers, what relationship do we have with them as design media and what are the aspects we should expect and should be developing? Computer use in design has developed relatively slowly, compared to other applications. At present the state of available hardware is quite good and software is of reasonable quality, but we are on the frontier of possible new developments concerning creative computer assisted design.

The computer has always been surrounded by often romantic predictions concerning their future possibilities and social impact, bordering on myths. Some see the influx of computers in design as a revolution for the development of architectural form<sup>4</sup>, and predict the evolvement of architectural concepts, such as 'solid liquid architecture' brought about by the new medium. One can question whether these will not turn out to be temporary fascinations of an avant garde with feeling for public relations and seductive imagery, and will merely become a brief and superficial trend.

Others expect a great deal from Artificial Intelligence, and even 'Artificial Intuition' (Oosterhuis, 1990). What kind of (artificial) intelligence do we expect - and indeed want - from the computer?

Is it *Rational* intelligence, with the emphasis on 'scientific' procedures, logic and precedent?

There are many who would argue that something as complex and unpredictable as architectural creativity can not be captured via typologies and schemes, that such an approach tends towards excessive simplification and abstraction, and that we should be careful not to confine creativity in this way (Coyne and Snodgrass,1993).

Is it *Creative* intelligence, in which case we might expect the computer to carry out imaginative design tasks which could surprise us? There is much to be said against this, as there appears to be no blueprint for creative reasoning. It is important that the designer remains in charge and is 'supported' by the computer. The last thing we should want is that the computer starts making our decisions for us...

This does not mean we should treat the computer without respect. It is not a slave, but neither is it a partner. Perhaps it is better to see it as an assistant we can rely on to carry out tasks for

which it is best suited, like organising and visualising information. Creative use means bending the rules if necessary. Abuse, playfully suggested by Glanville (Glanville,1996), might lead to novelty but not to durable working methods.

Design Computation is a medium which is not consumed passively, but used actively - as a *Tool*. In the light of the need for creative use and reliable performance perhaps it is best to think of the computer as an *Instrument*.

A blunt pencil is a medium, but it is a poor tool and it is certainly not an instrument for creative design. A good instrument is rational in structure and has to be 'in tune' in order to inspire creativity. Although creative processes themselves are often chaotic, tools and instruments should not be. An organised and responsive working environment is beneficial to design, but it is not everything. Just as a well equipped recording studio is no guarantee for a musical masterpiece (but may easily lead to over production), so design is a product of the creative talents of the designer, assisted - and possibly fuelled - by the possibilities of the instrument used.

In the computer the designer can work on different levels of rising complexity (from basic pixel level, through objects, components, sampling and texture mapping, (virtual) models, to complete design- or knowledge systems, possibly linked via network sharing).

This growing complexity stands in the way of the kind of directness and interaction which the restless, impatient designer should ideally have with his/her/their instrument. To lower the interface barrier, it is essential that these instruments become more clearly organised.

The **Clarity** required for making complex digital design support systems manageable and pleasant to use, means that they may have to become more specific. Hennessey argues that future generations of computers should not be multifunctional jumbles that can do a lot (but do nothing well). Instead they should be relatively simple, easy to use tools, designed for a specific purpose (Hennessey, 1993, 1994).

If computational design Instruments are to have a growing influence on creative processes, clarity for the user is of prime importance. This does not mean they have to become simplistic, but that the growing amount of information which can be drawn on has to be tamed and 'wayfinding' must be improved .

To achieve a more designer-responsive type of computer interface, two categories of 'clarity' are of importance: **Desktop clarity** (easy - visual - recognition of relevant options without a cluttering of unnecessary information, a clear and imaginative command structure) and **Structural clarity** (well organised, intelligently structured design-support data). Naturally these two factors are reciprocal. It is important that innovation on this level does not take the perspective of the computer programmer but that of the designer. As design choices are essentially made visually, the form the interface takes should be visually clear but not decorative, incorporating desktop metaphors appropriate to design.

## Project 12CAD and beyond

The case used to illustrate the points made earlier, is a modest compositional exercise on an architectural scale, which was developed some years earlier by the **Media sector** at the Architectural faculty of Delft University of Technology (TU Delft).

The research of the Media group is involved with the furthering of knowledge and the creation of insights into the ways in which **formal concepts** are **perceived** and **conceived** and how these can best be **communicated** through a range of design media. This concerns both the skills in existing, traditional techniques and the development of new applications and suitable combinations of emerging design visualisation technologies.

The education of the sector is divided over three sections: Freehand Drawing, Presentation Techniques and Form Studies, the last focusing on Design Composition.

This educational exercise was set up by the **Form Studies** staff as a part of the second year educational Block nr.12, entitled '**Imaging and Materialisation**', with an emphasis on innovative (lightweight) prefabricated structures, detailing and montage. The exercise was intended to familiarise students still more or less 'illiterate' in Cad with the potential of the computer for making an architectural composition using more or less standardised building components.

In creating the exercise, use was made of the Form Studies experience with other, more elementary compositional exercises. In these practical exercises the students work directly in three dimensional sketch models with a limited set of elements. Such a limitation of parts does not hinder creativity, but - on the contrary - defines a creative challenge whilst also facilitating the comparison and discussion of student work. It is also efficient as the work has to be done in relatively little time.

The exercise, which was named **12 CAD**, is deceptively simple in the way that a game can essentially be simple, have clear rules, but can offer surprising developments.

The students - working in twos - had to combine different elements (for construction, spatial organisation and the building 'skin') that had previously been made and saved in a project library.

Use was made of a standard Auto-CAD programme, but less relevant functions had been 'removed' and a series of special menus had been made.

Each team could choose one of eight basic variants, similar in volume and floor area (approximately 120 m<sup>2</sup>), which was then worked out in four half day sessions.

Different types of building components were stored in specific menus. Within each menu an overview of elements in different 'slides' that could be activated like a catalogue and from which elements could be 'ordered' and subsequently positioned in the model. Work on the screen could take place in different 'viewports', so the students could work both in 2D and 3D. In the spirit of Le Corbusier's remarks about colour in the lecture quoted earlier,<sup>5</sup> colour was used to keep the drawings 'readable', by giving different colours to different materials (red for steel, yellow for wood etc.).

Though the range of such an exercise is of course limited and the expertise of the students left a lot to be desired, the overall level of the results turned out to be surprisingly mature and imaginative. The idea that a clear visual and structural set up would help students - freshly confronted with a new medium - work creatively, seemed to have worked...

The Media group has since moved on to new experiments in education and research. The current programme focuses, amongst a number of themes, on **combinations** of different design

media such as **Endoscopy** and **Computer Visualisation** (Stellingwerff and Breen, 1996) and on the longer term development of a **Digital Design Support Instrument** for (virtual) simulation of **Urban Concepts**.

With the far greater complexity that these types of projects bring with them, the search for **Clarity** is certain to remain topical.

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## Notes

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<sup>1</sup> John Zeissel stresses the importance of a milestone in design progression, which he calls 'the decision to build'. Before this point decision-making is still relatively free. From here onward design is focused on applications that should be buildable and have to follow specific rules.

<sup>2</sup> Le Corbusier : 'If I had to teach you architecture', a lecture to students of architecture published under the caption 'For Students Only' in *Architectural Design*, vol. 29, pp. 86-7, February 1959, London, and previously *Focus*, vol. 1, pp. 3-12, Summer 1938.

<sup>3</sup> An indication of the creative power of modelmaking in education is given by the results of a limited design and realisation Form Studies exercise at the TU Delft, published in: *De Tafel als metafoor voor architectuur*, by Breen, J. and Olsthoorn, B., 1993, Publicatieburo Bouwkunde, Delft, the Netherlands.

<sup>4</sup> Dutch Architect Ben van Berkel states: "To me the computer is a way of radically breaking with traditions. The mediation techniques enabled by the computers signify a complete overthrow of many architectural assumptions, from the typology of organisational structures, to the hierarchical order of planning a structure, ending with details. The computer entails a radical rethinking of the valuations implicit in architectural design. In this sense computational techniques could represent the first important development in architecture since modernism." From: 'Conversation *by modem* with Ben van Berkel, by Greg Lynn, *El Croquis* 72, nr. 1, 1995.

<sup>5</sup> Le Corbusier: "Here is a golden rule: use coloured pencils. With colour, you accentuate, you classify, you clarify, you disentangle. With black pencil you get stuck in the mud and you're lost. Always say to yourself: *Drawings must be easy to read*. Colour will come to the rescue." (see: 2).