Computers and the Creative Process

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1. Introduction

For many years I kept all my personal details, appointments and notes on a Psion Organiser. One day I started questioning the efficiency of this and my motivation for doing it. On analysis, (which I suppose I should have carried out before I bought it) I realised that, compared with a paper-based system, it took me longer to a) record information and b) retrieve it. But almost more importantly I realised that scanning information to build up a picture of say a particular week or month was not nearly as easy. As for annotating with a pencil or felt tipped pen.....how I suddenly longed for the good old days and a paper-based system. I have now reverted to a Filofax, which even at the exorbitant price of £22.50 was still a lot cheaper than a Psion.

It is a random access device, with a large permanent storage capacity, is expandable and in easy-to-access hardcopy format. It is infinitely flexible. There are no batteries to run down and I can still get into it if I forget the password!

The point of this is that computers do not necessarily always provide us with the best or most appropriate way to accomplish a task. There are still much that paper-based systems are better at than computers, but our digital bias tends to distort their relative values.

In just the same way, I do not believe that we should necessarily assume that as far as architects and the design process is concerned, Computer Aided Design provides us with everything we need. Clever software, seductive hardware and slick marketing together with our natural enthusiasm for the technology combine to persuade us that computers, and particularly Computer Aided Design can provide us with everything we need to automate the entire design process from inception to working drawings.

In spite of the claims of some architects, educationalists and the CAD industry I believe that not only is an exclusive CAD environment misguided it is also dangerous.

I do not advocate abandoning CAD but rather reassessing how we use it and then rehabilitating it into the design studio. I would like to see CAD integrated into a comprehensive suite of design tools where they can be used more effectively. After the headlong rush to computerise, architects need to stand back and consider what they have achieved with computers but also recognise the problems that have inevitably accompanied them.

I believe that design cannot be accomplished purely in digital format and that exclusive use of computers is interfering with the creative process. Designers are

unable to take advantage of what Renzo Piano sees as part of the act of making. Computers should help architects understand the spatial and formal consequences of design decisions and to communicate their ideas to others, not get in the way. An image on a computer screen is just that, an image, a representation of a building. The image must not become a substitute for the physical building.

It seems to me that there is a preoccupation and fascination with the technology for its own sake. It is obscuring the purpose for which it is being used. It is becoming an end in itself.

2. Computer Aided Design in School and office

By far the greatest use of computer power in the field of Computer Aided Design is employed in producing two-dimensional production drawings. Only a small proportion of architects offices use computers in the design process, either to explore ideas or communicate ideas to others. Significantly they are rarely used to develop ideas in three-dimensions. In Schools of architecture, on the other hand, it seems that computers are used primarily as tools to explore form and space three-dimensionally and to assist in the presentation and communication of ideas.

It appears, therefore, that there is a great disparity between the way Computer Aided Design is taught and utilised in education and the way in which Computer Aided Design is employed in practice. Indeed we are often castigated by architects in practice for not providing them with graduates that can use AutoCad to produce drawings. Rather, we a educating future architects who can design with the assistance of computers.

CAD in architects offices

Most practices view Computer Aided Design as a means of maximising profit instead of ideas. By using Computer Aided Drafting the conventional drawing office production line can be automated. Rather than exploring design in more depth and complexity it provides the opportunity for the production of more mediocre architecture more quickly. It is a mechanising of the conventional manual process and ignores many of the more exciting possibilities presented by computers.

For many offices the only time they might venture into the realms of three-dimensions is to produce a slick, photo-realistic view to help sell a third-rate scheme. This perspective is often purpose-drawn after design and generally photo-rendered in hyper-surrealism. Once its purpose is achieved it is discarded. Computer Aided Design is generally not integrated with other methods and generally precludes the sharing of information across media.

For a small percentage of enlightened architects and engineers, computers have provided the ability to work with forms and geometries in a way that would have

been impossible even ten years ago. They have looked beyond the obvious financial and practical benefits of automating drawing production and examined how computers can contribute to the design process.

It has encouraged others to investigate theoretical and intellectual issues in a completely new way and in considerable detail. Theoretical designers like Peter Eisenman, Bernard Tschumi and Daniel Libeskind have been able to pursue their ideas about theoretical issues unencumbered by practical restraints. Computer Aided Design has helped foster a whole new area of debate on the intellectual and theoretical issues of architectural design.

In Education

In education on the other hand computers are used predominantly at the conceptual and early design stages with little interest being shown in conventional two-dimensional drawing.

A very positive effect of Computer Aided Design in Schools is that it has encouraged more students to work in three-dimensions from an early stage and to consider aspects of design that are often left until the end or never considered at all, such as internal space, colour, light, texture, materials, and external spaces.

But at the same time it encourages shape-making at the expense of internal planning and a preoccupation with presentation rather than content.

When Computer Aided Design is used for drafting it is often more graphic and flamboyant than office Computer Aided Design. The final pieces often resemble works of art more than technical drawings. Work is frequently of an investigative, exploratory or theoretical nature where the technology is used to examine and present ideas in a way that is difficult with conventional media.

A recurring problem with CAD in schools is that sometimes students are not so much solving design problems as computer problems, resolving the best way to represent a particular element rather than considering its architectonic significance. They struggle to address issues of architectural form and composition that are better dealt with using models or drawings. There is a perception that once a building is in digital format all aspects of its design have to be represented in that way. Others are obsessed with images that cease to be recognisable as buildings. There is a distorted view of presentation that is generated by the capabilities of the software rather than the requirements of the design. Photo-realistic presentations seem to be more important than the design content.

Students have been quick to appreciate the possibility of multi-media, interactivity, animation and video. Programs and hardware are developing at an increasingly rapid pace providing cheap power for features and speed that was unthinkable even only two years ago.

We are producing a new breed of student who works exclusively in digital format

regardless of the requirements of the architecture with which they are interacting. For many students the act of drawing is unnecessary, difficult and superfluous. Neither do they attach any value to physical models when everything can exist in the digital world.

3. DRAWING

Drawing and Making

What most architects and many educationalists are losing sight of is the value of drawing and producing models as part of the act of making which is an essential facet of the process of design. Renzo Piano sees drawing as part of the act of making. "You think and you do at the same time. You draw and you make. As a pure instrument of a circular process between thinking and doing, drawing is in the middle". Architects need to understand the spatial and formal consequences of design decisions and to communicate their ideas to others.

Historically the design process was very much part of the making process and it was not until the act of building became complex enough that drawings became necessary both to inform and instruct. Originally the design drawings fulfilled both requirements and craftsman used them to assist with the visualisation of the project and as a guide to how things fitted together. The designer or master builder of the 15c would be both a designer and craftsman. But in the course of time as the organisation of the building process became more complex and production was made more effective by the division of labour the process of design and making became separated. The designer was no longer involved in the act of creation. It was now his job to communicate design decisions to others who would execute the work.

Today this has gone one stage further and there is a discernible difference between those who realise the design and those who communicate it to the craftsman. We have design drawing on the one hand and drafting on the other. Not only are the designers separated from the making, they are also separated from the communication process, with offices of draftsman interpreting the ideas of the designer. With the widespread use of computers for drafting the designer is not only separated from his final work by the drafting process but also by the computer.

Drawing and Thinking

The act of drawing is an inseparable part of the design process and is an essential part of the thought process. We draw and think at the same time. The act of drawing supports and reinforces the designers thinking particularly at the conceptual stage. The placing of images on paper can stimulate thought and feed ideas. It is a circular process. The one activity stimulating and informing the other.

If we look at the way designers represent their ideas on paper we can begin to

appreciate the diversity of approach that is possible with paper and pencil that has no counterpart in digital technology. The work of Alvar Aalto, for instance, demonstrates a designer working in a very exploratory way. His conceptual sketches are amazingly rich in form and texture, vigorous, loose and yet very specific in intention. There is evidence of a rapidity of execution and diversity of thinking and a high degree of co-ordination of mind, eye and hand.

The sketchbooks of Le Corbusier reveal an intellect and thought process that is intense and focused. Here is a man with a gift of observation and interpretation and an ability to transform a record of his travels and ideas into a scholarly work that illustrates the development of thought and creativity.

Carlo Scarpa said "I draw because I want to see" he was very aware of the connection between seeing and knowing in his mind.

In his book "Visual Thinking", Rudolph Arnheim wrote about the psychology of art and dissolved the artificial barrier between thinking and the action of the senses. "By cognitive I mean all mental operations involved in receiving, storing and processing of information: Sensory perception, memory, thinking, learning."[1].

Paul Leseau further developed these ideas in his book on Graphic Thinking. He argued that Arnheim was suggesting a new way of understanding perception, namely an integration of mind and senses: the focus of the study of creativity shift from the mind or the senses to the interaction of both. "Visual thinking is therefore a form thinking which utilises the products of vision - seeing, imagining and drawing. When thinking becomes externalised in the form of a sketched image, it can be said to have become *graphic*."[2]

"The process of graphic thinking can be seen as a conversation with ourselves in which we communicate with sketches. The communication process involves the sketched image on the paper, the eye, the brain and the hand. How can this apparently closed network generate ideas that are not already in the brain? Part of the answer lies in the definition of an idea. The so-called ‘New Ideas’ are really a new way of looking at and combining old ideas. All ideas can be said to be connected; the thinking process reshuffles ideas, focuses on parts and recombines them. In the graphic thinking process all four parts, eye, brain, hand and sketch have the capability to add, subtract, or modify the information that is being passed through the communication loop. The eye, assisted by perception, can select a focal point and screen out other information"

4. Designing with the computer

So, why can we not simply transfer this process to the computer? The short answer is that to some extent you can, but consider what is lost as this predominantly sensory experience is transferred to digital format. And why transfer certain aspects of the

conceptual stage to the computer when there is a better way of doing it. Yes we can now make the software emulate different media - water colour, charcoal, pen and ink. But why when you can use the real thing? Let us not forget the pleasure and feedback we get from placing words and pictures directly onto a surface by hand. Physically holding a stylus, moving it through space, applying varying degrees of pressure, constantly controlling its angle and direction, feeling the texture of the media, the hardness or softness of the tip of the stylus and responding constantly to the updated information received by the brain via the hand, the eye and even the ear, is a unique and very particular sensory experience. It is a very special and instinctive ability that should not be cast aside in favour of digital alternatives.

Drawing and Thinking

With graphic thinking there is a very direct and unambiguous connection between the brain, the eye, the hand and the sketch. They are all part of a closed circular process that is very accessible. As soon as you introduce a digital interface there is a whole new layer of filtering and interpretation and that intuitive, closely co-ordinated relationship is interrupted.

Early on, during the conceptual stage, we are engaging in a process of exploration and investigation, rapidly moving not only between ideas but between ways of representing them. So that on the same piece of paper we may have flow diagrams, abstract graphic thoughts, fragments of elements or conceptual diagrams, plans, sections, elevations, perspectives. Ideas are originating in the brain, being transferred instantly to paper where they are immediately being reassessed by the brain. We don’t have to think about which piece of paper is appropriate or how to use it - it is a spontaneous action where the media is transparent.

Many computer-oriented architects enthuse about the virtues of programmes in which you can sketch as you would on a piece of paper. With tools that emulate pencils of varying hardness, water colour, felt tipped pens or drawing pens, sketches similar to paper-based versions can be produced. My suspicion is that these tools are used not because they are appropriate but because they exist and because some architects are so rigid in their ideas of a paperless office that they will use the computer rather than other media through dogma or obsession.

Consider the spontaneous nature of design and how important it is to respond to ideas when they occur, not just when you happen to be sitting in front of a computer. How many schemes started life on a cigarette packet or table napkin? Perhaps Crystal Palace may never have been conceived if Joseph Paxton had required a computer to sketch his early ideas rather than utilise the nearest media to hand - a blotting pad. There are architects and students who have been brought up with the computer and find it difficult contributing ideas in a design team when most people are sketching their thoughts.

So it is my contention that, particularly during the early concept stages, conventional

media is a far more accessible and immediate way to explore certain ideas than the more clumsy and contrived digital environment.

Modelling

However there is a point during that process when it becomes important to test those initial ideas on a three-dimensional model. At that point the computer model and physical model come into their own. Having progressed through the stage of a rapid exploration of alternative ideas it is then important to be able to quickly gauge the three-dimensional implications of those thoughts. What are the formal consequences; How are internal volumes relating to each other and human beings; How is sunlight and daylight modifying those spaces; What is the quality and proportion of external spaces; How will the materials and colours being considered impact upon this nascent piece of architecture?

Depending upon the nature and complexity of the forms under consideration the designer may choose to develop a simple card working model that will enable him to take his thoughts further. In the case of complex geometry or sculptural form a computer model may be the best way forward. Both physical models and computer models are invaluable to the thorough understanding of a building.

David Harris of Nicholas Grimshaw and Partners summarises this approach, "We have not thrown away our sketch pads and we still make sketch models. However, once the initial concept, or range of options, is established, the computer enables us to test and change it during the development of the design".

Appropriate Software

We need to look at the software we are using and assess its relevance and how and when it will be used. Appropriate software has a considerable effect on how effective the computer's contribution is and how well it can inform and feed into drawing work and physical models. I am concerned that software design is now working against us in our search for a balance between old and new media. Software has become too complex, offers too many possibilities, requires a much greater investment in time and mitigates against integration of media. The more tools and commands a program possesses the longer it takes to learn how to use it. Together with the drive for more elaborate rendering and photo-realism it means that students are spending more time mastering programs and producing unnecessarily elaborate views and less time designing buildings.

Unfortunately not much contemporary software measures up to the original Modelshop, the cheap and cheerful 3D modelling program that was simple, had a few basic primitives, was quick to learn, fast and 'dirty'. Modelshop was the digital equivalent to card or balsa. Students quickly worked out how to assemble basic components in space and soon realised that they could build a whole town or a light fitting - Modelshop wasn't worried whether you were working in millimetres or metres. It was very forgiving.

Modelshop was a wonderful supplement to paper and pencil. Students did not abandon their more familiar modelling and drawing techniques they just used it alongside them. It did not get in the way of designing buildings because it was so simple and even though it sometimes got things wrong nobody minded. At that time we weren't hung up about photorealism. Most of the time spent designing on modelshop was productive as very little went wrong and mostly people were solving design problems not computer problems.

Object oriented software such as Modelshop provided a much faster and more accessible approach to computer modelling than vector-based, 3D by extrusion software. It was also more appropriate to architectural design. The program knew about objects and it was easy to manipulate them in 3D space.

One of the contemporary developments of that approach to computer modelling is Form•Z and when we first acquired it for the school of architecture we were very impressed at its sophistication. It appeared to be an extremely versatile and potentially creative tool. Using the same basic approach as modelshop - object oriented modelling - it possessed a bewildering array of primitives, method of describing them, and editing tools. It also had advanced rendering capabilities. For modest models it is fine but once they get more ambitious there are significant time and memory overheads. And because it can produce photorealistic images and surface texture, everyone has to do it. It can produce complex geometries, meshes and sculptural form but most students spend inproportionate amount of time accomplishing it. It is no longer a transparent process that slots in nicely with other ways of doing things, it is a major investment in time and patience.

5. Architects, Computers, Drawings and Models

To enable us as tutors to develop a way of working with computers that allows our students to embrace other media it is important to understand how some of the more progressive architects use computers in practice and how they integrate them with their more traditional design methods.

It is always a great temptation to skew surveys and research in the direction that will help reinforce the thrust of your argument, but the picture that I got from my limited investigation showed a polarisation between design-oriented progressive practices and the majority of commercial profit-oriented practices.

What is clear is that a lot of current cutting edge architecture has been due to the involvement of computers. Much of the work of Michael Hopkins involving membrane roof structures, for example, would not be possible without sophisticated computer software for the structural calculations and membrane cutting patterns. And Frank Gehry's obsession with geometry could not have been satisfied in the way it was without computers. Computer assisted design invites architects to explore

hitherto unimagined opportunities of creating new forms. The enthusiasm of a number of contemporary architects for computer techniques is a sure indication that this electronic revolution will have a growing influence on design.

Michael Hopkins and Partners

Michael Hopkins and Partners have been responsible for many progressive buildings and in particular for the innovative use of membrane structures. John Pringle, one of the partners, declared quite frankly that it was not a case of the practice deciding to use CAD but more a case of CAD reversing itself into their office through the pre-existing office administration Macintoshes. It was only after it had infiltrated its way into the office that CAD became recognised as a useful tool. Initially people experimented with MacPaint and MacDraw and then Schema, the precursor to Modelshop. But it was only when students who had used Modelshop at college started using it in the office that other architects were encouraged to try it.

Although the office is now substantially computerised Pringle is realistic about other tools. "Although Microstation has a three-dimensional capability we only use it for two-dimensional work. By far the most useful program was Modelshop which was quickly mastered and was very useful for visualising, particularly interiors. But it is by no means a replacement for models and hand drawings."

He also felt that while computer perspectives were attractive in an abstract sort of way, they tended to be somewhat dull, rather like an over-perfect airbrush drawing and sometimes not atmospheric enough to be of real use. He thought that they levelled all projects to the same repetitive standard of quite acceptable but ultimately tedious competence. Of students projects he said, " ...diploma projects which may in reality be improbable buildings can often look more spectacular than a masterpiece of modern architecture on a computer screen"

Pringle also felt that computer images do not help you really understand how a building fitted together in the same way a physical model can. "We often find we need the tactile quality of a model to help us understand relationships between different elements." It was also true that since the advent of computers they now make more models than they ever did before and do more specialised hand drawings in the early stages.

Whereas the computer offers endless possibilities for examining multiple options or different views of the same thing, it can also generate endless useless work, investigating alternatives that would never be investigated if they were to be carried out manually because it would be too tedious to do so. One sometimes wonders whether any real purpose is served by the computer doing this; were we not better off deciding for ourselves by instinct beforehand? The risk is that computer techniques could create as much irrelevant work as the drudgery they remove.

Sir Norman Foster and Partners

In this large practice drawings play a vital part in all stages of the work. Foster himself is a fine draughtsman as early sketches for Stansted Airport and other schemes testify. The standard of draughting in the office generally is unusually high and great pride is taken in drawings both as a means for communicating within the office and to the world outside.

Fosters have a reputation for taking a part of the building and examining it in great detail through drawings and models. They have strong belief that each part of the building has to be explored three-dimensionally and scale models and full-size models are used very early in the design process

Along side these traditional methods they also have a powerful computer system. "It’s used for the more detailed production co-ordination of a building design, but almost more importantly we are able to do sophisticated three-dimensional drawings using the computer. However, no three-dimensional drawing, no matter how accurate or sophisticated, is a substitute for three-dimensional physical models. What is more important is that it is difficult to imagine an architecture practice where drawings aren’t absolutely essential to the way they work"

They consider it very important to determine which type of drawing is appropriate to convey the right type of information to the right person. There have been occasions where brilliant ideas have gone wrong because they haven’t been presented with the right drawings. Foster himself is drawing all the time and at a design review he will always be there and his pencil and sketch book are much in evidence. Design discussions are accompanied by sketches and drawings illustrating the line of thinking. Everything they do is, in one way or another, related to the drawn image.

Great emphasis is placed upon quality of drawings and sketches as they feel this says a lot about your attitude to the work. "Care and attention to drawings, whether it be a freehand sketch or a finely crafted drawing, immediately conveys to someone else the involvement and commitment of the office. If you get a sloppy drawing on a scrappy piece of paper you tend not to take that as seriously as a carefully considered drawing. It doesn’t have to be hard-edge, but how you draw conveys an attitude.

Design work for the Stansted Airport project, completed in 1991, was carried out using CAD, models and drawings. In the end, for the Foster office, drawing is an essential part of the crafting of their buildings, and it documents not only their design creativity but the care and the attention to the integration of all the functional and structural parts and details that go into the making of so complex a place as Stansted Airport.

Neil Spiller

Architect and architectural theorist, Neil Spiller, has an interesting angle on computers and their by-products. Using a distinctive and abstract hand drawing style he comments on current theoretical issues and anticipates future scenarios, through his articles and lectures

In one particular article published in an architectural newspaper, Spiller describes a future environment populated by billions of nano-computing machines that occupy micro-space in the same manner as micro-organisms.

In this way our bodies would themselves be invaded by machines and machinic desires. Evolution would then be extended to these aerostats, minute artificial intelligences capable of individual or group action.

He foresees symbiotic relationships between artificial and biochemical devices leading to the emergence of a hybrid mechanism which develops hyperstuctures of its own.

Their subsequent independence and eventual liberation would lead to our final loss of control of the machine.

Spiller sees it as ironical that the domination of the machine could be fully realised by its reduction in scale and the loss of its immediate recognition as machinery.

Frank Gehry

Frank Gehry used a 3D modelling program devised by French aerospace company, Dassault, - for mapping curved wing surfaces of fighter planes - to develop the sculptural forms used in his design for the new Guggenheim Museum in Bilbao. When you combine the skills of a designer like Gehry who has predilection for sculptural forms with a powerful specialist computer you are opening new horizons in architecture. Now anything, no matter how complex, is possible.

What is particularly interesting about Gehry is that in spite of all this computing power he still considers physical models to be the best way of fully exploring and developing his ideas and his forms. Once he has used the computer to construct the geometries and relationships that he requires it is translated back into real world materials, shapes and forms. Gehry believes these to be far more accessible and he delights in working directly with shape and form.

He designs mainly through large-scale models where he can approximate the perceptions of the real object. He always views his models from eye level, moving around them to correct the angles, almost as a Renaissance architect. " It is one of the most important parts of my method. If I had to say what is my biggest contribution to the practice of architecture, I would say it is the achievement of hand-to-eye co-ordination. This means that I have become very good at implementing the construction of an image or a form I am looking for. I think that is my best skill as an architect. I am able to transfer a sketch into a model into the building. For example, Michael Graves’ first drawings are beautiful, but he can never make a building that is as beautiful as the drawing. I always focus on the building; the drawings are not important to me; they are just stepping stones. And they do not even look like buildings, but I know what they are telling me to do next."

Peter Eisenman

Peter Eisenman is another American architect using computers to explore unusual and complex geometries. His approach however is probably more theoretical than aesthetic. Where in the past Eisenman has taken his inspiration from philosophy he is now using computer technology to develop his thinking, although he has been criticised recently for promoting a bogus, avant-garde approach to architectural theory.

He proposed a controversial design for the Max Reinhardt Haus in Berlin based upon the exploration of the Mobius strip on a computer. This is a band having only one side, made by turning one end of a rectangular ribbon through 180 degrees and fastening it to the other end.

He is interested in ..."internal questions such as those of profile, repetition, movement, relationship of object to subject perception and what he calls fluid architecture." His work has a gelatinous quality and makes much use of morphing techniques. He is absorbed with the relationship of human memory to computer memory and is concerned with the dearth of current philosophy that deals with internal problems of memory.

It is Eisenmans intention to "break critical ground" in his work with computers and in particular in his exploration of the theme of random access memory of the computer compared with that of the most inventive designers.

Eric Owen Moss

Eric Owen Moss experiments with material and form. Old chain and broken trusses are much more likely elements in his architecture than cavity brickwork and standard timber windows.

His 450 seater Culver City Theatre in California has a form created by the interaction of three spheres that was explored using computers and traditional modelling techniques. The spatial innovation achieved by Moss is achieved through interaction between computer and real-world models.

Steven Holl

Holl, a practising architect and a tutor at the School of Architecture at Columbia University, is probably best known for a small gallery space in down-town Manhattan, Storefront for Art and Architecture. A collaborative project with artist Vito Acconci it is a radical scheme without windows or doors in the conventional sense.

Much of his work is concerned with challenging traditional ideas about light, space and durability.

His thoughtful application of computer techniques in the exploration of colour and

refraction produces some stunning internal spaces in the New York offices of D E Shaw and company.

He is very aware of the impact of computers and communications technology when he talks about: " The devices propelling this world of information-flow utilise non material impulses in a visual field. CAD, motion control, virtual reality, Magnetic Resonance imagers, computer animation, synthetic holography..... are all rapidly developing vectors of information characterised by motion and light....."

6. Conclusion

Whilst a great majority of practicing architects are employing Computer Aided Design to automate the production of 2d drawings it is clear that in many of the more innovative and progressive offices designers are using computers along side more traditional methods, utilising each to the best effect.

What is also clear is that many practices lay great stress on the importance of hand drawing at various stages and many feel that there is no substitute.

It is interesting that several offices stress the importance of using physical models together with computer models as they allow them to determine aspects of design that are difficult to deal with on a digital model. Indeed Gehry's approach to design is predominantly model-based.

It is encouraging that there are architects using the technology to achieve what would be very difficult or impossible to work out manually. These are the exciting areas of development, where computers are freeing us from the tyranny of the straight line brought about by the convenience of working with set square and 'T' square. This is where CAD is really contributing to the creative process. The creation and manipulation of complex sculptural forms, Working out and visualising the relationships of non-conventional geometries, exploring light, space, colour and texture, and looking at the more theoretical and abstract nature of architecture.

Computers are also stimulating people like Neil Spiller to address wider issues involving technology, philosophy, society and architecture.

However, we have to be very careful that we balance the requirements of architecture in general with the in-depth investigation of form that is now possible with computers. so that instead of driving the technology it is driving us. Producing complex form because we can not because its appropriate architecture. We should constantly question whether a preoccupation or obsession with three-dimensional geometry and sculpture should take precedence over the shaping of effective interior space. We do not necessarily want to carry on our lives inside tilted cones or angular crystalline forms.

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