Pen or PC?

Is Sketching essential to architectural design?

Wolfgang Dokonal[1], Michael Knight[2]
[1]Graz University of Technology, Department of Urban Design, Austria
[2]University of Liverpool, School of Architecture, UK

This paper reports on an ongoing student architectural design project that is investigating the differing effects of the use of PC's or Pens in the design process. We are interested to see whether designing wholly on the computer with a volume modeling software would produce differing results to a traditional design process with a strong basis in 2D sketching. To minimize the influence of the participants previous experience in either the use of PC's or the pen, we have been working with very young students that have not yet gone through a traditional training on architectural design and CAAD software. This is one of the key aspects of our experimental procedure. We have found that recent software developments in the field of CAAD clearly have and will influence the way architects design and brings the computer as a design tool to the "normal architect". Until very recently the computer was seen as a design tool almost solely for "computer geeks" in the profession, the majority of architects still using it mainly as a drafting machine or to produce visualizations of their projects after a more 'conventional' design process had finished. It is now very clear to us that the ongoing change in technology will have a profound effect on the way all of us will work in future undertaking architectural design. It is an important question for every school of architecture what effect these developments will have on our teaching methods and the curricula. We use the above mentioned ongoing educational project to find out about the benefits and risks of using the computer as a design tool for first year students.

Keywords: *Early Design stages; Collaborative Design; Sketching*

Introduction

Ever since the introduction of computers into our field there has always been a battle between "the computer guys" and "the ones who deal with architecture". The reason for that was that the computer started a career in architectural offices first as a word processor and for office organization but only lat-terly for architecture itself. A very short time ago – at least on an architectural timescale – the computer moved on into the architectural production process as a drafting machine. All the early experiments in using the computer as a design tool where quite exciting for "the computer guys" but rather disappointing for the rest of the architects. Just a second ago on this architectural timescale the computer started

to really influence the design process itself . Having been accepted at the end of the design process, it is now moving towards the beginning.. Nowadays we have some buildings where the computer clearly had an influence on the design of the building at an early stage, but this is still an exception to the rule. As far as we know, the main tool for architectural design in the very early stages amongst the majority of architects is still manual sketching. Therefore there has been an attempt to give designers digital replications of traditional tools (pen or pencil and paper) to use them in a manner that mirrors the traditional way of design; but with the assistance of the computer to enhance and augment the process. But the question is: Do we necessarily need to manually sketch when we are working on a design or is it just because we have been trained to do so and because it has been the most efficient way to clarify ideas in the past? So what would happen if we started to teach our students from the outset to design with the computer? Will it increase their design capabilities, or might it hinder their ability to generate design ideas: might the change to digital sketching be an unnatural one that ends up constraining rather than freeing ideas? Or will traditional sketching be replaced by digital model making in the long run? Is there not also a case for quite naturally starting an architectural design with the computer when it is omnipresent in every aspect of both work and daily life?

The Starting Point

After teaching design over several years on different levels in the architectural curricula it was clear to us that an important aspect of our experiment would be to work with first years students. They have not yet gone through a traditional training on architectural design and CAD systems so had no preconceptions or set habits of design. We could expect to get a more unbiased look at the possible tools at this early stages of design.

We started the project for the first time in 2004 just as a joint workshop with First Years students from Austria and England. This first workshop was initially not intended to be a research program, it was not structured enough to evaluate the results scientifically. However, this "first run" had some very interesting results. In 2005 we organized a similar, but more structured, workshop at TUG Graz. Due to the problem of having to fit the project into the restraints of two different national curricula and existing courses in architectural education we failed to have it structured rigorously enough to be able to compare the results on a highly scientific level. There was also the problem that we could not free the workshop week entirely for this course so the Austrian students had also other courses and business to fulfill. In 2006 when we organized the workshop again we started it over the weekend to attempt overcome some of these problems. We still had the major problem that the main goal of the workshop which was to teach first years students design and there was, in reality, insufficient left for the research aspects.

Our main goal was to see whether designing wholly on the computer would produce substantially different results to those produced via a traditional design process. As mentioned above we wanted to do this as early as possible in the curriculum with the very young students to minimize unwanted influences from previous experiences - CAD courses or Design courses. Ideally they should not have any experiences in either field. It turned out that it was not possible to do a pre-selection of students that fulfill these rules. In Austria the access to university is free there is no pre selection of students possible. They have to finish secondary school and have their "Matura" which is a school-leaving examination and university entrance qualification. Because of this fact there is a significant drop out rate and the first year should clarify the position of the students. In the UK students apply to a university of the choice competitively, so an element of pre-selection exists. So we had to deal more or less with what we got.

The Brief and the Site

The Brief was a house for a given artist on a small site in Graz. We did not establish a detailed brief - the artist should be able to live, work and present their work in this house. This time the students had no choice of their artist (clients) – we randomly matched student groups and artists. So some of the students ended up with clients they did not really like which sometimes caused some problems. The students had to investigate their clients, describe their needs and develop their own brief for the project in discussion with the tutors. The artists we picked were Sigmund Freud/Brian Eno/Richard Long/Rachel Whiteread/Damian Hirst/Adolf Loos/Michael Clark/Kurt Ostbahn/Gónther Helnwein/Hermann Nitsch and Michael Knight (sic!). The site itself was the same as the year before – this gave us the advantage to reuse the digital and analogue site model and therefore we had more time for the design itself. It is a small urban corner site adjacent to a parting wall and consisted of a small slope and a significant tree, so it was quite a demanding task for our inexperienced students.

Overall we had 18 students from Liverpool and 20 students from Graz. They were divided into two groups of 18 students each, one group working wholly digitally and the other traditionally on the above mentioned scheme on the same site. Both worked on the problem simultaneously in an environment that allowed a degree of controlled analysis. Students had expressed a preference for working either digitally or traditionally before the workshop started and as far as possible their preferences were accommodated. They were paired and worked with tutors from both institutions.

The Workshop

The initial workshop was one week in Graz where they started on Friday afternoon with the introduction into the project. Afterwards they were split into the digital/analogue groups and were paired into English/Austrian teams. Then followed a trip to the site and some research on their proposed clients on the Internet. They had to present their clients using digital media they collected from the Internet. Most of the students knew nothing about their clients so they really had to investigate. In their presentations they had to describe what they thought their clients would need. In their first presentations many of the students were not specific enough about the demands of their clients and started with list like
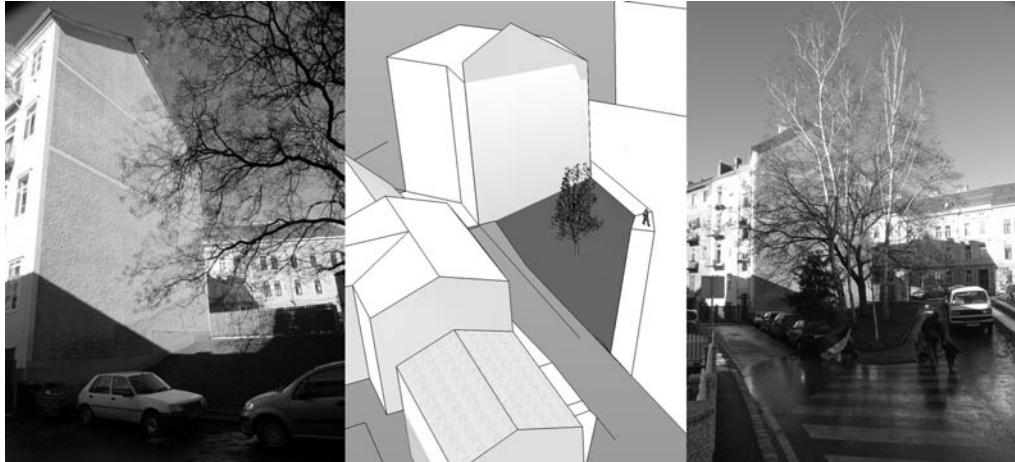

Figure 1
Site and site models

"he/she needs a bedroom and a bathroom". It took a while for them to distill a distinct profile for the needs of their artists and the quality of the spaces these particular clients would demand.

Then the groups split to work on the design in either the computer lab (digital group) or the seminar room (analogue group). Both groups could use the existing site model in their setting (digital / analogue). The digital group were not be allowed to use any analogue means in the initial design phase and the analogue group was not allowed to use the computer for design purposes. As mentioned before both groups of students were first year level who in theory, had similar levels of both CAD and traditional skills. After this first day they had three days to develop their design and on Friday afternoon they had to present the results of this initial first workshop week. After this workshop all the students had five more working weeks to finish their design individually. As a final result all of the students had to present a digital and analogue version of their design. For the presentation of the nearly final design the students from Graz went on a field trip to Liverpool to join in the final project review.

Main Questions

Some main phases involved in the evaluation of architectural design in our educational setting were as follows

- Understanding the problem
- Dealing with the site and the "client"
- Formulating the solution
- Evaluating their own projects

This time we wanted to see if there are any significant differences between the digital and analogue groups in terms of :
- Is it an interesting design solution?
- Is it a complex design ?
- Is it an appropriate design?
- How well is the site context tackled?
- How well do the students understand their own design?
- Does it increase design abilities?

During the workshop week we tried to supervise how typical schemes developed when students used wholly traditional and wholly digital techniques respectively. Therefore we decided to take snapshots of the projects two times a day at 1pm and 6 pm. We took copies of the SketchUp Models at these times and photographed the results of the analogue group. The analogue group had been briefed to put a time stamp to all their sketches and models (which, being students, they did not always do). To check up on all the materials was a quite demanding task for the tutors because it was an additional workload on top of the intense workshop work. At the end it turned out that we could not take track on all the materials produced during the workshop and we had to establish a different procedure to keep the work manageable.

Figure 2
Workshop pictures

In fact for the best research results it would be much better to free the workshop from its constraints in the existing curricula and organize it as an additional intensive seminar.

During the first days of the workshop it was clear that the strong students in the digital group were quicker in developing design ideas than those in the analogue group. They also produced more design variations and were stronger in explaining the spatial aspects of their design. The weak students were weak in both groups – the digital group did not manage to find proper solutions with their models and the analogue group was equally failing in developing adequate solutions. Our new systems with the time stamps showed that the strong analogue students managed to catch up with the strong digital students during the rest of the workshop week. So at the final presentation after the first week there was no significant advantage of a particular group – the distinction between strong and weak students either analogue or digital was much more visible.

As we expected in the analogue group much of the development was through 2D sketches. The development of the design started mainly through plan and elevation drawings. Exploration in drawn 3D were rarer events. The analogue group this year used physical models at a much earlier stage than previous years.

One possible reason for this might have been the presence of the big site model (1:100) in the analogue studio. Sometimes they already worked on larger scale sketches to work out details of their design - this did not happen among the digital group.

In the wholly digital scheme the evolution of the design is in 3D . This is clearly necessary and directed by the used CAAD system (SketchUp). Some of the students had problems working wholly in 3D and tried to find a way to work in 2D. Sketching on paper was expressly forbidden, but there were people trying to do additional 2D plans to clarify certain aspects of their design. This mainly turned out to be when people already had previous experiences other CAD software and/or traditional design experiences.

An interesting aspect was the amount of discussion between the two members of a design team. The two studios had a completely different atmosphere – in the analogue studio there were several teams discussing their project quite vividly. In the digital group the discussion between team members was much more reduced. One reason for that might be that we had the setting of a normal computer lab with several rows of computers in line, rather than the more conventional analogue studio where students sat around the edge of a group of tables.

In both groups it was sometimes hard for the students to work as a team. This was not too surprising due to the fact that they were not used to work as a team and came from different backgrounds and cultures. As a result some teams decided quite early to split their workload into different tasks that could be treated separately.

Observations

The Evaluation of the time stamps of the projects during the workshop days showed a slight difference in the progression between the digital and the analogue group. The digital group produced significantly more design alternatives during the workshop phase and usually tested them in the context of the site and building rather than in isolation. In a way they were a bit more exploratory than the analogue group. The analogue group claimed much more that they don't had enough time to finish certain aspects

We had two main times in which to evaluate the designs during our project. The first was at the presentation after the first workshop week in Graz, the second was five working weeks later at the final project review in Liverpool. There were some interesting observations to be made during the presentations. At the end of the first workshop week there was a significant difference between the digital and the analogue group. Many digital projects "looked" much more developed than the analogue ones although this sometimes was only on the surface.

But the results this time where not as clear as in
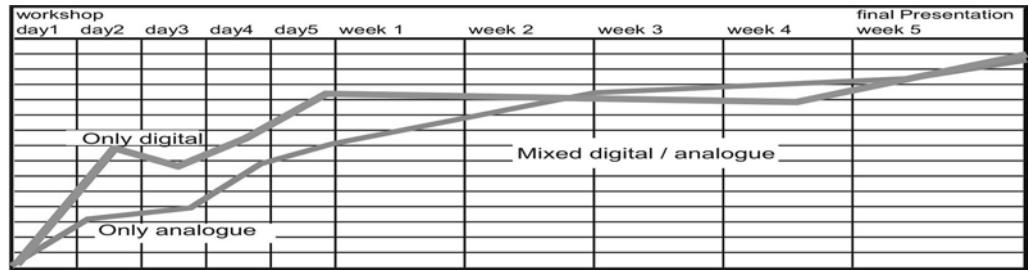
previous years. After this first week the digital group in general seemed to have a better understanding of the architecture they created – at least in their spatial aspects. But there were also very strong projects that were analogue based, in fact some of the best projects came out of the manual group. The analogue presentations after this first week left the impression that many projects where not yet developed as far as those from the digital group. Additionally, the lack of sketching and presentation skills of the student made many of the projects "look" less interesting than the digital ones.

One intriguing aspect was at the lack of further development of the projects in the digital group for the final presentation five working weeks later. Most of the "digital" students decided that the main design work has been already done after the first week and just "polished" their models for the final presentation. They also made their analogue model just to fulfill the brief and not to find anything additional or

new. The projects of the analogue group developed more over these five weeks. The strong students managed to get additional aspects from the work with the digital tools and sometimes refined their projects quite significantly. But the weaker students working manually did their main design decisions during the remaining five weeks still using analogue tools. Although they had to make a 3D SketchUp model, many of them just did it to fulfill the brief and did not get much further out of it.

Key Findings

After three years of working with first years students on their first design it is clear to us that it is no more a question of "PEN or PC" but a question of using all available tools as early as possible in the design process. We can now already add additional comments from our students that did the workshop three years ago. 90 percent of the former workshop students
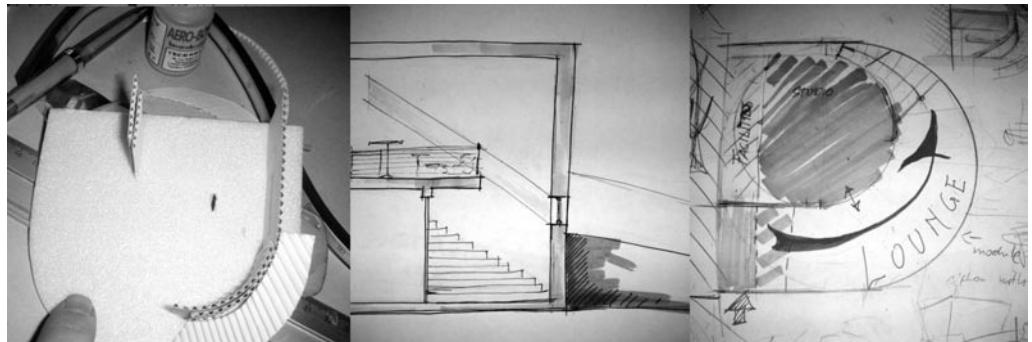

Figure 4
Analogue example

claim that they still use SketchUp when they start to design! With our findings, we feel we can say that modern CAAD software is at least an additional possibility to start a design with new benefits and still some disadvantages - especially when used as the only way to explore a design. It is clear that in using a software like SketchUp in the early design stages leads to a different design process. It has much more in common with model-making than working with sketches. We definitely do not always have to sketch when we start thinking of a design! But it is not the right tool for all designers especially when used exclusively. But definitely IT tools are a possible and rewarding addition to a traditional design process. For some aspects those tools are a substitution for the new design generation. Young designers are using the digital model quite naturally in the process.

Using IT tools leads to interesting complex design solution with a better control of spatial aspects even for inexperienced designers. Using easy to handle 3D modeling software helps to find an appropriate design solutions because it emphasizes to build the model "on site". It sometimes allows the students to understand their own design better and definitely increases their design abilities in a rather short time because they tend to be more adventurous – at least when they loose their "respect" and use it as a playful tool. There are still some drawbacks at the moment and as a traditional designer you are tempted to take the pen and make a sketch when something is not

working like expected in the 3D model. So we clearly have to use all tools available to us when we do a design but 3D modeling software like SketchUp will definitely change the way we design and gives us additional possibilities which sometimes will substitute traditional methods.

Outlook

We will try to do one more run of this workshop and plan to develop a more refined version for the time stamps to make it easier to categorize the progress of the designs in more detail. Ideally the next step would be to do a workshop exclusively on this topic without the restraints of having to fit it into the normal curricula. The future of our planned Socrates intensive seminar on this topic is at the moment in doubt. We want to keep the bureaucratic overhead as reduced as possible but with the present regulations from Brussels this seems to be impossible. So we will do our fourth run in a similar way to previous years. The main goal will be to have a more scientific setting, but still be able to have the creative atmosphere essential to carry out architectural design.

References

Daru R.: 1991, "Sketch as Sketch Can - Design Sketching with Imperfect Aids and Sketchpads of the Future" Experiences with CAAD in Education and Practice

[eCAADe Conference Proceedings] Munich (Germany).

Gross M.D. and Do E.Y.L.: 1996, Demonstrating the Electronic Cocktail Napkin: a paperlike interface for early design , CHI 96, Conference on Human Factors in Computing Systems. Vancouver, British Columbia, Canada, ACM. Conference Companion: 5-6

Schweikardt E. and Gross M.D.: 1998, Digital Clay: Deriving Digital Models from Freehand Sketches. , ACADIA 98. T. Seebohm and S. V. Wyk. Quebec City, Canada, ACADIA: Association for Computer-Aided Design in Architecture, pp. 202-211

Knight M.: 1996, "Architects use of 3D in the design process" in Habitat, journal of the CTI Centre for the Built Environment

Rauhala K.: 2003, Playing Games: the Role of Computers in Sketching, Digital Design [21th eCAADe Conference Proceedings / ISBN 0-9541183-1-6] Graz (Austria)

Dokonal W, Knight M, and Brown A.: 2004, To CAAD or not to CAAD? SIGraDi 2004 - Proceedings of the 8th Iberoamerican Congress of Digital Graphics, Sao Leopoldo Brazil, pp. 98-100.

Knight M., Dokonal W., Brown, A. and Hannibal, C.: 2005, Contemporary digital Techniques in the Early stages of Design, CAADFutures 2005 - Proceedings of the 11th International CAAD Futures Conference, Vienna June 20-22, 2005, pp. 165-174.