

# Digital Design Tools vs. Sketching in Design

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*This paper reports on and updates a research project which seeks to address two fundamental questions. Does the current breed of user friendly 3D CAAD software really enhance our design abilities when compared to more traditional techniques like sketching and how might the use of such software inform how we teach the new generation of architectural students. It furthermore summarizes the results of a web questionnaire that tries to find out the current main tools in the early design phases amongst architectural practitioners in two European countries.*

**Keywords:** *Digital design; practice; early design stages.*

## Introduction

The discussion about using the computer in the early phases of an architectural design is a very old one. We experienced many examples at eCAADe conferences and there have been several interesting studies in this field, notably the Electronic Cocktail Napkin project and subsequent developments (Gross, Do 1996). All those early attempts in using the computer as a design tool were trying to give an equivalent of a traditional design method (mainly sketching) in the digital world. Now, ten years after these first attempts recent developments in CAAD software shows a shift in focus towards more “architectural friendly” interfaces. We were interested to see if these new tools have become powerful enough to have a major impact on the way we design in architecture.

Most of us still find it quite natural to use traditional design tools because we were taught using them and they are very efficient. But what is the position of the newer generation of architectural student

to whom the use of the computer is as natural to use as the pencil is to us? What happens when this generation is taught to use the computer to design from the outset? Will this new focus inevitably reduce their skill in working with the traditional tools or will they compensate in other ways?

In parallel, we were interested about the current use of CAAD amongst architectural practitioners. Is “Digital Design” already established as state of the art in architectural offices? Is there a significant difference between practice and education when it comes to the use of CAAD methods? To find out about this we initiated a web questionnaire and invited practitioners to comment on a number of questions relating a number of key areas of CAAD usage.

## The educational experience

The main idea was to use first years students with no history of design education to compare traditional design methods with wholly digital design methods.

These students were from two European Schools of Architecture who worked together on a common site and design problem. Half the students worked wholly digitally, the other half wholly manually. After the initial workshop, students had more time to complete their design using any available tool. These resultant designs were compared and analyzed and we reported on our experiences at past conferences (eCAADe, Sigradi and CAADfutures).

Our studies show that students can and do use the computer to generate richer design solutions in a shorter time span. 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 using traditional tools. But the strong analogue students managed to catch up with the strong digital students during the rest of the workshop.

As a summary of our educational experiments we can state that we are at a design crossroads where both sketching and digital model making are used. The use of 3D digital design methods are clearly moving towards the beginning of the architectural design process. Our results seem to indicate that the balance will shift so that digital methods will be the main tool in the design process and there is the possibility that we might move on to a new generation using only digital tools.

## The survey amongst practitioners

To see whether we were discussing the topic in an ivory tower, we wanted to find out the current use of CAAD in architectural practices. Because we did our educational experience with students from England and Austria, we decided to do a survey in both countries. The chosen method for this survey was a web questionnaire (<http://www.stdb.tugraz.at/survey/>

en/). One of the important aspects was to keep the questionnaire as short as possible. We agreed on 12 questions about the attitude towards CAAD and an additional 9 questions about the background of the office. Otherwise we had the fear that nobody would spend precious time filling in the questionnaire. As an additional bonus, we managed to get some sponsorship to make a draw amongst the participants.

The test regions were the RIBA North West region in England (500 offices) and the area of the “Ingenieurkammer für Steiermark und Kärnten” (600 offices) in Austria. Due to unknown circumstances there was a significant difference in the amount of participation. We received 107 answers from Austria and only 12 from England. Because of this imbalance, we decided to use only the results from Austria this time.

The Questionnaire itself has two parts. The first part wants to find out the practice's attitude to the use of CAAD. The second part is focused on the background of the practices. This allows us to see the results of the first part in the context of the practice's structure.

In the first part we established a five degree scale between the limits of “disagree strongly” vs. “agree strongly”. The following is a list of the questions.

### Attitude towards CAAD

- we use CAD only for production drawings
- we use CAD for concept modeling or massing studies
- we use CAD as an electronic drawing board
- we originate complete designs in a 3D CAD environment
- we create a 3D CAD model for visualization purposes only
- current 3D CAD packages are not intuitive enough for design use
- it is not possible to design using a CAD system
- clients require us to produce computer generated images
- clients require us to produce 2D CAD information

- statutory bodies requires us to produce computer generated submissions for approvals
- CAD is used as a tool alongside “traditional” methods of sketching and modelling
- as a practice we are open to new ideas and technologies to use in the design process

#### Background

- what age are you?
- what size is your practice?
- what is your professional experience?
- what is your job role?
- how many hours a week do you spend using a CAD package?
- is training available to you?
- what type of work does the practice undertake? (tick all that apply)?
- which CAD system is predominantly used in the practice?
- do you use external consultants to produce 3D images/animations?
- any other comments on the use of CAD either in your practice or in architectural practice generally

## Results

We were quite surprised of some of the results of this first attempt of our survey. Several of the comments we received were very critical towards CAAD and expressed a traditional, long established picture of CAD usage. But looking at the results in more details reveals significant changes. A substantial amount of offices already claim to use CAAD methods in the design process. In question one a high percentage of the answers - app. 56% disagree quite strongly that CAD is only for production drawings (answers 1+2). Additionally Question 4 shows that already 32% of the offices originate their designs in a 3D environment (answers 4+5).

It is very clear that CAD systems are still used in their traditional ways – Question 3 – 69% agree strongly in using CAD as an electronic drawing board (answers 4 + 5) and question 9 indicates that 2D CAD

information is still a major part in the building process (77 % agree with that).

Question 6 in combination with the background question 20 is not a very surprising result – the main software package is still AutoCAD even for 3D. Only 12% are using more intuitive packages like SketchUp (only 13 offices) – not a single one Revit from Autodesk. So the information about more intuitive software is not really out there yet. Some of the comments give some indication of the possible reasons. The lack of time for the evaluation of software packages and the substantial costs involved are definitely a factor that slows down the process.

The small size of the offices in Austria – 80% are less than 9 persons and app. 60% less than 5 – might also be a decisive factor.

A very important statement is that more than 50% disagree with the statement that it is not possible to design with CAAD. At least in Austria this marks a significant change – a few years ago the majority of architects claimed that it is not possible to design with the computer!

Finally we can say that for the majority of architects CAD as a tool is essential – one submission stated that working as an architect is unthinkable without CAD! But the reality of daily work in an architectural firm shows that the computer is ubiquitous. 82% of the submissions were from partners or project leaders which makes the 65% who claim to work with a CAD package more than 20 hours a week even more impressive!

## Outlook

Our next steps will be to extend the survey. First we will have to try to get a critical amount of submissions from England. This will make the initial idea of comparing the situation in the two countries possible. With a little luck we will be able to show these results already at the Frankfurt eCAADe conference. The Chamber of Architects in Austria is very interested in the results of this survey and there are plans to

extend the survey to reach all Austrian architectural offices.

This survey was intended as a pilot for a more wide ranging European-wide study. As educationalists, we need to continually re-assess our teaching methods and curriculum, both to respond to the requirements of the profession, and to advance the techniques used. This initial study shows that the profession is (largely) in areas, still conservative in its attitude when compared to other areas such as automotive and aeronautical design. This opens the debate as to what we can (or should) do to change this situation.

## Appendix - Summary of the results of the questionnaire

107 submissions (out of 600) 17,83%

### 1. We use CAD only for production drawings

1 Disagree strongly	42	39,25%
2	18	16,82%
3	10	9,35%
4	22	20,56%
5 Agree strongly	15	14,02%

### 2. We use CAD for concept modeling or massing studies

0 not submitted	2	1,87%
1 Disagree strongly	20	18,69%
2	16	14,95%
3	15	14,02%
4	20	18,69%
5 Agree strongly	34	31,78%

### 3. We use CAD as an electronic drawing board

0 not submitted	1	0,93%
1 Disagree strongly	10	9,35%
2	6	5,61%
3	16	14,95%
4	33	30,84%
5 Agree strongly	41	38,32%

### 4. We originate complete designs in a 3D CAD environment

1 Disagree strongly	35	32,71%
2	22	20,56%
3	16	14,95%
4	16	14,95%
5 Agree strongly	18	16,82%

### 5. We create a 3D CAD model for visualization purposes only

0 not submitted	1	0,93%
1 Disagree strongly	18	16,82%
2	18	16,82%
3	10	9,35%
4	32	29,91%
5 Agree strongly	28	26,17%

6. current 3D CAD packages are not intuitive enough for design use

0 not submitted	2	1,87%
1 Disagree strongly	28	26,17%
2	19	17,76%
3	17	15,89%
4	22	20,56%
5 Agree strongly	19	17,76%

7. it is not possible to design using a CAD system

1 Disagree strongly	32	29,91%
2	22	20,56%
3	28	26,17%
4	16	14,95%
5 Agree strongly	9	8,41%

8. clients require us to produce computer generated images

0 not submitted	1	0,93%
1 Disagree strongly	11	10,28%
2	11	10,28%
3	16	14,95%
4	30	28,04%
5 Agree strongly	38	35,51%

9. clients require us to produce 2D CAD information

0 not submitted	1	0,93%
1 Disagree strongly	7	6,54%
2	5	4,67%
3	13	12,15%
4	21	19,63%
5 Agree strongly	60	56,07%

10. statutory bodies requires us to produce computer generated submissions for approvals

1 Disagree strongly	24	22,43%
2	10	9,35%
3	27	25,23%
4	30	28,04%
5 Agree strongly	16	14,95%

11. CAD is used as a tool alongside "traditional" methods of sketching and modelling

1 Disagree strongly	1	0,93%
2	8	7,48%
3	16	14,95%
4	31	28,97%
5 Agree strongly	51	47,66%

12. as a practice we are open to new ideas and technologies to use in the design process

0 not submitted	1	0,93%
1 Disagree strongly	1	0,93%
2	1	0,93%
3	9	8,41%
4	34	31,78%
5 Agree strongly	61	57,01%

13. what age are you?

20 – 29	6	5,61%
30 -39	47	43,93%
40 – 49	42	39,25%
over 50	12	11,21%

14. what size is your practice?

1 to 4	63	58,88%
5 to 9	23	21,50%
10 to 19	10	9,35%
20 to 49	7	6,54%
over 50 persons	4	3,74%

15. what is your professional experience?

1 to 2	2	1,87%
3 to 4	6	5,61%
5 to 9	38	35,51%
10 to 19	42	39,25%
over 20 years	19	17,76%

16. what is your job role?

Partner	70	65,42%
Project leader	18	16,82%
Job Runner	10	9,35%
Architectural Assistant	9	8,41%

17. how many hours a week do you spend using a CAD package?

1 to 4	12	11,21%
5 to 9	7	6,54%
10 to 19	18	16,82%
20 to 49	66	61,68%
over 50 hours	3	2,80%

18. is training available to you?

not submitted	9	8,41%
formal	15	14,02%
informal	12	11,21%
in-house	22	20,56%
by external company	49	45,79%

19. what type of work does the practice undertake? (tick all that apply)?

residential – private	93	86,92%
residential – local authority	66	61,68%
residential – commercial	60	56,07%
commercial – office	81	75,70%
commercial – industrial	65	60,75%
competition	91	85,05%
educational	58	54,21%
hospital	43	40,19%
other	89	83,18%

(percentage of the 107 submitted /multiple answers possible)

20. which CAD system is predominantly used in the practice?

AutoCAD	59	55,14%
Microstation	1	0,93%
Vectorworks	3	2,80%
Archicad	28	26,17%
Rhinoceros	9	8,41%
SketchUp	13	12,15%
Allplan	14	13,08%
Revit	0	0,00%
Maya	6	5,61%
Abis	9	8,41%
3Dsmax	5	4,67%
Cinema 4D	3	2,80%
Archline	3	2,80%
Accurender	2	1,87%
Spirit	2	1,87%

(percentage of the 107 submitted /multiple answers possible)

21. do you use external consultants to produce 3D images/animations?

yes	55	51,40%
no	52	48,60%

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