# Interactive Representation of Architectural Design: The Virtual Design Studio as an architectural graphics laboratory

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## Abstract

This paper introduces the Virtual Design Studio (VDS), an internet based design studio environment established by ifib. VDS transfers lessons learned through research projects in the field of Computer Supported Co-operative Work (CSCW) being carried out at ifib into design education. By training for interdisciplinary co-operation within the design process, the students will become better prepared for the flexibility and co-operability required in planning situations. Increasing the communication and co-operation in the planning process can be achieved through the implementation of IT based virtual workspaces. In the design studio setting, this is done through the use of available internet software and technologies. The methodology of the VDS is briefly described including specific assignments intended to focus student investigations into specific areas including the representation of their work using the world wide web. The pedagogical expectations are discussed and anecdotal evidence precedes an general evaluation of the teaching method. The authors postulate that one of the unintended by-products of the studio is the evolution of an effective use of interactivity in the presentation of design concepts, ideas and solutions. A handful of student work is presented to describe the different approaches taken in using the world wide web (WWW) to display project work. A description of the local evolution (VDS specific) of graphical methods and technologies is followed by a comparison with those used in traditional settings. Representation is discussed with focus on the ability of the WWW to replace, augment or corrupt other methods of presentation. The interactive nature of web based presentations induces alterations to the narration of architectural work and can enhance the spatial perception of design space. Space Perception can be enabled through geometrically true VRML representations, the inclusion of auditory sensations, the abstraction of representation through the use of advertising techniques as well as the introduction of non-linear narrative concepts. Examples used by students are shown. A critical assessment of these new representational methods and the place of current new media within the context of architectural representation is discussed.

Keywords: virtual design studio, architectural graphics, teaching, communication, collaboration.

## The Netzentwurf: a Virtual Design Studio

The ever more popular hype about all things "virtual" notwithstanding, the Institute für Industrielle Bauproduktion (ifib) undertook in the summer of 1997 to transfer the upper level architectural studio work done at the institute to the realm of computer based tools and media. The reasons for doing so were three fold. Firstly, in keeping with the tradition started by Professor Haller at ifib, the institute sought to explore the boundaries of computer usage in design. Secondly, the current professional outlook for graduating architects is all but rosy and certainly a great deal of them will find work in other, possibly related fields. Enabling these students with skills such as those needed to develop a web based presence is considered a positive aspect of work done at ifib. Thirdly, owing to the nature of the design studio in general, and the situation in Karlsruhe in particular, it was thought that the creation of a virtual workspace with its attendant tools and communication devices could enhance the student/teacher and student/student relationship as well as foster a better kind of studio atmosphere.

We have, in the last two years, conducted seven such virtual studios (*Netzentwuerfe*) involving approximately 70 students. The work produced by the students as well as the direct feedback from them has allowed us to draw some preliminary conclusions about the formation and execution of such studios. While the number of students is not large, the work produced has been very broad. The conclusions drawn here are certainly open to debate, owing to the relatively small sample of work, however, the variety of work and the similarities in reactions to the studio has given us the impetus to form some initial criticisms of the project.

The design studios at ifib can be characterised by two main qualities: the use of an integrated planning approach and its application to unusual design exercises. The use of this strategy is grounded in our perception of the role and nature of architectural design and of the architects themselves. The ability of architects to work with incomplete and unstructured information is, perhaps, what sets them apart from engineers. Indeed, the process of design can be described as a process of information flow and manipulation, where goals, parameters and raw data are interchangeable in their role and effect. The design process with its various participants and conditions behoves a cognisant, co-ordinated and flexible planning strategy in order to meet the ever changing design goals. The inherent complexity of such iterative processes is more so compounded in the design and production of singular products such as ships and buildings. These conditions call for a front-loaded and co-ordinated planning strategy, namely the integrated planning approach.

The VDS utilises existing technologies to create a planning platform to enable to communication channels necessary in the integrated planning model. Specific tools such as email, newsgroups, html documents and structured, shared databases are used to emphasise various aspects of a common planning system. These tools are combined within a design exercise framework which requires the students to confront design problems using non-traditional methods. Further, the design problems themselves are chosen for their unconventionality, either in their form or in their format. The students are required to use only internet based presentation methods to ensure a universality in accessibility.

Through the confrontation with unusual situations or design problems, we are training the students how to manage information and how they can use it to achieve collaborative design solutions. The co-ordination and management of participants, information and processes that is required by current practise conditions is incredibly difficult to teach. Indeed, it could be said that such skills can only be trained. It is the intention of the VDS to carry out part of this training.

The use of internet based tools has the added complexity of exploring and evolving a meaningful methodology with new possibilities for display and communication. This can, in

certain circumstances, serve to occlude the goals of the VDS rather than clarify them. Although the results of the studios are graphically enticing, it is the way with which the students are taught (and teach themselves) which primarily concerned the authors.

In the traditional architectural design studio, the students are given a well defined design assignment and instructed to begin work as soon as possible, usually alone. The students attempt to solve the problem using various design methods and are usually instructed to select one which solves the predefined problem and is internally consistent. The work is carried out in either in the student's own home or in communal work spaces at the school with planned consultation and review sessions setting a timetable for work planning. Consultation and criticism is given in sessions where the students first present the work and the Critics react with the allotted time with their comments. The final evaluation is based upon the internal consistency of the student's logic and the elan with which a solution is provided (or with which it is presented).

The VDS is an attempt to reduce the linearity of the studio environment, the student/tutor relationship, and the way with which the students work with their resources. The framework for the design exercise is parameterised through the assumption of internet based tools to create a workspace through which information will be aggregated and shared.

The scope of the design studio is widened through the flexibility inherent in using this approach. There exists the real possibility, however, that by becoming more flexible, the assignment is, for the student, eventually intractable. By redefining the nature or qualities of the design studio environment, the students are often more involved in meta-problems of the assignment than in the core design problem itself. This behoves a large degree of diligence upon the studio tutors to ensure that the students balance their concentration between the process and the product of the VDS. Although the need for this balance is made clear to the students, the realisation of its implications varies with each individual and usually requires an attendant individually crafted response from the tutors. This is, perhaps, inherent in the teaching of design.

The scope of the VDS also requires that the expectations of the students be well defined and that the assignment includes not only the production of a design solution, but the investigation and use of the workspace itself. In this respect, an important aspect of the Virtual Design Studio is the establishment of a timetable. The timetable is not, however, one which defines dates for design goals. Rather, the timetable defines dates for setting design goals. This entails, for the students, a not inconsequential amount of research as well a fostering a discussion about how to define the goals necessary to achieve an acceptable, if not overwhelming, design solution.

A typical VDS last for 4 to 6 months and involves between 15 and 25 students, one or two full time assistant professors, guest consultants (both locally and remotely) and a guest critic (usually a full professor) for the design reviews. During the studio, the students are required to involve other persons as either consultants (field specific) or as *Netzpaten* (currently translated as Netfathers or Netnannies, neither of which is fully acceptable to the authors). The role of the Netnannies is to demonstrate the rich variety of opinions easily available (either with or without the internet) as well as to ensure that the students receive an independent criticism of their work. The Netnanny also provides a control that the information presented with the internet based methods is in itself complete and understandable.

The students work alone or in teams of two. It is unclear as to whether one or the other is better for the VDS concept as the results are inconclusive. Rather, the tutors attempt to accommodate the wishes of the students if it is thought that this will foster faster learning and better comprehension. Approximately 90% of the students have no previous experience with actively using the internet or designing world wide web pages. There is no minimum

requirement stated other than that the students have at least a working knowledge of computers in general and of at least one or two mainstream computer programs such a word processing program.

In addition to the already complex nature of the design exercise, the requirement to learn, use and construct HTML documents is often near the limit of some students. Despite this, we have been able to combine the technical aspects through intensive steep courses at the beginning of the studio. This quickly raises the student's abilities and can help to overcome fears of failure to complete the studio. In actuality, it tends to raise false expectations as the students' learning curve tends to flatten sharply, which is often followed again by fears of failure. Here, the regular contact through the communication channels brings the students to the point where they can foresee completion within the allotted time, after which, they tend to work independently and intensively (See Figure 1.).

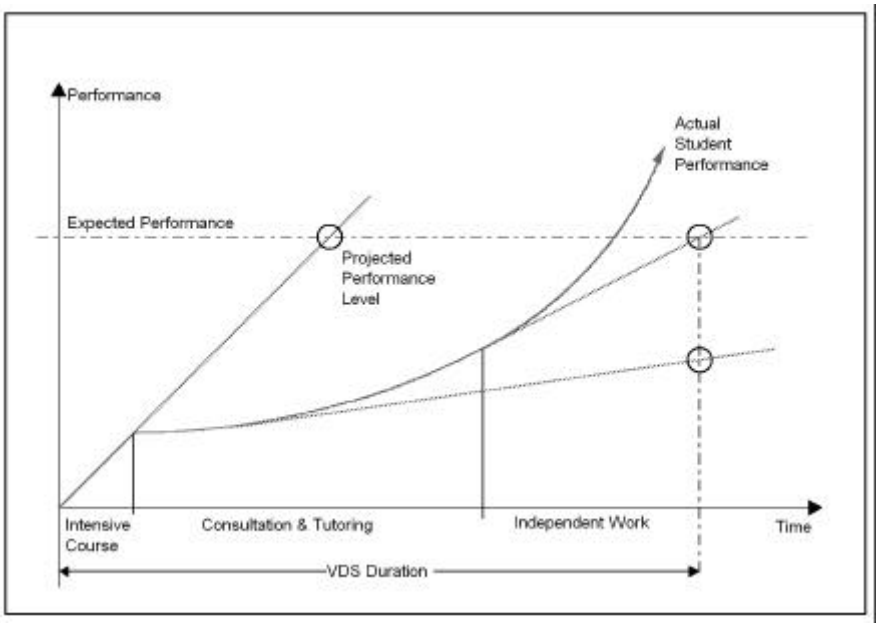

Figure 1: Performance Expectations

During the VDS, the students are to continually update their web sites and to send email to their colleagues, Netnannies and tutors when changes have occurred. This allows the students to work at their own pace and to reduce the surprises that can occur in a normal design studio. Essentially, the students work in a publicly accessible design space. This often requires a period of adjustment as many students are used to working concealed until they have decided and prepared all of the decisions for their solution. In the VDS, the design process is much more amorphous owing to the irregular and often unforeseeable variety of criticism that arises. As well, some students never get over the feeling that they are working in a display window. Still, there are deadlines set for certain goals. These can be as rudimentary as a room program or as complex as an overall energy concept for the building.

The design reviews that take place have a different atmosphere than other studio reviews. In the VDS, the work must be made available days before the review itself. This allows all participants to consider the work as well as reactions to it before the review as an event takes place. This allows a more thought out response to the work. Rather than presenting the work in order to elicit a response from the critics, the students are able to present their work as a design solution and to steer the discussion to topics that the student deems pertinent. The uncoupling of presentation and response is an inherent quality of the VDS that occurs in all facets of the student/consultant dialogues.

Finally, as an assignment, the students are required to evaluate the VDS itself. They are to take the VDS concept and its workspace parameters as an experiment in itself and through their personal experience therein, to critically analyse the various aspects, structures and concepts of the VDS.

## Architectural Graphics

The nature of the reviews has demonstrated the changed nature of architectural description by using the net-based hypermedia. It is often the case that the better developed web based presentations fall flat during the end review. This is predominantly due to the nature of the media and how one uses it. In the traditional design review, the student will hang all of their drawings and then guide the viewers through the building by focussing attention on particular drawings or parts of drawings. The entirety of the information is displayed to the critics and audience. By placing their work on the world wide web, the students have lost this ability to concurrently display all of the information about their project. Narration becomes a important part of the presentation as does the general issue of information interface. Alongside the requirement to produce drawings and models, the students must provide a mechanism which explains them. This has led to innovations in architectural graphics which were unforeseen to the authors of the VDS.

One of the biggest misconceptions of the VDS is the role of CAD (By CAD, we mean the drawing programs that replicate the pencil or ink drawings of yore) in the studio. Nowhere do we specify which graphical methods the students should use. The only specification is that the work be accessible from standard web browser. The use of vector based drawing aids such as AutoCad actually are a hindrance in this regard as the conversion from vector based drawings to pixel based (for the web) is far from trivial. There are examples where students have used vector reading plug-ins in order to allow the user to see their vector graphics. While initially seen as a step forward, these vector graphics are often misleading as they ignore traditional architectural graphic semantic tools like line widths and introduce newer ones like line colour. Interpreting a vector graphic is not straightforward, mainly because they resemble the codified CAD file rather than the architectural drawing which has been used for hundreds, if not thousands of years.

Architects produce drawings to communicate with (at least) three distinctly separate groups. Firstly, the working drawings explain to the builders how the object should be built. These documents are highly technical and explain the physical object. The second type of drawings are those for the layperson who is not trained to read sections and plans. These drawings are often painterly in quality and have more to do with image than with space. The third type of drawing is that which is used to convey the architectural idea to a colleague (or to oneself). These are the drawings of the design studio.

The necessity to navigate through the information has lead to three types of display strategy among the students. The first is based on the slide show analogy. The second is more akin to a book and the third a fully interconnected information space. Each has its drawbacks, strengths and requirements needed to bring out these strengths.

Practically all the students start out placing their work on the web in the same way. This is partly due to the requirements set out by the teachers (links to colleagues, personal information, sketchbook, etc.) as well as by the existing catalogue of work by previous students which are often emulated. Initially, the student's information is set out as a set of web pages resembling chapters of a tome; each dedicated to some topic (energy concept, design sketches, contact information, etc.). It is relatively easy to then fill the chapters with information and let the users read or see it with a web browser. However, using a web browser is a personal experience. For the individual, it is a comfortable way to learn about the work. In the review setting, where students must present their work before an audience, this standard web layout is not appropriate. Not all people read at the same rate and often

the student's voice is in conflict with the text displayed (reading one text and listening to another is beyond the capabilities of most people). Indeed, the scrolling of text in front of an audience is quite similar to someone channel surfing among a group of television watchers.

This has lead to variations in displaying the information that is more akin to a slide show. The work is presented in a series of vignettes which the user or presenter can flip through, according to the rate of cognition or the time constraints of presentation. These types are mostly linear in nature and consist of very little text. They are somewhat static in their structure so that returning to certain parts requires starting over in the presentation.

The third type of information structure is when the students combine these two ideas and develop and interactive book/slide show which allows the user to use hyperlinks to connect horizontally to other information or vertically to more detailed information, according to their current inquisitiveness. This also allows the students to dynamically alter their presentations, according to the questions or criticism which can arise during a presentation. The development of the hyperlinked architectural drawing has lead to variation where the links are in addition to the drawings or an integral part of them.

The simplest interactive version is much like a cross-linked index of information sheets. These are certainly helpful in readily clarifying issues the student has worked through. However, the real jump in representation comes when the links are included in the drawings themselves. The simplest of these resembles an adventure game where perspective drawings are linked together and the user can wander about the building. Indeed, some students have gone to the trouble of building VRML models which attempt to allow the reader to freely walk about the building. While allowing for freedom in choosing views of the project, the VRML models lack in narration which is certainly important in the design studio.

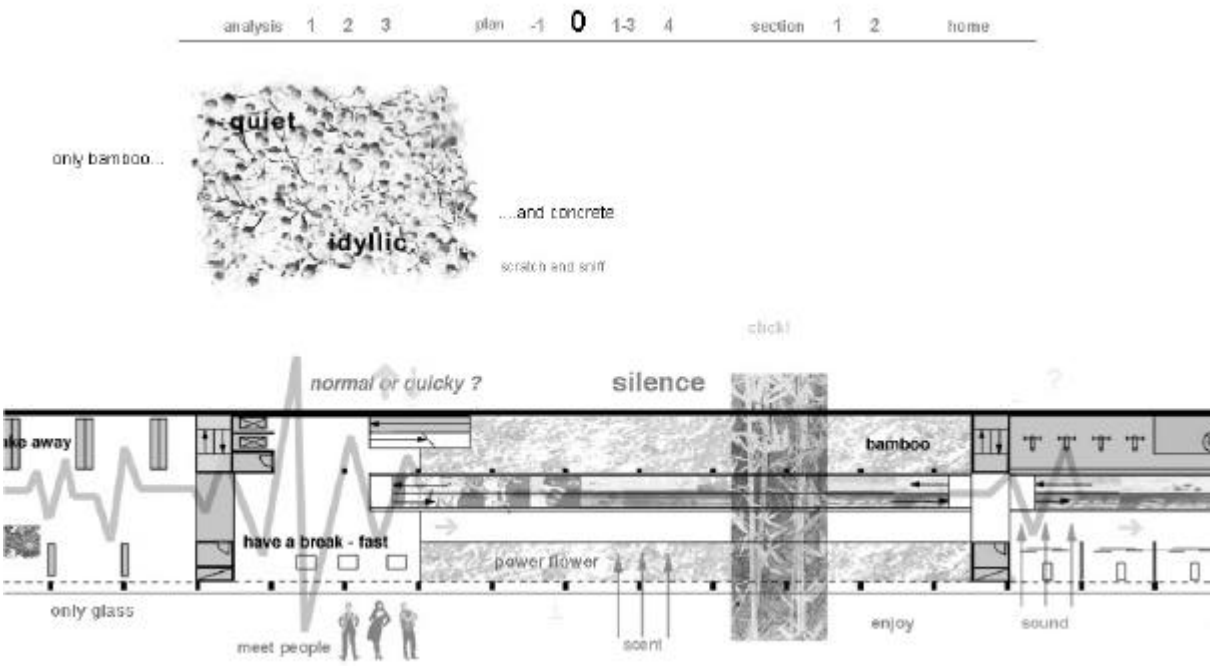


Figure 2 - Hyperlinked Plan: F. Strauss and M. Becker

More advanced variations have connected the drawing themselves: an example would be clicking on a staircase symbol to change plans. More thought through versions of the hyperlinked plans have added images of perceived qualities in the space as well as sound and animations in addition to the cross-indexing found in other projects. By clicking on a

room, one sees images associated with the qualities of that space as well as text elucidating other qualities and/or details about that part of the design.

In one or two cases, the work produced has lent an insight into the possible future of a hyper-drawing language where the plan serves its original role through long established semantics of architectural graphics as well as the role of an intermediary to the wealth of other information that constitutes an architectural design.

## Conclusions

Architectural graphics have, over hundreds of years, established a well defined visual language with which to interpret them. The development of hypermedia methods of information presentation has allowed the expansion of this vocabulary through the layering of existing and new types of information. The use of hypermedia techniques are effective mostly in the graphics used to convey architectural ideas to other architects.

Predominant in the comments from the students is the wish or need for more partners in the studio situation where the communication through the internet is a necessity rather than an augmentation. Indeed, perhaps one of the problems with the concept so far is that the participants seldom change their work and communication habits when old avenues and methods are available. In this respect, the evolution of the VDS will involve other schools and participants which would allow an expansion and precision of the methods, designs and graphics through the involvement of other partners.

## Links

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| The Institut für Industrielle Bauproduktion | http://www.ifib.uni-karlsruhe.de/ |
| Current ifib Education Program | http://www.ifib.uni-karlsruhe.de/en/lehre/ |
| Virtual Design Studio Archive | http://www.ifib.uni-karlsruhe.de/en/lehre/archiv/ |
| VDS White Paper | http://www.ifib.uni-karlsruhe.de/en/lehre/VDS/ |