"NOT EVERY NEW MONDAY…"

On using computer-games technology in architectural design education

FRANK PETZOLD, AND JAN FROHBURG
Bauhaus University Weimar
petzold@archit.uni-weimar.de,
jan.frohburg@archit.uni-weimar.de

Abstract. The application of new media is common practice in architectural offices and complements traditional forms of presentation such as drawings and physical 'haptic' models. Other interactive forms of presentation are also already available, for example in the realm of computer gaming, however the transfer and application of game engines to an architectural environment has not yet been explored in any depth. This paper looks at how "new media" can be used as a means of communicating architectonic information without simply emulating an already available traditional means of representation. We discuss the process of learning how "new media" (the computer as a multi media) can be used as a tool for the analysis and reconstruction of architecture. Using Mies van der Rohe's unrealised project for a brick country house as a basis, a project was devised which communicates valuable design and analysis skills and also allowed us to explore the use of "new media" and to draw conclusions for teaching and research as well as to critically assess the opportunities, limitations and risks involved.

1. The Term "New Media"

"New Media" is a catchword that features heavily in numerous publications and programmes. However, what is actually meant by "new media" is not precisely defined, whether in general terms or in the field of architecture; a consistent use or understanding of the term has not been established. While some authors assume that New Media evolved from pre-existing modes of representation, others speak of their genuine novelty (see Luhmann, 1995; Klimsa, 1993).

In the context of this paper we use the term "New Media" to describe (somewhat simplified) the 'comprehensive computer', i.e. "a computer that

can serve as a radio, television and video console, that contains a number of media drives, and is connected to the internet" (Seel, 1998). A new media apparatus is a so-called "convergent instrument" that can be used for a number of purposes, e.g. to draw plans, to operate machinery, and also to play games. By new media we mean media, which are technically based on digitalisation, miniaturisation, data compression, network interconnectivity and convergence. For all media, new or old, one can differentiate between perceptive, action-oriented or representational media: language or drawings are, for example, representational media. The "comprehensive computer" is a multi-media device that integrates various media and can therefore bring forth new modes of representation.

2. New Media in Architecture

Architects consume and communicate to a large extent visually through the use of imagery. Using the various tools of traditional media a highly aesthetic and refined culture of (re)presentation has already been developed (Figure 1). Imagery serves as a "bearer of information", whether in the design process or in ongoing discourse on the history of architecture. Traditionally, a combination of material media such as sketches, descriptive texts, perspective drawings and physical models have been employed (Allen, 1981). By comparison, the use of "new tools" offered by new media, and the specific possibilities made possible by information and communication technologies, breaks new ground.

In the history of architecture, changes in the mode of representation have transformed the ways of communication and analysis. The introduction of perspective and photography are two significant examples. Even today the computer often just copies or adapts "traditional material media". New modes of expression or representation are explored but used rather reluctantly.

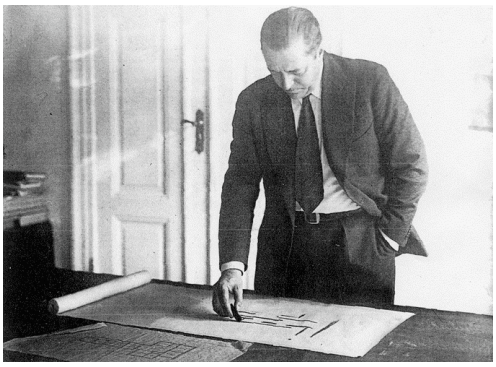

Figure 1. Mies van der Rohe sketching…

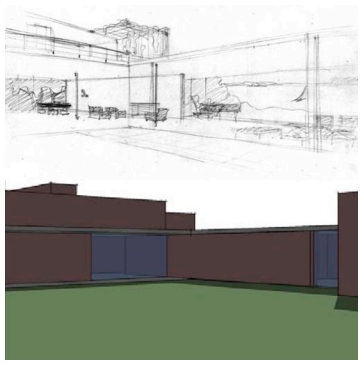

Figure 2. New media in the work process

The choice of a medium and the concomitant acceptance of its limitations to our perception are of fundamental importance. Architecture is more than three-dimensional material space: Likewise, it is also more than just a visual experience, although this is too often forgotten. Most representations of architecture, however, exclude other sensory experiences or create a sensory quality that is specific to the respective medium. As a multi-media device, the computer could help close a gap and bring about new possibilities for presenting and representing architectural ideas. For instance, in interactive systems, spatial relations can be experienced differently: users can immerse themselves in a new perceptive reality by "moving freely" around a virtual model. The use of new media is not just limited to representational purposes; it can also open up new opportunities for analytical investigation. The full range of possibilities in architecture is not yet fully explored.

3. New Media in Architectural Education

New Media can inspire and enhance new ways of teaching architecture. In this case we focus on new media as a tool in the work process of an architect (Figure 2). CAD, rendering and animation are already well established tools of modern architectural practice. In most cases, however, they are used as a "digital drawing board" or as "pure" presentation tools. Architectural education should help architects to critically assess and explore the possibilities offered by digital tools over and above 'digital versions' of traditional tools – as well as to avoid falling for the many promises made. A sound knowledge of contemporary media applications will serve architecture students in their professional career and they will be able to use them more sensibly and more purposefully.

In order to maintain a competitively high level of education for future architects, it is necessary to engage new media actively and in its specific

contexts. Architecture faculties are facing a series of questions, which should be considered and discussed in design-oriented courses, such as:

- What are the media applications that architecture students should be proficient in at the start of the third millennium – and why?
- How do they differ from previously and currently used media?
- What do they offer in comparison to "traditional" media?
- How can new media be integrated into the design process?
- What do the demands of the media age mean for the profession of architecture?
- How can new media and their tools be taught when the sector is developing so rapidly?

For architectural education this means that the focus should not only be on learning how to use "new media", but also to critically assess the possibilities offered by applications, to explore new forms of (re)presentation and to define the requirements an architect should expect of such systems. The architect should not need to adapt his or her working method to the program system; the computer or application should be a tool for representing and working with in an architectural context.

4. The Brick Country House

The two drawings of a country house in brick (Figures 3 & 4) date from 1924 and are probably a design for Mies van der Rohe's own house. The architect followed the idea of a bourgeois residence but formulated it in a radically new way. This project is the last in a series of five projects between 1921 and 1924 including the designs for the skyscraper on the Friedrichstrasse, the glass skyscraper, the concrete office building and the country house in concrete. In retrospect these designs are regarded as a manifesto documenting Mies' experiments with new materials and construction typologies (Riley, 2001).

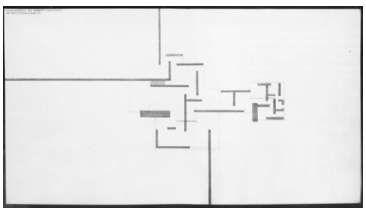

Figure 3. Brick Country House, plan

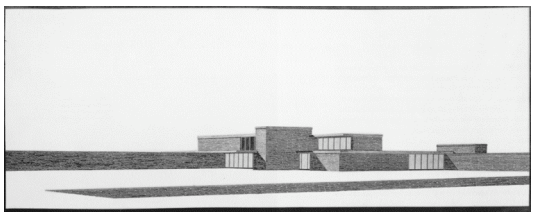

Figure 4. Brick Country House, perspective view

This unbuilt design is generally attributed as being of outstanding importance in Mies van der Rohe's œuvre: it formulates the open plan and the concept of free-flowing space in a prototypical manner. However, critical acclaim seldom extends beyond this commonplace statement; the brick country house is often characterised as singular and unprecedented. But it is safe to assume that Mies referred to spatial ideas from earlier projects. This hypothesis can be tested through our proposed procedure. The students working on our experimental project chose instead to focus on situations of the brick house that were transferred to subsequent designs and developed further in later projects. They tracked down, as it were, the brick country house in individual elements of later realised projects. To trace developing and changing spatial ideas through design and realisation helps us to explore and understand the design concepts employed by Mies van der Rohe.

Mies' sketches and drawings exhibit a distinctly visual, almost photographic idea of the spaces he envisioned. An analysis shows that he often refers to spatial situations he had created earlier in another design – as he said, one cannot invent a new architecture every Monday…

4.1. ATTEMPTING A PARTIAL RECONSTRUCTION AS A VIRTUAL MODEL

Part of the assignment was to visualise the spatial relations as laid out in Mies' evocative plan. We attempted, as far as possible, to transfer Mies van der Rohe's design for a brick country house to a virtual, digital model. Based on available sources (plans, sketches, photographs) as well as the computer model the students tried to reconstruct key situations in the interior representing the main spatial ideas. The computer-generated model complements the modes of representation employed by Mies van der Rohe and enables us to compare spatial situations.

The photographic reproduction of the lost 1923 drawing could hardly serve as a basis for a precise reconstruction; the 1964/65 re-drawn plan showing brick courses raises even more questions. Therefore, the result of a digital reconstruction can only be one of a series of possible interpretations of the original plan (Figure 5). However a "realisation" of his design was not the intention of the project. Instead the project aimed to explore to what extent spatial concepts could be better understood with the help of a virtual model, as well as to see if one could 'complete', i.e. interpret the rest from Mies' sketches through the knowledge the students had gained of his other projects and his ideals and vision.

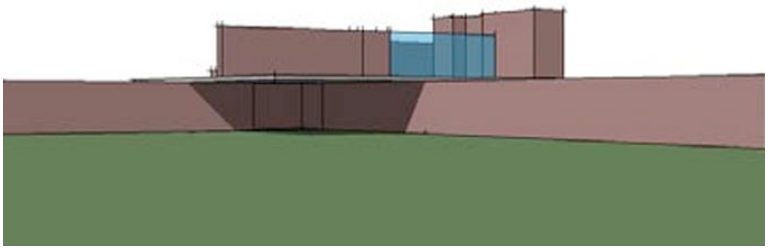

Figure 5. Sketch approximating the reconstruction of the original design

4.2. FROM REPRESENTATION TO ANALYSIS

The use of the computer not just for presentation purposes but also as a tool for analysis was central to our project. We encouraged the students to study the unrealised design and the underlying spatial concept as well as to investigate the possibilities computers may offer for analysis and interpretive reconstruction; the new technologies were to be compared with the traditional repertoire of presentations techniques and judged critically with regard to advantages and disadvantages, the effort involved and added value they offered.

The digitising of available images and modelling in a virtual model provided us with a new fundamentally different representation of the design, and a new starting point for further interpretation. The versatile computer, the same platform which generated the model, could now be used for its interpretation. New possibilities for analysis and interpretation became apparent: a digital image contains information that can be processed in different ways by the computer. It enables us to excerpt particular aspects, to uncover relationships, to discover connections and to compare (Figure 6).

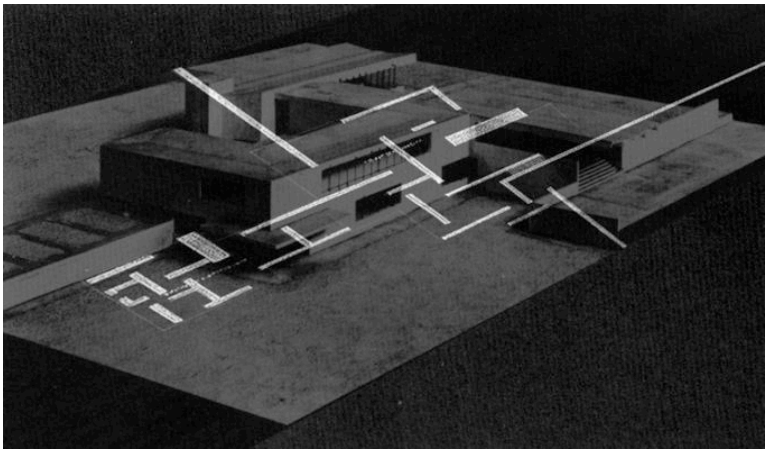

Figure 6. From rendering to analysis – dynamic superposition of model and plan

4.3. METHODOLOGY

A reconstruction is a process of successive steps, no matter which media are employed. The aim in this course was a digital reconstruction including a computer-assisted analysis along with an interactive presentation of the results from the preceding stage.

The work process was divided into four distinct stages. These helped to structure the work progress and to schedule additional input: studio work was complemented by lectures on model theory, interactive systems, navigation, and user guidance.

The students were expected to be able to address analytical problems methodically, and have a sound proficiency in the use of traditional tools for architectural representation. The new digital tools were introduced parallel to the initial phase of research and analysis with the aim of comparing working methods with available IT-tools. The emphasis lay not on how to use any particular software application but to assess the suitability and capability of available tools with regard to the task at hand and working method. The series presented here should not be understood as purely sequential; parts of the process often fed back into other phases (Tulodziecki and Herzig, 2004).

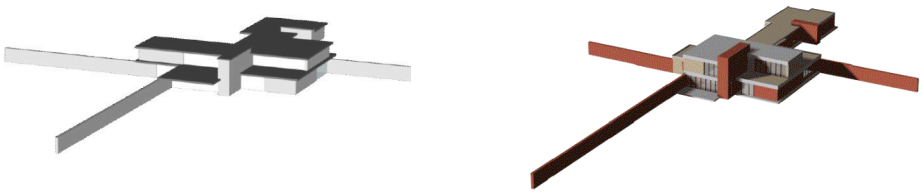

Figure 7. Different digital models

4.3.1. Basic Digital Model

The students were given available material in the form of a plan drawn by Werner Blaser in 1965 and a critique of this plan by Wolf Tegethoff from 1981, from which to generate a basic digital model of the ground floor (Figure 7). Perspective views generated from this model were overlaid with Mies' historic perspective and the digital model was adapted accordingly to match the historic perspective, e.g. the adjustment of room height, and the modelling of the upper storey and the outdoor terrain (Figure 8).

Lectures and exercises on CAD and modelling systems accompanied this phase.

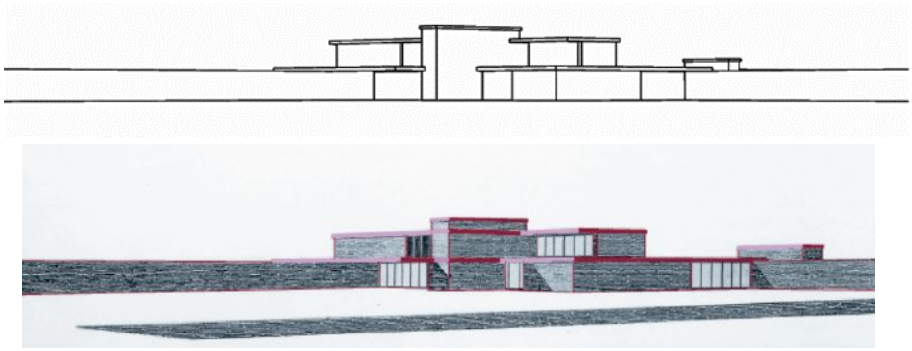

Figure 8. Juxtaposition of digital model and original perspective (with additions in red to help determine room heights)

4.3.2. Research

A second phase involved the research and analysis of historic photographs, sketches and drawings of potential reference buildings (Riehl House, Urbig House, Wolf House, Houses Lange and Esters, Barcelona Pavilion and Tugendhat House). Previous reconstructions and analyses were also taken into account. The aim was to improve the students' background knowledge of the work (and motivation) of Mies van der Rohe and to train their

analytical skills in identifying architectonic aspects which could be useful in a comparative analysis.

In this phase the internet served as a source of information. We provided an introduction to image editing techniques as well as OCR software and digitalisation methods for preparing the results of the researched information.

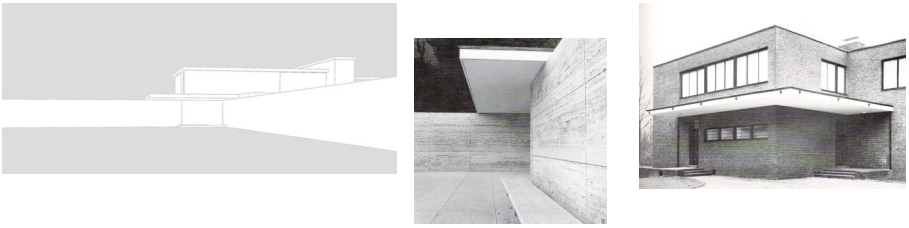

Figure 9. A comparison of entrance situations designed by Mies van der Rohe (left: the reconstructed brick house, centre: Barcelona Pavilion, right: Esters House)

4.3.3. Computer-assisted Analysis

In this phase the students were asked to generate interior perspectives and to overlay or juxtapose them with (edited) historic photographs (Figure 9). Assumptions or postulations made were to be documented and discussed critically.

The phase also introduced students to aspects of image editing and the problem of information visualisation, particularly the question of how to represent vague and inferred information.

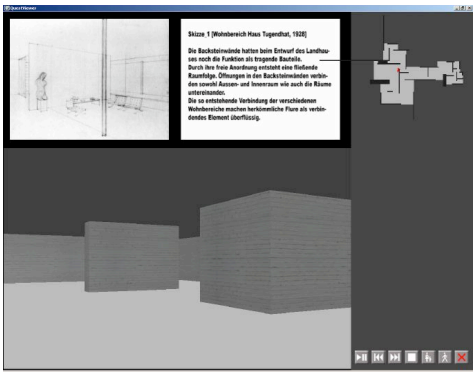

Figure 10. Interactive presentation with Quest3D

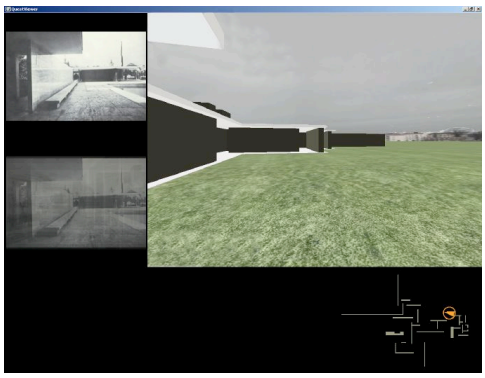

Figure 11. From storyboard to structured programming

4.3.4. Interactive Presentation

The final phase involved the preparation and presentation of the results of the analytical work in such a way that both process as well as final result could be clearly communicated (Figure 10).

Techniques borrowed from programming computer games were used to enable one to move around the virtual models. The visualisation and interactions made possible are incredibly varied and limited only by the imagination. They range from the purely visual (3D environments, interactive generation of architectural sections, overlaying with sketches etc.) and the audio-visual (integration of video sequences) to interactive feedback (simulated haptic feedback) where the limits of tangible space are intentionally transgressed.

The phase began with the introduction to a game engine – in this case Quest 3D. In a series of four tutorials the students introduced each other to the basic concepts and programming steps and explored the possibilities of the game engine.

The next step was to write a storyboard, i.e. to develop a strategic concept for the entire presentation (Figure 11). Additional attention was given to questions of interaction, navigation and user interface design. Specific questions could be discussed on the online Quest3D forum.

5. Results and Discoveries

The results proved to be as multifaceted as the assignment and the skills required, not only for the students but also for us as teaching staff and for our research interests:

5.1. FOR THE STUDENTS

The course helped the students learn to think strategically and how to structure and orient their work process towards the intended result. An added effect of the somewhat demanding learning process has shown them first-hand that there is more involved behind the enticing appeal of new media. They gained an insight and understanding of the structures and principles of CAD and modelling, and hopefully a healthy scepticism of the alluring "everything is possible, now and immediately…" promise of information technology.

In addition to IT-skills, the students also gained a better understanding of architectonic relationships and spatial concepts, which will help them in their future design work. Some of the students developed quite remarkable skills in identifying and reading spatial situations and were able to quickly transfer a found spatial idea to another project and a different context.

During our final presentation one student said that he could not only draw the plan from memory but also sketch views and vistas from within the plan. The experimentation and analysis of different media and modes of representation offered during the assignment helped him to improve his ability to link plan and perspective with one another and to develop a complex understanding of varying spatial situations. By the end of the course they had established an intimate relationship with the brick house and were able to intuitively navigate through the virtual country house, to point out and to explain reference situations.

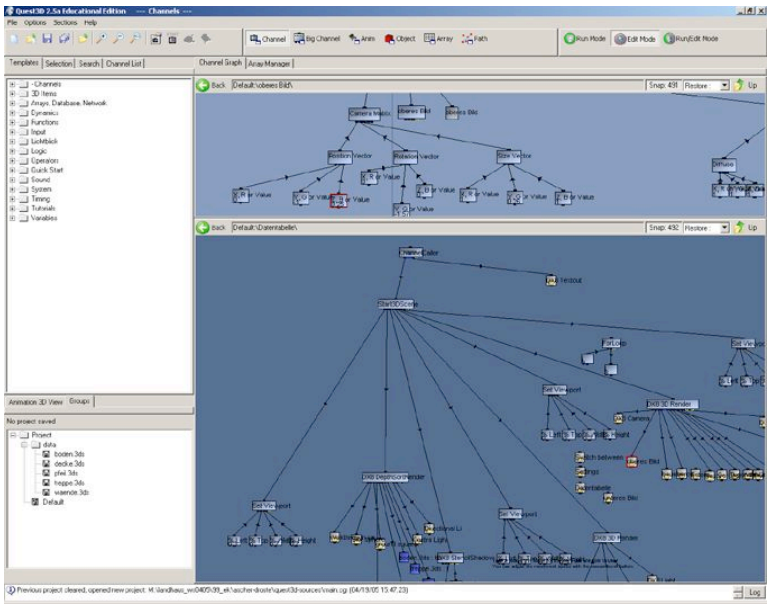

Figure 12. Quest3D main user interface

5.2. FOR THE TEACHING STAFF

With this assignment we were able to school design skills in a way that we may not have achieved through a traditional design project. We were also able to better address those students with less sensibility and awareness of design and conceptual issues. To a certain degree, these students are also those who are particularly enthusiastic about technology and therefore least critical in their approach to using them.

The project also demonstrated that the same skills as those required for design projects are also necessary for working with new media: conceptual clarity and a determination to subject oneself to the weary process of relating results to initial intentions over and over again.

We also became aware that many students were overwhelmed by the wide range of possibilities (particularly with regard to Quest3D) and the

process of learning simultaneously. As a result, not all possibilities were understood and used productively or appropriately. Here too Mies' dictum of "less is more" proved to be a valuable lesson.

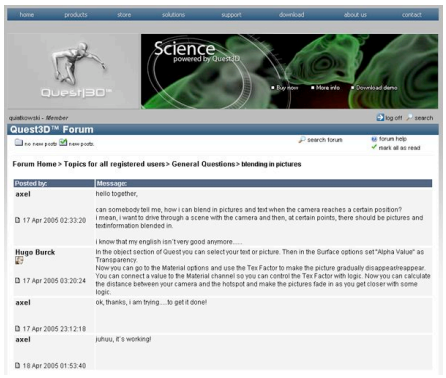

Figure 13. Quest3D Forum – individual web-based learning

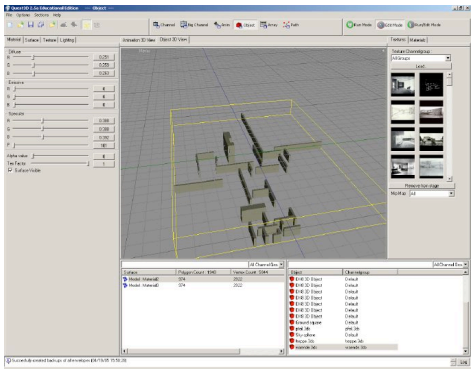

Figure 14. Complex menu in Quest3D

5.3. IMPLICATIONS FOR RESEARCH

The project is a further example of the versatility and potential offered by new media for architecture. It also shows that many of the tools are extremely complex and the sheer variety of possibilities is distracting or proves to be unmanageable for those less skilled in using information technology (Figures 13 & 14). Future research must focus on ways of simplifying the available software and to adapt it to the needs of architects.

New media, especially interactive systems, can also offer valuable tools for analysis, for which there is no real equivalent in conventional practice; they add a further dimension in communicating architectural concepts to the professional community as well as to a wider public.

In addition to technical aspects, research will also need to more closely examine the question of representation (abstraction versus photorealism), the visualisation of information (e.g. non-visible, non-geometric information and 'approximations') as well as the user interface in order to make full use of the potential offered by such technologies for architectural design.

6. Outlook – Opportunities, Limitations and Risks

Rapid technological developments enhance the possibilities of architectural representation. Today one can achieve more than merely static visuals or predetermined camera flights; the combination of common techniques of

reconstruction can result in completely new modes of presentation. Over and above the obvious possibilities of showing variations, creating atmospheres or animated scenes, it is also possible to illustrate relationships or sequences in time. Interdependencies and correlations can be revealed to the observer that would not otherwise be immediately apparent. This applies not only to architectural education or professional discourse but also to the public discussion on architecture and the built environment.

The wide range of options offered by the variety of different media is almost innumerable and consequently difficult to comprehend. Each of the different media available has certain advantages and disadvantages, and these are best assessed with reference to the needs of the specific project. This brings with it the need to focus, a restriction and concentration of the possibilities, i.e. to do not what is possible, but what is necessary.

We aim to continue the project described here, but to devise more directed assignments, with less room for diversion, and with a better knowledge of the tools at our disposal.

To complement the currently used hardware, we are also looking to explore the use of other technologies such as auto-stereoscopic displays and ARcave installations (ARcave is a research project at the Bauhaus-University Weimar, with the aim of creating immersive cave-like environments with the help of AR projection techniques on surrounding surfaces, Bimber, 2005). The aim is to assess the possibilities offered by "real" 3D modes of output and to compare these with the "normal" 2D output of the computer screen.

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