ADMIRE: an Architectural Design Multimedia Interaction Resource for Education

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This paper describes the development of a multimedia system called ADMIRE (an Architectural Design Multimedia Interaction Resource for Education), which enables undergraduate students to understand how to analyse existing buildings dynamically, as well as to develop their own initial architectural design theories. The system contains architectural information in the form of fully rendered models, conceptual illustrations created with a range of CAD software, and multimedia presentations showing various design theoretic analyses. Buildings are described with CAD generated images, and architects with profiles and theories. In addition to rendered designs, there are also conceptual models of each building in the system. Conceptual models are simplified forms of original designs in order to support an analytical understanding of buildings according to various analyses, such as structure, light, circulation, unit to whole, geometry, etc. Each conceptual model constitutes a different analysis of each building. The ADMIRE system links each piece of information to another, so that students can explore architecture and learn about it in a dynamic way. This system demonstrates a new way of learning about architectural analysis through dynamic multimedia computer interaction.

Keywords*: Dynamic Multimedia System, Analytical Models, Interactive Pedagogical Resource*

Introduction

Students who study architecture develop understandings of existing buildings. They need to know how to analyse buildings in order to see what constitutes them both physically and theoretically, and gain insights into how practising architects think about their designs. This analysis helps students to develop their own design theories and think about their projects. Traditionally, analysis takes place with the use of conventional media, such as books, journals, and drawings. Through the understanding of existing buildings using these conventional media, students start to develop their own design theories. It is our contention in this paper that the use of conventional media is insufficient to understand buildings entirely. Through computational presentation, however, it is possible to show buildings *dynamically* through the use of text, pictures, diagrams, animation, sound, and so on.

> *"Multimedia has the potential not only to improve current educational practices but to revolutionise the way that higher education is provided. Multimedia can make lectures more interesting and effective and, more so than books, can provide more varied information to students outside of class.*

Moreover, having the skills to use multimedia can empower students to learn in new ways and to develop higher-order cognitive skills." (Falk, Carlson, 1995)

Multimedia is a powerful tool for education because it contains information in various media forms, gives control to users for navigation, and the ability to choose information interactively. A variety of different views of buildings should be accessible to students for exploration in order to understand building types more fully. We are aiming to develop a system that controls information through multimedia interaction to make it easier for students to analyse schematic forms dynamically. Students should be able to see both *realistic* and *conceptual* models during the course of their interactions with the system, thus developing an understanding of buildings, as well as ideas for their own initial design theories.

Principles

There are five principles that we have focused on in order to introduce and develop new teaching tools into architectural education, and consequently, these will affect the implementation of our own interactive multimedia system.

PRINCIPLE 1: The Introduction of Pedagogical Interactive Multimedia Systems

It is our view that even though various computer systems have been around in architectural schools for a number of years now, still not enough use is being made of interactive multimedia learning tools during the course of design development. We are interested in responding to the requests coming from design students for the introduction of multimedia tools to support their studio project work. To this end, we agree with the following views of Matthew Bourne (in Penz, 1992), a third year undergraduate student of Department of Architecture, University of Cambridge:

"The worlds of semantics, associations and exploration during the design stage are not benefiting from the new 'multi-media' technologies, whose serious application at the early phases of a design, would offer the designer a vast range of resources — from interactive background video footage to the site, to ambient and directional acoustic feedback, to the visualisation of the metaphoric or generative themes dominating the projects evolution — combining to define a purely original conception of the role of a computer-aided design 'tool' within a world increasingly shaped by these dynamic representational media."

It is clear that multimedia technologies have not been applied to architectural design in the early stages of studio projects in spite of the fact that a vast range of resources are being offered to us in schools of architecture. However, we believe that it should be possible for students to get information about architecture during the early phases of a design scheme, and to begin using multimedia systems at this stage. Ideally, students need to explore architecture and to learn about the design theories of architects. We want undergraduate architecture students to be able to understand a range of building types such as those that they commonly encounter in studio work (e.g. libraries, schools, theatres, museums, galleries, housing, etc.), and to develop their own design theories from the particular building types that they have been analysing. We are aiming to develop a computer-based, educational medium for undergraduate students, which can be used in addition to reading books, papers, and journals.

PRINCIPLE 2: Encouraging Students to Compare and Contrast Different Views of Architecture

Discussion about architecture helps students to improve their own theories whether they think by themselves or argue with other students.

"The arguments give opposing views or a comparative analysis." (Sabater and Gassul, 1992)

We want to include different views or analyses of buildings into our multimedia system. These views and analyses give students the opportunity to see various new points of view. They can discuss these points by criticising or comparing different architectural solutions to particular building types. For instance, students can look at museums designed by two or three different architects in different styles and analyses. These different styles and analyses of particular building types encourage students to compare and contrast different analyses, to discuss different points of view, and these discussions in turn lead to the development of students' own design theories.

PRINCIPLE 3: The Use of 'Conceptual' Models

Simple models presenting analysis are useful for students to look at buildings in an effective way.

"To work well, such integration needs an embracing theoretical framework of the whole, a model of the nature of architecture and architectural knowledge that transcends the boundaries of fields or projects. The model need not necessarily be 'right' in an absolute sense, merely heuristically useful in providing a conceptual framework by which students can understand the whole." (Radford, 1992)

We intend to incorporate both *realistic* (often regarded as somehow being more *correct* or *right* by people in architectural education) and *conceptual* models of buildings into our system. The former are to show how these buildings look like when students use computer modelling software. Looking at *realistic* models, for example, would be the first step that first year undergraduate students might take. The models showing various presentations could also be reference material for other undergraduate students. *Conceptual* models, on the other hand, contain analyses of each building. *Conceptual* models are simplified in order to show specific analyses such as structure, volume, form, proportion, circulation, etc. (Baker, 1996). We believe that students can improve their abilities to analyse buildings by working more with conceptual rather than with realistic models.

PRINCIPLE 4: Relating Theory to Practice

Radford referred to Itten's basic course that students should keep *"the relationship between the theoretical and practical aspects"* (Radford, 1992), and stated:

"The aims of a beginners' course on the making and interpretation of form, then encompass a combination of theory and practice in relation to design and the representation of designs"

Amongst a list of things, he stated that students need to:

"relate theoretical ideas about the metaphor of design-as-language to the practice of design"

We have already mentioned that we are incorporating *conceptual* models in our system according to the previous principle, and also that our system leads students to discuss and develop their own design theories in **PRINCIPLE 2**. Then, students develop their own design theories into practical designs. This process enables students to think about the relationships between theory and practice. If students encounter problems with either theories or particular practical problems associated with individual building types, such as method of construction, for example, they can then return to our system and look at particular issues in more detail. Structure is a primary concern in our system requiring special treatment. For example, if students want to know the structure of a room with large span during their own design process, they can open structure section of our system and look at various large span *structure*

examples. Then students learn about this particular element of buildings and develop their design theories accordingly.

PRINCIPLE 5: To Support Dynamic Interaction

The issue of user control and exploration is referred to by Bourne again (in Penz, 1992):

> *"Multimedia has been firmly conceived as a tool of presentation (production), as an automation within the digital domain of conventional hand-worked animation techniques, or of film-editing techniques: and even at its most avant-garde and progressive edge, of interactive presentations and educational material, multi-media implementation risks being a closely scripted documentary over which the user might exert a degree of editorial control, but little true freedom for experimentation and genuine creative 'discovery'."*

Multimedia presentations that tend towards *scripted documentaries* require that the user has to know how to edit the predefined scripts. A *scripted documentary* is one type of multimedia presentation, even though it may contain materials such as animations, video clips, and sound. The most important thing in our own framework, however, is how the users can interact with the system allowing them to explore an architectural world effectively. We are aiming to provide an interactive multimedia teaching environment, in which it becomes possible for students to develop a greater awareness and understanding of a range of architectural types and design principles. The structure of this multimedia system is the next important thing to discuss.

Structure of our system

As with many other multimedia systems (Powell, 1994), we begin ours with an index section. The Index section provides a general introduction to the architectural ideas that can be navigated. The next step depends on which section students want to go to. We are preparing three sections for this second step. (**Figure 1**) One shows names of well-known architects. They can start in this section with profiles of each architect, their works and design principles. The Buildings section has information about particular buildings designed by architects. We use five building types because these are the most common types used in studio projects in our school. Buildings can be viewed through photographs, *realistic* CAD models in various views, animations, videos, and so on. We are especially interested, however, in developing the Analysis section. In this, there are explanations of design principles, *conceptual* CAD models, animations, etc. The Analysis section consists of important categories of analysis, such as structure, natural light, massing, plan to section or elevation, etc. (Clark and Pause, 1985) Students can look at analyses of buildings according to these categories. Each section links to the other sections. Students can explore this system from an architect in the Architects section to either a building, designed by the architect, in the Buildings section or one of the

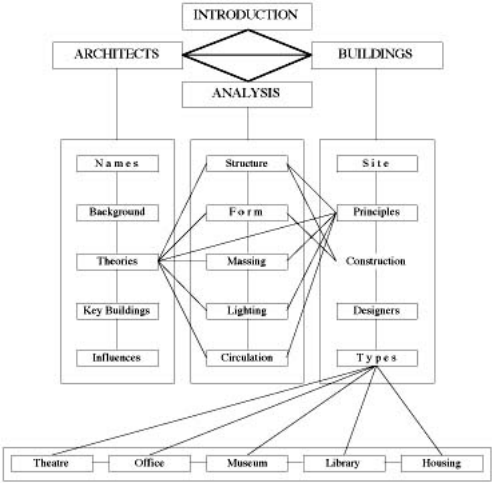
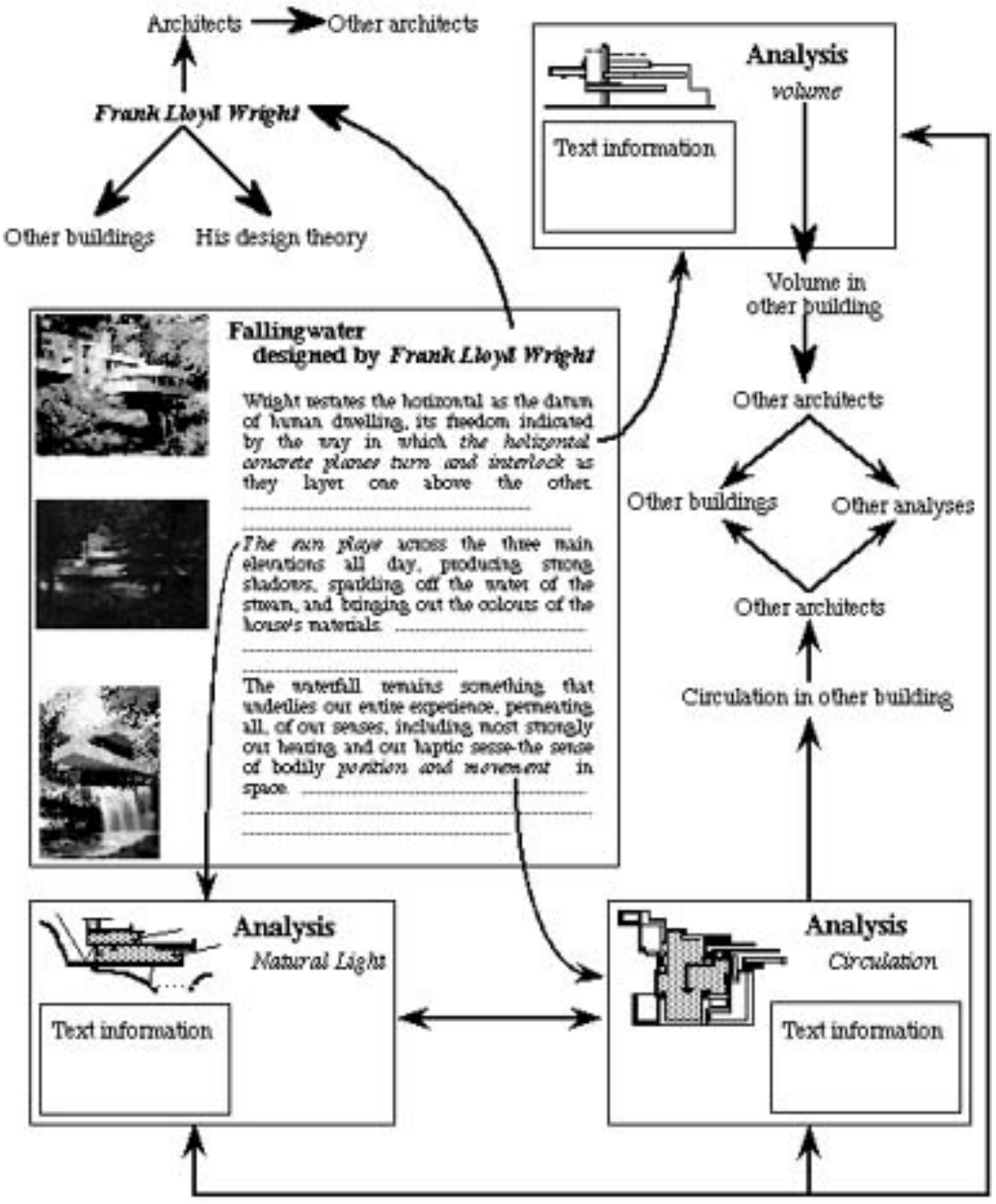


Figure 1 (left). The basic structure of the ADMIRE System

Figure 2 (right). Hypertext linking in the ADMIRE System (McCarter, 1994)



categories in the Analysis section. Students can go in other directions also. This kind of *dynamic* interaction between students and our system is what we want to encourage as a pedagogical technique.

Implementation of System

There are presently many kinds of multimedia authoring software that can be used to construct products in various areas, such as advertising, education, Internet web pages, etc. We are using HyperCard to implement our system, because this is a basic form of multimedia authoring software, and can potentially be subsequently transfered easily into other environments. We are developing our multimedia system according to the structure outlined in the previous section. When students first encounter the system, the Introduction card appears. Students have a choice of accessing either architects or buildings depending upon their particular interest at that moment in time.

The buildings card has choices of different buildings, and students can return to either the Introduction or the Architects stack if they do not know who designed the building. When a building card appears, students would notice that there is information about this building, and they also notice there are other buttons on the card. These buttons lead students to explore further more details of the building. (e.g. CAD models, analysis, animations, etc.) We are aiming to allow students to make their own connections and links in a context-sensitive manner during the course of their interaction with the system. Figure 2 shows an example of how we envisage a

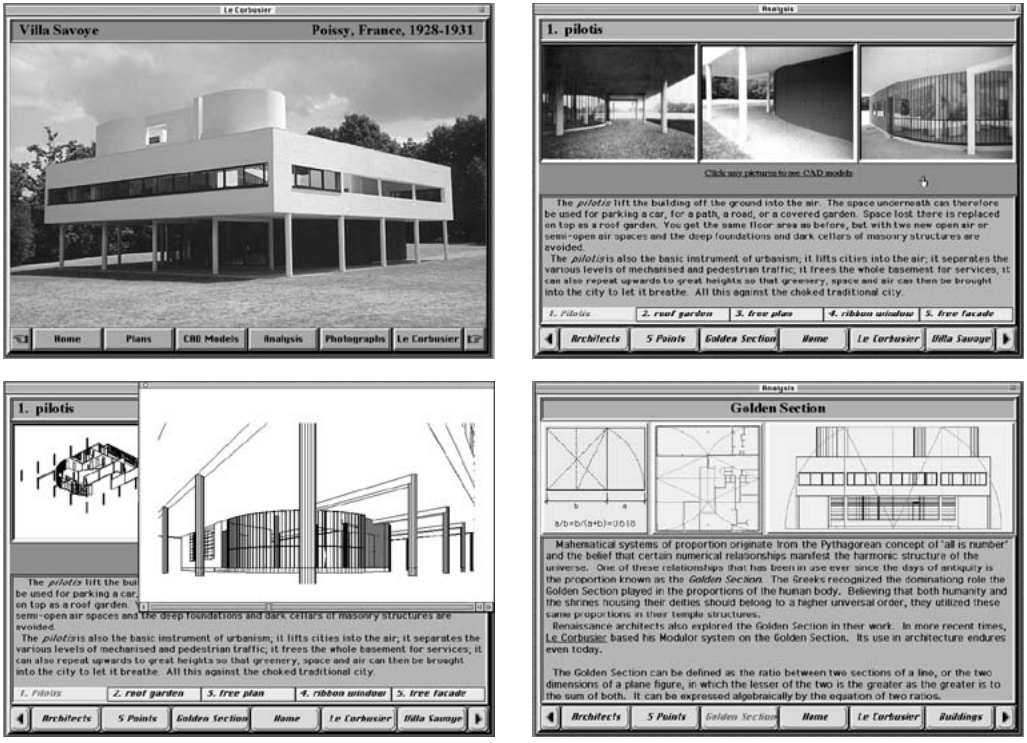


Figure 3. An analyses in the ADMIRE system: A House Building Type (far top left), Illustration and Explanation of pilotis (top left), CAD Conceptual Models / Animations of Building Type Presenting Dynamic Views (far bottom left), Conceptual and Analytical Models of Building Type (bottom left) (Ching, 1996)

particular context being created.

Figure 3 illustrates the range and types of information that students will experience as a consequence of interacting with the system. We are showing the idea of proportional analysis in plan and elevation with the Villa Savoye starting from (a) building type, (b) pilotis, one of Corbusier's principles from the "Five Points of a New Architecture" with (c) conceptual models and animation, and (d) use of Golden

Section in this particular building. Many other kinds of analysis are possible, and some of these will be encountered as students explore other building types and other architects. (e.g. lighting study on the Ruskin library by MacCormac)

Figure 4(right). Images from film of the Ruskin Library at Lancaster University designed by Richard MacCormac

Work to date

Computer modelling

In the ADMIRE system, we prefer to have fewer buildings and architects, but a greater number of, and emphasis upon, the different kinds of analysis that are possible within each individual building type. We use MiniCAD 7.0, StrataVision 3.0 and ArtLantis 3.01 for fully rendered models and conceptual models. Models are based on examples of building types taken from *Key Buildings of the 20th Century*, (Dunster, 1985) *Fallingwater Frank Lloyd Wright*, (Dunster, 1985) and *GA Architect 8: Tadao Ando* (Dunster, Futagawa, 1987).

Animations and Films

We have animations from QuickTime documents in MiniCAD and StrataVision. Web-based animations are in VRML or JAVA format. We have taken BETACAM film of several buildings which we are presently digitising and editing with Adobe Premiere 4.0. As with the computer animations that we are including in the system, our live film was taken in such a way that each of the clips that is being introduced into the multimedia system is *totally dynamic*, e.g. people walking through and around buildings to give a sense of scale and proportion (Figure 4 (a)); movement around a space (e.g. the reading room in Figure 4(b)) to give an impression of lighting and circulation. We are convinced that film and animation has to be used in this dynamic way to fulfil is full potential as a pedagogical medium. It is at this point that our system goes beyond those multimedia systems in architectural education that are mere slide shows.

Implementation

Multimedia scripting is being carried out using HyperCard and HyperStudio. We are organising information by making stacks, cards and buttons in this software. Ultimately, we will compile our multimedia system into a CD-ROM similar to *The Grolier Multimedia Encyclopaedia 1996*. [A]

Evaluating of the Project

We have compiled questionnaires that will elicit from students their impressions of interacting with the ADMIRE system, analogous to Penz's study (1992) of CAD vs hand drawings. The answers of these questionnaires are helpful for further development of our system. Our preliminary observations on these responses are of a more procedural nature. (i.e. the reading of text shows down and interferes with a flowing understanding of certain analytical description) We are currently trying to overcome this particular kind of deficiency by replacing the text with audible narrations, which do not interfere with the graphical visualisation and manipulation.

Conclusion

The ADMIRE multimedia system is based on five principles which allow design students to build up a *context* for their own design scheme. These contexts will include various types of building, analysis, architect, etc. As the information increases within the context of a project, students have the opportunity to compare and contrast various new kinds of analyses. These analyses in turn encourage students to improve their own design theories.

Conceptual models show the main principles of buildings very simply. The ADMIRE system clarifies these underlying principles, and the *conceptual* models can also be referred to by students for their own design presentations and crits. In addition to *conceptual* models, realistic models are referred to by students, for example, in their CAD course, and the feedback that they receive from such courses particularly in terms of refinement and development of models, can prove to be of use in their studio work.

Overall, our ADMIRE system helps students to develop their own design theories during the course of architectural design as another interactive pedagogical medium in addition to books etc. Students can also include their own design schemes in the ADMIRE system. These schemes can then be contrasted with the schemes of well-known designers in crit situations, for example. This system can ultimately become a collection of student work for schools of architecture. We are currently implementing a CD-ROM teaching resource, in which students can interactively develop design ideas. ADMIRE is currently under development, and will be used in the context of an actual studio project, after which it will be re-evaluated.

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Notes

[A] MACFORMAT Issue 65 Future Publishing Ltd. (1998)

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